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N. Serekpaev, G. Stybayev, A. Baitelenova, M. Zasada

FEED PRODUCTION

Study guide

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Authors:
N. Serekpaev
G. Stybayev
A. Baitelenova
M. Zasada

Reviewers::
Christina Yancheva, *PhD, Professor,*
Rector of the Plovdiv Agrarian University, Bulgaria
Gulnar Sabitovna Aidarkhanova, *Doctor of Biological Sciences, professor of the Department of Biological Sciences of*
JSC "S. Seifullin Kazakh Agrotechnical University"

The study guide outlines the components of feed production. A feature of this manual is a more detailed description of methods for assessing forage crops. The compliance of the chemical composition of feed crops with the standards for feeding farm animals was considered. The publication is accompanied by illustrations of plants. The theoretical foundations of feed harvesting technologies are discussed in detail. Feed production is summarized in accordance with the curriculum for feed production for the specialties "Soil science and agrochemistry", "Plant protection and quarantine", "Technology of production and processing of agricultural products."

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CONTENT

INTRODUCTION

Feed production as a subject of study is a complex of scientific information about fodder plants, their botanical and biological features, chemical composition, feed value, growing technology, theoretical bases for improving and rational use of natural and sown hayfields and pastures, technology of harvesting and storage of feed for livestock. Feed production is one of the leading disciplines of the educational program in preparing students for the specialties "Soil science and agro chemistry", "Protection and quarantine of plants", "Technology of production and processing of agricultural products."

The main purpose of this discipline is the formation of theoretical knowledge and practical skills in the organization of fodder production. The study of this discipline forms in students an idea of the system of feed production, the organization of a sustainable feed base for full-fledged animal feeding.

Agricultural specialists for organizing feed production need to know the conditions under which they receive maximum levels of forage crops. The study of the discipline "Feed production" will allow agricultural specialists to successfully organize the use of natural and sown forage lands, green conveyor in animal husbandry. Knowledge of the biological characteristics of forage plants, the dynamics of accumulation of nutrients in them, the palatability and digestibility of plants in the development phases will help to establish the optimal time for harvesting forage plants for forage with high quality.

The introduction of high-yielding crops, multicomponent mixed crops, balanced nutrients will allow you to create a sustainable feed base for livestock. The introduction of advanced technologies for the preparation and storage of feed will reduce the loss of nutrients in feed and improve their quality.

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CHAPTER 1 FORAGE PLANTS

In the agriculture of the Republic of Kazakhstan, about 60 species of field crops are cultivated, most of which are used for fodder purposes. Plants differ from each other in morphological and biological features, economic characteristics and growing methods. All the diversity of field crops is divided into groups according to their characteristics and purpose. On the use of the main product obtained in the crop, academician P. P. Vavilov and oth. (1979) proposed the following grouping of field crops (Table 1). Most of the field crops listed in the table are used for feed purposes, with the exception of some oilseeds, essential oil, spinning crops and tobacco.

Table 1

Production and botanical and biological grouping of field crops

Group of cultures	Biological sub-group	Field culture
Cereals	1. Grain breads (winter and spring) 2. Grain breads, spring and plants of other families Grain legumes	Wheat, rye, barley, oats, triticale. Corn, millet, sorghum, rice, buckwheat. Peas, beans, crushers, lentils, soybeans, lupins, beans, chickpeas.
Root crops, tuber crops, gourds, forage cabbage, new silos plants	3. Root crops 4. Tuber crops 5. Gourds 6. Forage cabbage 7. New perennial fodder plants	Sugar beet, fodder beet, carrots, rutabaga, turnip. Potatoes, earthen pear. Watermelon, melon, pumpkin, zucchini. Forage cabbage. Sosnovsky's hogweed, rough comfrey, maral root, cup-plant.
Feed grasses	8. One-year bean grasses 9. One-year grass grasses 10. Perennial legumes 11. Grasses perennial	Clover, vetch, serradella. Sorghum, foxtail millet, green foxtail, ryegrass. Medick, shamrock, sainfoin, bird's-foot trefoil etc. Bromus inermis, timothy-grass, meadow fescue, cat grass, agropyron, couch grass, Russian wildrye and others.
Oilseeds and oil esters	12. Oilseeds 13. Oil-bearing	Sunflower, rape, mustard, camelina, castor-bean, peanuts, oil poppy, etc. Anise, cumin, coriander, etc.

Group of cultures	Biological sub-group	Field culture
Spinning		Flax, hemp, cotton, etc.
Tobacco and Aztec tobacco		Aztectobacco and tobacco

Thousands of plant species grow on natural forage lands. Among them are predominant in value feed plants, many of which were introduced to the crop and are grown on arable land, when creating seeded hayfields and pastures.

Along with valuable fodder plants, there are poorly eaten, completely impenetrable, harmful and poisonous plants on natural lands.

As a result of the centuries-old adaptation of plants to environmental conditions, various life forms were formed. For the fodder assessment of plants use the classification proposed by the Austrian botanist Kerner, which is based on the appearance of plants. The main life forms that make up the vegetation cover of natural forage lands are trees, shrubs, perennial and annual grasses and lichens. Mosses are not eaten by animals.

From all the life forms of plants on natural lands perennial and annual grasses have high feed value.

The value of perennial herbs

From all life forms of autotrophic plants, herbaceous ones used for feeding purposes are of the greatest importance. Perennial grasses are especially valuable, which can be used for a long time for forage for the winter period and as pasture forage. Green fodder, hay and haylage from perennial grasses have high fodder value. They contain all the nutrients and vitamins necessary for animals, in an appropriate combination.

Perennial grasses, forming a powerful turf, prevent the development of wind and water erosion, enrich the soil with organic matter and contribute to the formation of humus. Herbs from the legume family with the help of nodule bacteria enrich the soil with atmospheric nitrogen.

The biological features of perennial grasses should be understood as the peculiarities of their growth and development, the adaptation of plants that allow them to live and reproduce in certain conditions of the external environment. Biological features include methods of nutrition, reproduction, types of shoot formation, nature of development, attrition, longevity.

Knowledge of the biological characteristics of perennial grasses is very large, fundamental to grassland culture. This knowledge is necessary for competently solving all the issues of a grassland economy: improving forage lands, creating seeded hayfields and pastures, organizing rational

use, and the technology of growing perennial grasses for fodder and seeds.

Perennial grasses differ from annual plants, first of all, by life expectancy: under favorable conditions they can live indefinitely. Annually ripened above-ground shoots die off, and underground organs continue to live. From the renewal of the buds of the underground organs grow new shoots. The life of perennial grasses continues in several generations of monocarpic shoots. The totality of the life cycles of such shoots is the life cycle of perennial grasses, which are polycarpic plants.

Perennial grasses differ from annuals and the specificity of the distribution of photosynthesis products between individual plant organs. In annual plants, all plastic substances are mainly used to ensure seed offspring. In perennial grasses, the outflow of spare nutrients occurs in two directions: for seed transports to the generative organs and to special organs of the reserve (usually underground) for vegetative renewal, and for some grasses and vegetative reproduction. Moreover, more stored nutrients in the organs of vegetative renewal than in seeds. This feature of the distribution of plastic substances formed in perennial grasses in the process of a long evolutionary development. Periodic changes in the living conditions of perennial grasses from favorable to unfavorable limited their seed renewal or even eliminated it in completely extreme conditions, for example, during a short period of vegetation of plants. This contributed to the adaptation for the accumulation of nutrients in vegetative organs, protected from the action of adverse conditions. This was facilitated by biological and anthropogenic factors, that is, the eating of herbs by animals and the use of grass stands by man for preparing fodder.

Perennial grasses in the process of growth and development go through a series of stages characterized by certain physiological processes, morphological changes and the response of plants to environmental conditions.

In perennial grasses, five stages are noted: 1) the weevil (seed); 2) the fresh shoot of a plant; 3) a simple bush; 4) complex bush; 5) clone.

The shoot is the main morphological unit at all stages of the life of perennial grasses. A plant sprout is an annual unbranched stem of a plant with organs located on it. Vegetative shoot is a stem with leaves and buds. The generative shoot is a stem with leaves, buds, inflorescence and fruits.

The growths of the shoot, the appearance of the rudiments of its main organs are associated with the division of the cells of the educational tissue - the meristem. In the process of growth, division and differentiation of cells, the buds of future leaves and buds appear in the form of tubercles, folds or ridges. The knots and interstices of the future escape are formed; the so-called metamers are formed, on the upper end of which a leaf is laid,

and on the lower kidney. The kidney is a rudimentary shoot, all parts of which are microscopic in size with very short internodes.

In various plants, the number of germinal metameres that are laid at the growth point is highly variable, depending on the external conditions and the period of stay of the shoot in the vegetative stage. Professor S. P. Smelov (1966) noted that the inception of nodes and interstices (metamers) with the buds of leaves and buds at the point of growth proceeds the more intensely, the more favorable the external conditions, and until the plant starts the inception of the inflorescence, i.e. until the formation of generative organs begins. In this regard, we observe shoots in perennial grasses with different numbers of knots, internodes, leaves, and buds, depending on the hereditary basis of plants, planting dates, and external conditions. According to S. P. Smelov (1966), shoots of timothy-grass, wintered, arising in the autumn of the previous year, had 14 metameres at the time of the flowering phase, and shoots arising from renewal buds in spring - only 6 metamers.

The shoots of some perennial grasses can be in the vegetative phase for more than one year, which allows the plant to form even more metamers. The number of pledged metamers is of great importance for the productivity of the plant, since it affects the number of leaves created by the shoots and the vegetative renewal in subsequent years.

The slow development of perennial grasses in the initial periods of life is probably associated with the adaptation of plants in the process of evolution in the struggle for longevity, survival and renewal of individuals. Formed buds serve for the renewal of individuals in subsequent years, and for some plants, for example, rhizomes, for vegetative reproduction.

Knowledge of these features of perennial grasses helps to choose rational terms and methods of sowing, cultivation technology, and paying particular attention to the initial periods of plant life, creating favorable conditions for moistening, lighting and nutrition.

The process of tillering of perennial herbs

The shoot of cereal perennial grasses, developed from the seed, when forming 4-5 leaves above the soil surface forms lateral shoots from the buds in the leaf axils, i.e. the shoot begins to branch. In grasses, in contrast to grasses of other families, the formation of lateral shoots occurs, as a rule, in the soil and the shoot forms a shrub. Therefore, this process was called tillering, and the region of crowded internodes of a shortened vegetative shoot, from which side shoots grow, was called a tillering node or tillering zone.

In some perennial legume grasses, when the seed germinates, the

sub-pericarp portion of the stem is pulled out and brings cotyledons to the soil surface, which acquires a green color. After some time, the first true leaf appears and the supremnadal part of the stem grows. After germination, perennial grasses grow very slowly, up to 5-7 cm in 30-40 days, therefore they are strongly shaded and are oppressed by weeds or by cover crops when cover crops are planted.

In 35 - 45 days after the shooting leguminous grasses in the place of the stem transition to the root (root neck), buds and lateral shoots are intensively formed. In the first year, only a rosette of leaves is formed for the perennial legume grasses of the winter type of development, i.e. only vegetative shortened shoots. Spring-type plants with shoots in early spring and favorable external lighting and nutrition conditions can form generative shoots, bloom and bear fruit in the first year of life. In perennial legumes, the root collar in the process of growing shoots is drawn into the soil by 3-5 cm, which protects the laid renewal buds from adverse conditions. The root collar with budding renewed buds is also a tillering zone, but unlike grass grasses, bean grasses branch in the above-ground part of the stem, forming lateral shoots from the leaf axils. In perennial grasses, overhead branching is sometimes the exception, for example, common cane.

Tillering is very important in the life of perennial grasses and for the practice of using them for feeding purposes. Tillering expands the nutritional area, since each side shoot during its subsequent growth and development forms its adventitious roots, with the exception of bush legumes with taproot. Due to tillering plants form a higher yield compared with branching only in the aerial part of the shoots. The herbaceous stem would not withstand the mass of lateral shoots formed during tillering, and would fall if they were formed only in the aerial part of the stem. Secondly, it would be a weakened diet of the whole plant.

Tillering provides vegetative renewal of perennial grasses after completing the development cycle of monocarpic shoots or after alienating the aerial parts of plants when mowing or eating animals. In rhizomatous and root-sprouting tillering herbs and grasses with creeping rooting shoots, it provides not only renewal, but also vegetative propagation of plants. Tillering is an important adaptive feature of perennial grasses, allowing them to live in extreme conditions that preclude the passage of the generative phase. For example, in the tundra or high in the mountains with a short period of vegetation of plants, they do not have time to form seeds. Renewal buds are laid in the early stages of development of shoots and serve as organs of renewal and reproduction of individuals in subsequent years. Thus, tillering is the basis of longevity of these herbs.

An axial shoot that sprouts from a seed is called maternal or first-

order shoot. The shoots that appear on the axial shoot during tillering are called second-order shoots. Axial, along with side shoots of the second order forms a simple bush. Having formed 3-4 leaves above the soil surface, side shoots of the second order also begin to bush, third-order shoots arise, which form fourth-order shoots, etc. Under favorable conditions for the process of tillering, several tens or even hundreds of shoots can form on a single plant.This bush is called difficult.

A complex bush of perennial grasses is a complex organism in comparison with a single shoot. There is a complex connection between the axial shoot developed from the seed and the lateral shoots emerging from the buds on it, especially in the diet. The tillering node of the axial shoot is a link in the whole complex plant bush.

Side shoots that grow from the buds, at first completely dependent on the mother - get from it moisture, mineral elements and organic matter before the formation of its green leaves and nodular secondary roots.

The formation of its own nodal roots in lateral shoots occurs the faster, the more favorable the external conditions. Therefore, the creation of optimal conditions of nutrition and moisture in the soil contributes to the rapid transition of lateral shoots to independent feeding, release from these functions of the maternal shoot and increase the overall bushiness of the plant. Thus, shoots have the opportunity to accumulate more plastic substances for growth and development, for the formation of the crop of the aerial parts of plants and the deposition of nutrients in the underground organs of the stock. Spare substances are needed for the development of new organs of renewal in the event of the alienation of the aerial parts of plants or dying off when they mature in the fall to grow into the next year.

After the formation of the aerial leaves and its own root system at the side escape, the dependence on the maternal disappears, but the connection remains. With the metabolism in a complex bush, the flow of substances is possible both from the maternal shoots to the children, and in the opposite direction. Under unfavorable conditions, the life of one of these shoots is possible due to the death of the other. Thus, in the complex bush of a perennial cereal plant, there is a physiological connection between individual shoots, especially in the diet.

The number of side shoots of all orders formed on an axial shoot is called bushiness. Bushiness depends on many factors: the hereditary basis of the plant, its age, and the phase of development and on environmental factors – light, temperature, moisture and diet.

Knowledge of the influence of environmental factors on the process of tillering is of great importance, it allows you to control the development of plants by changing the conditions of their cultivation.

The length of the day and the intensity of illumination have a great influence on bushiness. With a short light day (10-12 hours), the period of harvesting is lengthened, bushiness, leafiness of shoots and yield increase (Kirshyn I. K., 1985). In this regard, the choice of dates, sowing methods and even the direction of rows when sowing, as well as the compilation of grass mixtures is of great importance when growing perennial grasses.

Very important for the tillering of perennial grasses is water security. With optimal soil moisture, lateral shoots form their nodal root system more quickly, relieve axial escape from maternal functions more quickly and thereby stimulate the tillering process. Experiments by S.P. Smelov (1966) clearly show the effect of soil moisture on tillering. When watering, it was increased from 40 to 80% LWC, and by the end of the vegetation period, the number of side shoots in cock's-foot grass s of the national team and meadow fescue in areas with soil moisture of 80% LWC was 13.7 and 14.8, respectively, compared to 6.2 8.7 pieces per plant with 40% LWC, i.e. bushiness increased by 2 times. The optimum soil moisture for the tillering process is 75-80% of LWC.

The tillering process is also greatly influenced by soil fertility. Optimal nutritional conditions increase bushiness, provided that all other factors of plant life are sufficiently supplied. In the tillering stage, perennial grasses absorb up to 50% of the mineral elements of the total amount needed to complete the full development cycle of one generation of shoots. In this regard, it is of great importance to apply fertilizer in advance before sowing perennial grasses, regular fertilizer application during sowing and fertilizing when caring for crops in subsequent years. The process of tillering in perennial grasses is possible during the entire growing season of plants, but most of the lateral shoots from the buds develop in the spring. In most species of perennial grasses, two periods of tillering are noticeably manifested: spring and summer-autumn, since at this time more favorable external conditions are created in temperature and water regimes.

The tillering process, which began in spring, weakens in the phase of intensive growth of the stems above the soil surface. In grass grasses, such a weakening of tillering is observed in the booting and earing phase. In legumes in the phase of intensive above-ground branching of stems and budding.

The reasons for the slowing down of tillering explain in different ways. Some authors explain this by the distraction and consumption of nutrients to the intensive growth of above-ground shoots and the formation of fruiting organs. Many researchers explain the weakening of tillering by the influence of phytohormones, which are formed in the upper organs of shoots and exert an inhibitory effect on the development of lateral shoots

from the buds. It manifests itself the more, the more above-ground shoots pass into the generative phase. It can be assumed that the temperature and humidity of the soil during this period are not optimal for the tillering process, and all of the reasons listed affect its intensity.

The summer-autumn period of tillering increases after the flowering and fruiting of generative shoots. Autumn tillering continues until the winter dormancy of the plants. New lateral shoots, when they reach a certain degree of development in autumn, have their own lateral shoots of the following orders. In the spring type of perennial grasses, part of the shoots becomes elongated vegetative, i.e. the growth of the stem in the above-ground part begins. In the winter type of grass, lateral shoots that have appeared remain in the winter in a shorter vegetative state, i.e. above the soil surface only leaves appear.

The shoots formed during the summer-autumn tillering and remaining in the shortened state before winter overwinter, and elongated vegetative shoots, in which the point of growth of the shoots is above the soil surface, die in winter.

After overwintering, the next period of tillering begins, which continues until the phase of intensive growth of above-ground shoots of generative shoots. The lateral shoots that formed during tillering in spring grow slowly; they are weaker than overwintered shortened shoots formed during summer-autumn tillering. Therefore, the shoots that appear during spring tillering, most grass grasses do not have time to form the generative organs and die in the vegetative elongated state in winter. This is the main difference between the shoots of spring and summer-autumn tillering.

The process of tillering in different types of perennial grasses occurs in different ways. By the nature of forthputtingperennial grassesare combined into certain types.

Grasses, depending on the shape of the tillering knot, the depth of its location and the length of the horizontal part of the shoot in the soil are divided into rhizomatous, loose bush, rhizome-and-loose-bush and firm-bunch grasses.

Rhizomatous herbs in the process of tillering along with above-ground axial shoot form underground shoots called rhizomes. The rhizome is similar to the root, but differs from it in morphological and anatomical structure. There are knots with reduced leaves in the form of scales on them. In the axils of these scales are buds, giving rise to lateral shoots. Additional roots are formed from nodes on rhizomes. The top of the rhizome ends apical bud, and at the roots - root cap. Rhizomes grow very quickly, often horizontally below the surface of the soil and reach a length of 3 meters. Buds develop well in shoots, even on small segments of rhizomes, which

contribute to the rapid vegetative reproduction of rhizomatous plants.

Each rhizome of nodal and apical buds forms new aboveground and underground shoots that form their tillering nodes and the accessory root system.

With this type of tillering around a maternal axial shoot, a large network of rhizomes is formed with above-ground shoots located at a considerable distance from each other. When old rhizomes rupture or die off, new independent plants are formed, i.e. vegetative reproduction occurs.

Elevated shoots in rhizomatous plants are not tightly located near each other, the bush is formed loose. Turf with such a herbage is formed loose. This is the first stage of the sod process in the meadows, named by academician V.R. Williams is a meadow youth stage.

In rhizomatous grasses, the tillering knot can form in the soil at a depth of 5–20 cm. Therefore, rhizomatous plants are very demanding for aeration, they grow better on loose fertile soils. In the meadows with a predominance of rhizomatous grasses, it is very effective to loosen the soil with gaps, heavy disc harrows to improve the water and air regimes of the soil, to stimulate vegetative reproduction. Most rhizomatous herbs tolerate prolonged water flooding.

The rhizomatous type of germination of cereal grasses includes creeping wheat, awnless brome, white bentgrass, common reed grass, lady grass, wood small reed, Beckman's grass, Arctofila yellow, wild ruttishness etc.

Rhizomatous grasses are longevous, under favorable conditions they provide high yields and therefore are widely used in grass sowing.

In *loose-bunch*herbs lateral shoots formed during tillering, depart from the tillering nodes at an acute angle to the axial shoot. Side shoots have a short underground part and immediately come to the surface of the soil. The tillering node in loose-grained cereal grasses is formed in the soil at a depth of 3-5 cm. Each lateral shoot forms its own tillering node, from which side shoots of the next order extend, also at an acute angle. With such tillering, a loose shrub forms above the soil surface. It may increase in volume, but remains loose. The newly formed lateral shoots are concentrated around one center of a complex shrub and do not spread to such a distance as that of rhizome herbs. Therefore, loose sprout herbs form a denser turf than rhizomatous ones, they tolerate soil compaction relatively more easily, although they require good aeration of soils for growth and development. High yields are possible on loose loamy and sandy soils. Loose sprout herbs do not tolerate prolonged flooding with water.

The turf processformed by loose grasses, academician V.R. Williams referred to the second stage of the sod process and called the

meadow stage of maturity.

The loose-bunch grasses include timothy grass and purple-stem, cat grass, agropyrons, meadow fescue, Russian wildrye, slender wheatgrass, awned wheatgrass, oat grass, mulberry etc.

When caring for grass with a predominance of loose sprouts, soil loosening can be carried out by shear. You cannot handle such grass heavy disc harrow, which can cut loose bushes and destroy plants. Vegetative reproduction is absent in loose-bunch grasses, they multiply by seeds.

*Rhizome-and-loose-bush*type of tillering of perennial grasses is a transitional form from rhizomatous type of tillering to loose-bunch. This is a special group of plants whose tillering occurs in a dual way. In this group of grasses, tillering grows above-ground and underground shoots, like rhizomatous plants, but there are differences. First, the underground shoots or rhizomes are short, and secondly, the above-ground shoots that grow on them grow in the form of soft-grassed grasses. As a result of such tillering, a network of above-ground bushes arises, interconnected by underground shoots or rhizomes. Loose-bunch grasses form a dense, developed root system and create a strong turf. They need for growth and development in well-aerated structural soils. To improve the air regime of the soil should be carried out.

The rhizome-and-loose-bush type of tillering includes meadow foxtail, meadow grass, red fescue, marsh bluegrass, perennial ryegrass etc. These herbs provide a good harvest of leaves in the lower tier, are pasture.

The firm-bunch type of tillering has significant differences from the root and loose-bunch ones. First, tillering nodes in densely-custy grasses form at a shallow depth in the soil (1-3 cm) or even above the ground level of the soil surface, in small tubercles and hummocks. Secondly, the lateral shoots that are formed have a very short underground part and grow immediately upward, tightly clinging to the axial escape. As a result of this type of tillering, firm bushes are formed, forming dense turf. Soil particles are brought into the surface part of these bushes annually with the help of wind and water, and hummocks are formed there. Closer to the surface of these hummocks, tillering nodes of newly emerging lateral shoots are formed; so gradually grow these hummocks on hayfields and pastures.

The perennial herbs of the firm-bunch type of tillering are less demanding to aerate the soil, because their tillering nodes are located on the very surface of the soil. They are more resistant to soil compaction and other adverse conditions, more durable. Striated fescue or fescue, lime grass, needle grasses, matgrass etc. are among firm-bunch grasses. These types of grass are low yielding, quickly coarse and poorly eaten by animals.

The predominance of the firm-bunch type of tillering in the grass stands testifies to the irrational use of hayfields and pastures and the lack of care for them. This is the third and last stage of the sod process in the meadows, named by V.R. Williams stage of old age and degeneration of meadows.

Legumes are divided into the following types according to their pattern of shoot formation: *shrub, rhizomatous, root-sprouting, and grasses with creeping rooting shoots.*

In *shrubs*, shoots arising from the buds on the root collar grow straight up or gradually rising. They branch over the top of the soil and form a loose bush. The longevity of such herbs is associated with the vital activity of the core root system, which provides for the annual formation of new shoots from the buds that form on the root collar. Their vegetative reproduction is undeveloped. Spray bean grasses include shamrock, meadow clover, alsike clover, sainfoin, sweet clover, bird's-foot trefoil etc. These herbs, as a rule, have high branchy, well leafy stems, high-yielding, are used as hay plants. The root neck with renewal buds is close to the surface of the soil, therefore, bush grasses often freeze in winters with little snow and are short-lived in practice. Bush herbs do not tolerate prolonged flooding with water.

Rhizomatous legumes from the buds of the root of the neck form above-ground and underground shoots, or rhizomes. Of the buds present in the rhizomes, above-ground shoots appear, forming new above-ground bushes. Such herbs include meadow, vetch, or mouse polka-dot, Ural licorice, etc. They need good aeration of the soil, and under favorable conditions, vegetative reproduction is well pronounced.The yield is high, rhizomatous grasses are used as hay plants, especially vetch.

*Root-sprouting*grasses on their roots form adventitious buds, from which grows above-ground shoots. These shoots are called root shoots or root shoots, which branch out above the soil and form new bushes. Medick, camel thorn, eastern galega etc. belong to root-sprouting ones. Medick is a long-term valuable grazing plant. To improve the water and air regimes of the soil on herbage of medick, it is possible to carry out fissure and treatment with heavy disc harrows.

Legumes with creeping rooting shoots have non-durable stems with thin long internodes. Such stems do not grow vertically upwards, but under their own weight lean towards the soil, take root and form new above-ground bushes. When the binding stems are damaged or die off, independent plants are formed, i.e. vegetative reproduction occurs. Creeping stems are also called mustaches. Such legumes, multiplying vegetatively, occupy significant new areas. Bean grasses with creeping stems include

creepingand strawberry clover. Creeping clover is more durable compared to other legume grasses, tolerates animal grazing, and with rational use of pastures lasts up to ten years, quickly grows after grazing.

Types of perennial grasses on the nature of development

The growth and development of perennial grasses are two interrelated processes in plant life. But they should be distinguished. Growth of a plant is an increase in the mass and volume of its organs, i.e. quantitative changes. Development refers to morphological changes associated with the formation of new vegetative and generative plant organs, i.e. qualitative changes. The formation of vegetative and generative organs in the ontogenesis of plants is usually denoted by phenological phases.

Perennial grasses distinguish the following phases of development:

1. Seedlings in the year of sowing of seeds or regrowth of shoots in the following years;
2. Etillering shoots;
3. Exit to the tube in grass grasses, growth and above-ground branching of stalks of legumes
4. Earing in grasses, budding in legumes;
5. Bloom;
6. Seed ripening;
7. The death of shoots.

The duration of each phase in individual types of perennial grasses is not the same and varies depending on the heredity of the plant, soil and climatic conditions: from one to three or four weeks or more.

Perennial herbs are cold-resistant plants. Spring regrowth in them begins in early spring at a temperature of +3, + 5 ° C. The beginning of the spring regrowth of perennial grasses is the appearance of the first green leaves on the soil surface.

In 2-3 weeks after regrowth, the process of tillering begins. Its beginning is considered to be the appearance on the soil surface of the first lateral shoot. Tillering continues intensively until the plant begins to form an inflorescence, that is, until the plant passes into the generative phase.

For the escape of the vegetative state to the generative phase, it is necessary to expose it to a complex of external conditions and accumulate a sufficient amount of reserve nutrients in the storage organs. The duration of the tillering phase depends on these conditions, i.e. the stay of shoots of certain types of perennial grasses in a shorter vegetative state. A sprout is called a shoot, in which only leaves are located above the soil surface, and the rudimentary nodes and interstices of the stem in the soil, at the base of

the leaves.

According to the nature of development, three biological types of perennial grasses are distinguished: spring, winter and semi-winter.

In perennial grasses of the *spring* type of development, shoots that are formed during tillering can move more quickly to the next phase of development, i.e. in generative, at temperatures above +10, + 15 ° C. Such herbs in the year of sowing may have time to form generative shoots, fruits and seeds. In subsequent years, after mowing perennial grasses in the earing phase of grass grasses and budding legumes, they manage to form another one or two generations of generative shoots, depending on external conditions. Therefore, spring-type herbs of development are called multi-cuts. These include medick, meadow timothy, early maturing clover, ryegrass multiflorum etc.

The perennial grasses of the *winter* type of development in the year of sowing form tillering shoots that are in a shortened state for a very long time. For the transition to the generative phase, these shoots require the accumulation of a certain amount of spare nutrients in the storage organs, the effects of low autumn and early spring temperatures, short daylight hours, and water availability. The effect of such a set of conditions on plants of a winter type of development is called vernalization. In winter-type grasses, shoots are in a shorter vegetative state before passing through the vernalization stage. The stage of vernalization of shoots is completed more quickly if there is a developed leaf surface necessary for the accumulation of nutrients in the storage organs. This is the result of the adaptation of plants in the process of a long evolution to environmental conditions. According to the duration of the stage of vernalization, the "degree of susceptibility" of perennial grasses is determined.

Perennial grasses of winter type of development in the sowing year form shortened vegetative shoots, which, after overwintering in the second year, and sometimes in the third, turn into a generative state, form seeds.The more favorable conditions for the growth of perennial grasses and the intensive accumulation of plastic substances, the faster the vernalization stage passes. Winter-type grasses of development of this stage of vernalization pass at a temperature of +2, + 3 °C.

The winter-type herbs of development include cat grass, meadow fescue, meadow foxtail, white bollard, late-ripened clover, sainfoin, two-year clover. These herbs form only one generation of generative shoots for the next year and one full-cut mowing during the growing season.

The legumes of the winter type of development in the year of sowing form the rosettes of leaves, and after overwintering, these shortened shoots grow into generative ones. The shoots that appear during tillering in

the spring remain in a shortened state and undergo a staged development during the summer, autumn, winter and spring of the next year.

The *semi-winterized* type of development includes grasses that can form generative shoots only in the case of early spring and blooming crops in the year of sowing. The shoots formed during tillering in early spring have time to pass through the stage of vernalization at spring low temperatures and move to the generative phase in the year of sowing. With summer crops, grass of a half-winter type of development does not have time to form generative shoots; they remain in a shorter vegetative state in winter. These herbs include awnless brome and agropyrons.

Some perennial grasses, for example, clover, creeping, cock's-foot grass and others, depending on the conditions of origin, have a spring or winter type of development. These herbs are called two-handles.

According to the nature of development in three types (spring, winter, semi-eaten), there is a common opinion on the unification of cultivated species of perennial grasses by all researchers. But there is no unity in assigning certain types of perennial grasses to one or another type. For example, I. G. Serebryakov (1952) attributed the timothy meadow to the winter type of development, and S.P. Smelov (1966), V. N. Stepanov (1958), N. G. Andreev (1971) ranked it as a spring type of development. Meadow foxtail I. G. Serebryakov (1959) refers to the winter type, and V. N. Stepanov (1958); N. G. Andreev (1975) – to a semi-winterized type of development. Academician I. V. Larin (1964) attributed meadow foxtail to the spring type of development. Some other perennial grasses are estimated differently, for example, awnless brome, cat grass.

Different opinions of researchers on the classification of species of perennial grasses to one or another type of development are explained by several reasons. First, the classification of grass species to biological types was carried out according to different evaluation criteria, according to various indicators. For example, V. N. Stepanov (1958) was guided by the ability of grasses to form generative shoots in the first year with the spring sowing season, the number of generations of generative shoots in subsequent years. N. G. Andreev (1971), when determining the type of development, paid special attention to the duration of the stage of vernalization, during which preparations are made for the transition to the generative phase.

Secondly, studies of different authors were carried out in different regions and geographic latitudes, with different environmental conditions. In experiments, we studied various ecotypes of perennial grasses with established adaptations in the process of evolution to certain geographical and ecological conditions.

The type of plant development is not determined by the hereditary basis, but by adaptation to the conditions of life in the process of evolution. Type of development isa relative concept. When the external conditions of plants change, the type of their development can gradually change, and by artificially creating optimal conditions for lighting, nutrition and hydration, for example, in artificial climate chambers, it is possible to change the winter type of plant development in the spring in one year.

Aftermath ability of the perennial grasses

The ability of plants to grow after mowing or eating by animals is called aftermath ability, and grown plants are called aftermath. Absence is due to the growth of vegetative shortened shoots, the emergence of new buds in the process of tillering or the growth of vegetative elongated shoots, if during the alienation of the above-ground shoots the growth points of the grass grasses remain and the legumes have lateral axillary buds on the surface remnants of the stems.

Aftermath abilityis very important, as it determines the growing plants and the formation of a new crop after another mowing or bleeding. It depends on the biological characteristics of plants, soil and climatic conditions, the mode of use of grass, the timing and height of mowing or grazing plants and the availability of spare nutrients in the plant's storage organs.

Perennial grasses, depending on the type of tillering, development, obesity, have a different ability to grow after mowing or grazing animals. Herbs with creeping rooting shoots and surface foliage, such as creeping clover, quickly grow back, as more remains untouched shortened shoots when mowing or bleeding. Grass-roots plants, in which vegetative shortened shoots predominate in the herbage, and the bulk of the leaves are concentrated in the lower tier, as a rule, are more distant. These include bluegrass meadow grass, grassland ryegrass, red fescue, and clover creeping.

Spring-type grasses of development that are capable of forming more vegetative elongated and generative shoots during one growing season, as a rule, are more absent.

In terms of age, perennial herbs are divided by someauthors into three groups: well, medium and low-aftermath, theothers into two groups. For example, N. G. Andreev (1981) divides grasses into well: white bent, meadow fescue, meadow grass, grassland ryegrass, red fescue, cat grass, awnless brome, cane-fescue, etc., and low: grains, wheatgrass, creeping wheatgrass, rootless, etc.

He places the legumes according to the degree of senility in the

following order of destabilization: white clover, medick, yellow medick, red clover, sainfoin.

Soil and climatic conditions have a decisive influence on the aftermathability of perennial grasses. Plant aftermathability decreases with the transition from fertile humusto poor brown earth and gray soil, from sufficient soil moisture to arid conditions. Good aftermathability provides herbs on fertile, well-hydrated soils. According to N.G. Andreeva (1981), after-harvest in the forest zone reaches 50% of the first cut, which was carried out in the flowering phase of herbs. In the steppe zone, the aftermath harvest is 10-20% of the first cut. When organizing irrigation and applying the calculated norms of fertilizers, it is possible in all zones to get good aftermath of perennial grasses after mowing or grazing animals.

Aftermathabilityis greatly influenced by the mode of use of grass. With the rational use of perennial grasses, when the theoretically justified terms and the number of plant alienations are observed and the necessary measures for the care of the herbage are applied, the plants grow quickly and a high yield is ensured.

Of great importance for the growth of herbs are the timing and height of mowing or grazing. Grasses grow faster when mowing and bleeding in the early phases of development, before flowering. When grazing in the tillering stage and the beginning of booting in grass grasses, when most of the shoots are in a shortened condition and the points of growth of the stems are in the soil and are not damaged, this grows quickly due to the continued growth of the shortened shoots. At the beginning of booting, the inflorescence with a growth point is located above the first node close to the soil surface and is also not bitten by animals. Therefore, these shoots also continue to grow rapidly, providing a good aftermath.

When mowing and grazing herbs in later phases, with earing and flowering, when inflorescences with the point of growth of generative shoots are removed, the further growth of such shoots stops. The exception is made by some legume grasses, for example, medick, in which, after mowing, axillary buds can remain below the cut, which quickly form afterburning. In the majority of grasses, especially highbearing, after mowing in the earing phase, regrowth occurs mainly due to new shoots developing from the tillering nodes, therefore, aftergrowth grows slowly.

Low mowing has a negative effect on grass. The lower the cut, the less leaves and shoots with intact points of shoot growth remain, therefore the intensity of growth grows.

With the growth of grass, an important role is played by the spare plastic substances accumulated in the underground storage organs. After low mowing, in the absence of green leaves, photosynthesis ceases, and the

growth of the shoots occurs due to the use of spare nutrients. The larger these stocks, the more intense the growth of shoots. With the unsystematic use of grasses, especially in pastures, the accumulation of spare plastic substances in plants is disturbed, the aftermath is delayed or completely stopped, the grasses gradually die off, and the grass stands out, the pasture yield drops sharply.

Spare nutrients

The reserve nutrients consist of carbohydrates (sugars, starches), proteins (proteins), fats, enzymes, vitamins, mineral elements. These substances are deposited in the plant storage organs - in the roots, tillering nodes, rhizomes, root shoots, tubers, bulbs, in the ground parts of the stems, in fruits and seeds. The dry matter of the vegetative organs of plants on average contains: 70-80% carbohydrates, 6-18% proteins, 2-3% fats, 5-12% ashes.

Accumulation of spare plastic substances occurs during photosinosis in the leaves and other green parts of plants. Starting from the tillering stage of perennial grasses, the formed leaf apparatus assimilates such amount of organic substances, which are enough for the growth of the formed shoots and for deposition in the collecting organs. Replenishment of nutrients in plants continues until fruiting. After the completion of fruiting, their consumption begins to grow new shoots from the buds during the summer-autumn tillering. When a large leaf surface is formed in the tillering stage in the fall, the consumed reserves of nutrients in the subsurface organs are replenished again. This is crucial for the later life of perennial grasses. They are necessary for breathing and preserving plant life in winter.

In the spring, with the onset of positive temperatures, the branch of overwintered shortened shoots and the emergence of new buds during spring tillering of perennial grasses due to the consumption of spare nutrients begins. The more nutrients in the plant's organs of stock, the easier they overwinter, the spring grows faster and more shoots grow, the more yield they provide.

Spare nutrients are consumed by perennial grasses and for the regrowth of aftermath after another mowing or bleeding during the summer. After alienation, perennial grasses, deprived of leaves, cannot ensure the growth of shoots due to photosynthesis. Therefore, the regrowth of aftermath occurs due to the consumption of spare plastic substances. Only after the development of a sufficient amount of green leaves during tillering does the replenishment of nutrient reserves in plants begin again.

Methods for breeding perennial grasses

In perennial grasses, along with sexual, or seed, it is possible to have a non-hollow vegetative reproduction. Under vegetative reproduction, this means the formation of a new individual from vegetative organs or even parts and cells of the maternal organism. In perennial grasses, it is associated with the ability to form new shoots from the buds located on the aboveground and underground stem organs, on the roots (creeping stems, rhizomes, root shoots, tubers, bulbs, etc.). Despite the great diversity of vegetative reproductive organs, the beginning of a new individual should be considered a kidney, which gives rise to all organs.

The annual renewal of perennial grasses and vegetative reproduction are closely interrelated and condition each other. The shoots growing from renewal buds gradually lose their physiological connection with the mother plant, become isolated, become independent individuals capable of further renewal and reproduction.It is strongly pronounced in rhizomatous, root-sprouting, rhizomatous-loose-buch herbs and plants with creeping stems.

In perennial grasses with a taproot that have no root offspring and rhizomes, for example, sainfoin, meadow clover, and medick, newly formed shoots on the root neck do not spread over the area, therefore vegetative reproduction is not expressed.

Vegetative reproduction is of great importance for the life of many years of grass and practical human activity. Thanks to it, a great longevity of perennial grasses is ensured, especially under conditions that exclude seed reproduction, for example, when mowing or grazing grass several times before they mature or other unfavorable conditions for the formation of seeds.

In herbage of perennial grasses, renewal and reproduction occur mainly by vegetative means (S.P. Smelov, 1966). There is intense competition among living grass for living conditions. Young shoots of crumbling seeds cannot withstand the struggle for existence and mostly die. Professor A. M. Dmitriev noted that seeding herbs in the raw turf does not give a positive result. Processing turf “affiliated” means destruction of the existing phytocenosis, ensures the development of plants from sown seeds.

Vegetative reproduction in perennial grasses was formed in the process of evolution as an adaptive trait contributing to the survival of the individual. S.P. Smela (1966) considered the advantage of vegetative renewal and reproduction of perennial herbs over seed in the meadows to be resistant to the introduction of new species, the death of seedlings from the seeds seeded or produced by the cenosis itself. Vegetative reproduction is a very reliable way of preserving valuable varietal characteristics and

properties of plants in practical human activity.

Vegetative and seed reproductions are closely interrelated. Seed provides a gradual renewal of herbage plants growing from seeds. Even more important are the seeds when creating new hayfields and pastures.

Life expectancy of perennial herbs

The life expectancy of perennial grasses is determined by the number of successive generations of shoots that retain their ability to further regeneration and vegetative reproduction (W. Williams, 1949). It includes the period from seed germination to the withering away of all vegetative arising shoots. The life of perennial grasses is made up of many generations of shoots, which are links in a single chain of plant development. There is a continuous alternation of monocarpic shoots that end their life course in one to three years. The totality of their life paths is the life of a perennial herb.

The presence of the organs of vegetative renewal in the ontogenesis of perennial grasses provides an annual change of shoots that occur at different times in certain environmental conditions. The development of each shoot in perennial grasses occurs according to the type of shoots of annual monocarpic plants. But in the latter, after fruiting, the entire plant dies off, along with the root system, while in perennial grasses, only the above-ground part. Tillering nodes and other organs of vegetative renewal with the root system continue to live for 2-3 years or more.

The development cycle of a separate shoot was called the small development cycle of perennial grasses (A.P. Shennikov, 1950; S. P. Smelov, 1966). The large cycle includes the development cycles of all sequentially emerging vegetative generations of shoots.

Most perennial grasses, especially cereals, each new shoot forms its roots. The more favorable the living conditions, the sooner the roots of newly emerging shoots are formed, the earlier they switch to independent feeding. After three to four years, the root system and the tillering node of the maternal shoot die off, the physiological connection in the complex bush is lost. All shoots of the second order with shoots of the subsequent orders are isolated in independent individuals.Thus, a complex bush as a single individual splits into several complex bushes or individuals, called clones. A clone (Greek “klonos”–“movement”) is a progeny of a plant organism formed by vegetative means. This process of the emergence of independent individuals by vegetative means, i.e. the clone stage, occurs continuously in the phytocenoses in the meadows. The formation of a clone is the last stage in the age cycle of perennial grasses.

How long can vegetative renewal of perennial grasses last and what is their lifespan? The species composition of natural forage lands

indicates a different longevity of certain species. The limit of longevity is a sign formed in the process of evolution of a species in certain environmental conditions and competition.

There is no consensus about the life expectancy of perennial herbs. According to some scientists (S. P. Kostychev, 1933; T. A. Rabotnov, 1947), the degeneration of perennial grasses does not occur during vegetative reproduction, clones do not age. Other researchers (V. R. Williams, 1949; I. G. Serebriakov, 1952) argued that in the process of vegetative reproduction, gradual aging occurs, leading to the complete death of the clones. V. R. Williams (1949) argued that the degeneration of perennial grasses, or degradation, is a manifestation of the general law of biology, according to which with asexual reproduction, any subsequent generation is less developed and less resistant to adverse external conditions. In this regard, he spoke of the need for periodic seed renewal of grass stands.

In the practice of grassland this is confirmed. But the opinion of the inevitability of plant degeneration during vegetative reproduction is not accepted by many scientists. Academician S. P. Kostychev (1933) believed that the phenomenon of degeneration cannot be considered proven, because in nature there are many examples of mass vegetative reproduction of plants without signs of degeneration. This provision is confirmed by the following signs of vegetative reproduction:

1) vegetative shoots develop from the kidneys, which are formed from staged they are formed from staged young meristem located in the lower parts of plants - in tillering nodes, on rhizomes;

2) each shoot, developing from a kidney, again forms not only above-ground, but also underground organs - rhizomes, roots, root shoots, i.e. the organism is completely renewed;

3) the slowing down of aging is promoted by the fact that in the process of tillering and further development an individual of the species goes into a state of clone, i.e., the shoots are separated from the parent in two to three years (S. P. Smelov, 1966). Therefore, signs of aging should not be passed on to subsequent generations of shoots.

Professor S. P. Smelov (1966) explained the weakening of vegetative renewal and reproduction not by aging, but by the deterioration of life conditions, the irrational use of perennial herbs and the lack of care for them, the inability to create optimal conditions for the growth and development of perennial herbs. Reduced yield and low longevity of herbs can be explained by their irrational use due to lack of knowledge of the biological characteristics of herbs.

The longevity of perennial grasses is directly dependent on

environmental conditions. Favorable conditions contribute to the longevity of meadow grasses. An example of this is the practice of creating long-standing cultivated hayfields and pastures.

It is necessary to distinguish between the biological and economic longevity of many years of herbs. Under favorable conditions, they can live indefinitely, but in practice, their life expectancy is limited.

According to longevity, perennial grasses of hayfields and pastures in the practice of their use, academician I. V. Larin (1964) divided into the following groups: young, middle-aged and long-term.

Young grass in mixtures gives the maximum yield in the second year of life. In the third year, their yield is sharply reduced, in the fourth and fifth years they disappear from the herbage. Such herbs include red clover, hybrid clover, sainfoin, ryegrass, etc.

Herbs of average longevity give maximum yield for the third year of life. In the fifth year, the yield drops sharply. Such herbs include meadow moth, meadow fescue, cat grass, bird's foot trefoil.

Perennial peasants give the maximum yield in the 4th - 5th year of life. Of the long-term grasses introduced into the crop, the rump boneless meadow, fox-tail grass, bluegrass, grain harvester, corngrass, red bark, white clover are noted.

The division of perennial herbs into groups on the longevity of their use is conditional. Depending on the environmental conditions, methods of use and care of herbs, their life expectancy can be significantly increased.

1.1. Evaluation of nutritional value of fodder plants

The feeding value of plants is determined by the following indicators:

1. eatable animals;
2. digestibility in the body;
3. nutritional value.

In addition to these three indicators, the plants are given an economic characteristic of yield, duration of use, ease of harvesting, preparation and storage of feed, yield and cost of production per unit area.

Under the palatability of plants should be understood the willingness and fullness of eating them by animals. Feeding is an important indicator of the fodder value of a plant. If, with good palatability of plants, a high productivity of animals is ensured, this indicates a high nutritional value of the plants.

But not always good palatability of feed provides high

productivity. For example, in case of violation of the harvesting technology of haylage, the feed is self-heating, which acquires a brown color and the smell of freshly baked rye bread. Such haylage is readily eaten by animals because of the characteristic smell, but it is poorly digested in animals and has low nutritional value.

Feeding the feed is estimated by the coefficient of eating, which is determined by the ratio of the feed eaten to everything specified by zootechnical norms and expressed as a percentage.

The degree of eating of plants by animals is assessed according to a five-point system: 5 - well-eaten plants; 4 - good; 3 - satisfactory; 2 - below satisfactory; 1 - bad; 0 - not eaten.Determine the degree of palatability of plants can be on the coefficient of palatability, by adopting the following ratio (Table 2).

Table 2

Determination of the degree of palatability of plants by animals on the coefficient of eating

The coefficient of palatability,%	The degree of palatability in points
0	Not eaten - 0
1-10	Poorly Eaten – 1
11-30	Eaten below satisfactory - 2
31-65	Eaten satisfactorily - 3
66-80	Eaten well - 4
81-100	Eaten excellent - 5

The consumption of plants by animals depends on many reasons: on the chemical composition, anatomical and morphological features, phase of development, conditions of growth and development of plants, species and age of animals.

The more soluble carbohydrates in plants, especially sugars, the better they are eaten by animals, for example, roots, cabbage, corn, peas. The absences of bitter taste, a sharp unpleasant odor in plants increase their palatability, and the presence of various protective devices (spikes, jagged spines, needles, burning juice, down) reduces.

The consumption of plants depends on the phase of development. Most of the animals, especially cattle, young animals, pigs, are better eaten by young succulent plants with a low fiber content and high digestibility of other nutrients. Sheep, goats, camels are more likely to eat more dry, xerophilous plants, steppe sedges, wormwood, salt grass.

The conditions of growth and development of plants have a great

influence on their quality and palatability. Plants grown on fertile soils with optimal moisture and sun light, as a rule, have high fodder value and are readily eaten by animals.

The digestibility of dry matter of plants in the body of animals refers to the ratio of the digested part to the whole eaten dry matter, expressed as a percentage. By digested part, we understand dry matter, which is used by the animal's body to ensure vital processes and the formation of products. The assimilated part of the dry matter of plants is determined in physiological experiments on animals by the difference between the eaten dry matters of feed and selected with excrement.

In addition to the digestibility of the dry matter of plants, they determine the digestibility of all nutrients separately, for example, protein, fat, carbohydrates, vitamins, and mineral nutrients. Nutrient digestibility of more than 75% is considered high, less than 65% is low.

The digestibility of the dry matter of plants depends on a number of reasons: the chemical composition and the ratio of nutrients in the plant, the age of the plant, the species and the age of the animals. Plants, containing all the nutrients necessary for animals in a suitable combination, as a rule, are more fully digested and absorbed, because the absorption of nutrients in the body of animals occurs in a certain ratio. For example, according to zootechnical norms of feeding dairy cows with a daily milk yield per cow of 14-20 kg per feed unit, a certain ratio of nutrients is required (Table 3).

The lack of one of the nutrients will limit the absorption of all others. Excess nutrient, as a rule, is not absorbed in the body, it is excreted with excrement. Lack or excess of one of the nutrients in the feed leads to their waste per unit of production, deterioration of animal health, reduction of their productivity and reproductive functions.

Plant digestibility depends on the phase of their development. Plants before flowering are digested well. However, herbs in the tillering stage have the highest digestibility, when the proteins in them are in water-soluble form, and carbohydrates are mainly represented by sugars and starch-scrap. In subsequent phases of plant development, their digestibility decreases. N. G. Andreev (1981) cites data on a decrease in plant digestibility compared with the tillering stage: during flowering, by 10–15%; fruiting - by 15-20%; drying - by 30-40%.

Table 3

Nutrient requirements of dairy cows of different production per 1 feed unit (Kalashnikov A. P., Kleimenov N. I., 1985)

Indicators	Daily milk yield fat3,8-4,0 %, kg		
	up to 10	11-20	21-30
Crude protein, g	145	155	160
Digestible protein, g	95	100	105
Sugar g	75	90	105
Starch, g	110	135	160
Fat	28	32	36
Crude fiber,% of dry matter	28	24	20
Cooking salt, g	from 6.5 to 7.4		
Calcium, g	from 6.5 to 7.4		
Phosphorus, g	from 4.5 to 5.3		
Magnesium,g	from 2.4 to 1.5		
Potassium, g	from 8.1 to 6.7		
Sulfur, g	from 2.8 to 2.1		
Iron, mg	80	80	80
Copper, mg	8	9	10
Zinc, mg	55	60	65
Cobalt, mg	0,6	0,7	0,8
Manganese, mg	55	60	65
Iodine, mg	0,7	0,8	0,9
Carotene, mg	40	45	45
Vitamin D, IU	1	1	1
Vitamin E, mg	40	40	40

In the later phases of development in plants, the relative content of essential nutrients and their digestibility decrease. This is explained by an increase in the percentage of fiber, a decrease in the proportion of leaves in relation to the stems. The leaves are 2-5 times more protein, 10 times more vitamins, and fiber is two times less compared to the stems of plants. Leaves and inflorescences of plants have the highest feed value. As plants age, an increase in the proportion of mechanical tissues occurs, the cell walls are impregnated with lignin (C57H60O10), their lignification occurs (lignification), and therefore plant digestibility decreases sharply.

Plant digestibility depends on the type of animal. Ruminant animals, especially sheep, are characterized by increased metabolism and energy, consume more nutrients per kg of body weight, digestibility of

coarse and bulky feed is higher. Pigs better assimilate concentrated and succulent carbohydrate feed.

When organizing the feeding of animals, it is necessary to know the dry matter content in the feed for the preparation of rations in accordance with the needs of various animals. Dry matter consumption is more dependent on digestibility. The lower the digestibility of dry matter, the less it is eaten by animals. Especially dairy cows need food with a digestibility of dry matter of at least 65%.

The nutritional value of fodder plants and fodder harvested from them is the ability of them to meet the needs of animals for energy, minerals and vitamins. These animal needs are determined by the physiological state, mass, age and productivity.

The energy nutritional value of plants is understood as the amount of energy absorbed and used in the organism of animals for increasing energy costs, building tissues and forming products. The nutritional energy of plants is ensured by that part of the organic substances contained in them, which are digested in the organism of animals. It is expressed by conditional fodder units with a certain productive action. In the Russian Federation, the standard is a feed unit equal to the nutritional value of 1 kg of oat grain. Oatmeal feed unit equated to 2714 kcal or 11.36 MJ.

The energy nutritional value of plants and feed from them, expressed in oat fodder units, was determined in balance experiments on cattle and does not correspond in nutrition to other species of animals with different structures of the gastrointestinal tract, with significant differences in the ability to the digestion of nutrients contained in various feeds, to their use for the formation of products. Scientific institutions under the leadership of the Institute of Livestock (VISH) have developed a system for assessing the energy of the nutritional value of feed by exchange energy. The exchange energy is determined in balance experiments on animals as the difference between the gross energy in the eaten feed and the energy of the non-digestible part of the feed, released with feces and urine. For ruminants, energy losses due to gases generated during fermentation in the stomach are taken into account.

In this system, the assessment of energy nutritional value of feed exchange energy for various species of animals and birds is calculated by the formulas (AP Kalashnikov et al, 1985).

For ruminants and horses:

EE = GE - (Ef + Eu + Erwg) The correction for methane is: for concentrated feeds - 5%, for green and silageable feeds - 10%, for coarse feeds - 15% of gross energy

For birds: EE = GE - Ep, where:

EE - the exchange energy in feed in megajoules (MJ) Megajoule = 1 million joules. 1 J = 0.2388 calories

GE - gross energy in the eaten feed, MJ

Ef - energy in feces, MJ

Eu - energy in urine, MJ

Erwg - energy released with gases, MJ

El - energy in the litter, MJ

The amount of exchange energy in the feed, the chemical composition of which is determined, can be determined by the following equations (A.P. Kalashnikov and oth., 1985).

For cattle (cattle):

EE = 17.46dP + 31.23dF + 13.65dC + 14.78dNFS

For sheep:

EE = 17.71dP + 37.89dF + 13.44dC + 14.78dNFS

For horses:

EE = 19.46dP + 35.43dF + 15.95dC + 15.95dNFS

For the bird:

EE = 17.84dP+ 39.78dF + 17.71dC + 17.71dNFS

where dP is digestible protein, g; dF - digestible fat, g; dC— digestible cellulose, g; dNFS - digestible nitrogen-free substances, g. Coefficients: 17.46 - the amount of exchange energy from 1 g of protein assimilated in the body of cattle in kilojoules (KJ); 31.23 - the amount of metabolic energy from 1 g of fat, absorbed in the body of cattle, KJ; 13.65 - the amount of metabolic energy from 1 g of fiber absorbed in the body of cattle, KJ; 14.78 - the amount of metabolic energy from 1 g of nitrogen-free extractive substances, absorbed in the body of cattle, KJ. The equations for different types of animals can be summarized in one thing:

$EE = E1 \cdot dP\ (g) + E2 \cdot dF(g) + E3 \cdot dC\ (g) + E4 \cdot dNFS(g)$,

where E1, E2, E3, E4 will be different for different types of animals. For example, E1 is the amount of exchangeable energy in KJ from 1 g of protein absorbed in the organism of animals: for sheep - 17.71 KJ; for horses - 19.46 kJ; for pigs - 20.85 KJ; for poultry - 17.84 kJ.

E2 - the amount of exchangeable energy in KJ from 1 g of fat, absorbed in the body with the corresponding values of coefficients for different species of animals.

E3 - the amount of exchange energy in KJ from 1 g of absorbed fiber.

E4 is the amount of exchange energy in KJ from 1 g of assimilated nitrogen-free extractive substances with the corresponding values for various animal species according to the equations.

However, the energy assessment of the nutritional value of feed does not give a complete assessment of their quality; it is only part of a comprehensive assessment. Animals need not only enough energy, but also the necessary set of nutrients, minerals and vitamins. The exchange energy of the feed depends not only on the amount of nutrients contained in it, but also on their relationship with each other, the digestibility in the body of various animals. The balance of feed for all nutrients and mineral elements is one of the main indicators of nutritional value.For a complete assessment of the quality and nutritional value of feed, it is necessary to determine many other indicators along with exchange energy: dry matter, crude protein, lysine, methionine + cysteine, sugars, starch, fiber, fat, calcium, phosphorus, potassium, sodium, chlorine, magnesium, sulfur , iron, copper, zinc, manganese, cobalt, iodine, carotene, vitamins: A, D, E, B1, B2, B3, B4, PP, B6, B12.

Feed must contain all the nutrients necessary for animal life and the formation of products. For a comprehensive assessment of their nutritional value, it is necessary to determine, in addition to energy, also protein, mineral and vitamin nutritional value. Under the protein nutritional value of feed understand the amount of digestible protein per 1 feed unit with the necessary content of amino acids. The required amount of digestible protein for 1 feedunit different for different species of animals depending on their age, productivity and physiological state.

Under the protein nutritional value of feed, it is necessary to understand the ability of them to satisfy the need of animals in the required quantity and quality of protein for each feed unit according to zootechnical norms. The quality of protein depends on the content and ratio of amino acids, especially essential.

Proteins are the most important part of each cell of an animal and plant organism (muscles, integumentary tissues, internal organs, cartilage, blood - all are protein substances). The composition of proteins includes nitrogen, which is not in fats and carbohydrates. Protein - the main “building material” for a living organism, as well as a source of energy. It stimulates the metabolism, increases the body’s resistance to infections, increases blood formation and is used in the synthesis of enzymes and hormones. Nitrogen is part of nucleic acids, which are crucial in the metabolism and management of heredity in animals.

Simple plant spare proteins are also called proteins. In addition to proteins, the composition of the crude protein includes amides-glycosides, nitrates, ammonium salts, free amino acids, alkaloids. The elemental composition of proteins is diverse, on average they contain: C – 52%; O – 21-23%; N – 16%; H – 6-7%; S– 2%; P – 0.6%.

Proteins are biopolymers of amino acids. Simple proteins or proteins are composed of amino acids. Amino acids in plants can be in a free state, especially during the period of their intensive growth. Before animal protein is formed, plant proteins decompose into amino acids, undergo a complex restructuring during digestion and metabolism in animals. Cleavage begins in the stomach and ends in the intestine, from which amino acids are absorbed into the blood.

About 20 amino acids have been studied, of which 8 are not synthesized in the organism of animals: lysine, methionine, cysteine, valine, tryptophan, leucine, phenylalanine and arginine. These amino acids are called indispensable for animals, and their absence in the feed leads to metabolic disorders. Plants containing proteins with an incomplete composition of essential amino acids are considered defective food.

In addition to amino acids, there are amides in plants - nitrogen-containing substances of a non-protein nature. The nutritional value of amides is less than proteins. Amides are more abundant in young plants; while in concentrated feed protein is mainly composed of storage proteins.

The amount of crude protein that is absorbed from the feed in the animal's body is called digestible protein. The composition of crude protein and its digestibility in different plants is different. More leguminous plants contain leguminous plants – annual and perennial legumes, cereals. Bean grasses contain it 2 times more than grasses; the seeds of some legumes are 3 times richer in protein than grains of cereals. And the digestibility of protein in leguminous forage crops is higher than that of cereals. For example, the digestibility of legume seed proteins reaches 82-87%, and cereal grains – 70-75%. With full amino acid composition of proteins of seeds of legumes and high digestibility, they have a high nutritional value.

Experiments of scientific institutions found that in the rations for each feed unit should be 95-120 g of digestible protein, depending on the species, productivity and physiological state of animals.

Fats play a very important role in feeding animals, they are an energetic material. In the oxidative decomposition of 1 g of fat, 9.3 kcal of heat is released, 2.25 times more than in the decomposition of 1 g of carbohydrates.

Fats can be deposited in the reserve in the subcutaneous tissue, in the glands, in the liver, in the pararenal cellulose. This store of fats is consumed by an animal organism with insufficient feeding, serious diseases and protects more important tissues and organs from destruction.

The role of fats is not limited only to the energy value, since they are part of the protoplasm of cells and regulate the metabolism in animals. Fat-soluble vitamins are absorbed with fat in the body.

It has been established that unsaturated fatty acids, which are found in vegetable fats called oils, are very important for the metabolism in animals. Unsaturated fatty acids (oleic, linoleic, linolenic) are actively involved in fat metabolism and enhance the protective functions of the organism of animals. The full value and biological activity of vegetable fats is explained by the high content of unsaturated fatty acids in them. For example, in sunflower oil, 68% linoleic acid, i.e., 17 times more than in butter and 4 times more than in lard.Consequently, vegetable fats containing many biologically active substances should be included in the diets of animals. Their content in feed for dairy cows should be 4%, for pigs - more than 6% of the dry matter of the diet. More fat contains oilseeds: sunflower, canola, camelina, soybean, peanuts and others.

Carbohydrates are an energetic material in the body of animals. They are divided into two groups - crude fiber and nitrogen-free extractive substances (BEV). Crude fiber consists of cellulose (C6H10O5) n, hemicellulose (C5H8O4) n, pectin substances (C6H8O5) n, and inlaying substances (lignin C57H60O10, cutin). BEVs include sugars, starch, inulin (C6H10O5) n, organic acids, glycosides. Sugar and starch are of primary importance in feeding animals. Entering the body with food, starch undergoes hydrolysis in the stomach and intestines and is absorbed into the blood in the form of monosaccharides. Sugars and starch are food for microorganisms in the rumen of ruminants, are absorbed by them for the synthesis of bacterial protein, and fermented to organic acids.

Carbohydrates easily decompose in the body, releasing energy. With the decomposition of 1 g of carbohydrates 4.2 kcal are released energy. If the body receives a sufficient amount of carbohydrates, the energy processes are carried out at the expense of them, and proteins and fats are stored. In the body of animals, carbohydrates are stored in the form of glycogen polysaccharide in the liver, muscles and other organs. Some of them are converted into fats and deposited in the form of adipose tissue.

Sugars are already available sources of energy for the organism of animals and for the microflora of the pregastric ruminant. With an optimal sugar ratio (1: 1) in the diets of ruminants, favorable conditions are created for the life of the microflora, the synthesis of bacterial protein, fatty acids and B vitamins in the rumen is improved.

Along with starch and sugars, fiber is of great importance in feeding animals, especially ruminants. Although digestibility of fiber is small, it is necessary as a factor normalizing digestion in the rumen, which plays a large physiological role. For lactating ruminants, fiber is needed in the diet for the synthesis of volatile fatty acids as precursors to milk fat. Being a mechanical irritant of the intestine and the slag component of the

feed, it contributes to the contraction of the smooth muscles of the intestine, the promotion of chyme in the intestine and emptying it. Excessive fiber in the diet reduces the digestibility and absorption of nutrients by the body of animals.

In cow rations, the amount of fiber as a percentage of dry matter should be 18-28%. The higher the productivity of animals, the lower should be the percentage of fiber. For pigs, the amount of fiber in diets is 7-8% of dry matter. Fiber is more found in roughage — hay, straw, less — in root crops, tuber crops, pasture grass, grains, and seeds of grain crops.

Of great importance is the content in the feed of mineral salts. The elements of mineral nutrition regulate the activity of the nervous system, support osmotic pressure and a weakly alkaline blood reaction. Mineral salts are part of hormones, proteins, lipids, vitamins, enzymes. For example, iron is part of the blood hemoglobin; sulfur is part of the amino acids cystine and methionine. Calcium, fluorine and phosphorus are the main components of the skeletal system of animals.

The value of the elements of mineral nutrition is explained by their large role in metabolism. When organizing a science-based feeding of animals, rations of calcium, phosphorus, sodium, chlorine, magnesium, potassium, sulfur, iron, zinc, manganese, copper, cobalt, and iodine should be rationed. For the normal functioning of the animal organism, it is important not only the presence of all the necessary mineral elements, but also their relationship, the so-called mineral balance. The need of animals for mineral elements depends on their interrelationship in metabolism, the level of their assimilation and excretion, the ability to accumulate in the body.

In addition to proteins, fats, carbohydrates and mineral salts in plants should be vitamins. The biochemical value of vitamins is that they stimulate the metabolism in the cells of the animal body, like enzymes and hormones. The lack or absence of one of the vitamins in the rations leads to disorders in metabolism and the disease of animals.

1.2. Economic evaluation of food plants

Under farm conditions, fodder plants are estimated, first of all, by the magnitude of yield in specific soil-climatic conditions. The most widespread are those fodder crops that provide a higher yield of dry matter per unit area.

The second very important indicator is the cost of one feed unit and the output of livestock products per unit area of feed crops.

In the economic evaluation of forage crops, the ease of harvesting,

harvesting and storing feeds is taken into account. It is easier to prepare concentrated feed from grain crops than to harvest and store root vegetables. It is easier to harvest hay from cereal grasses or their mixed crops with legumes, as compared to harvesting hay from single-species crops of leguminous grasses. Haylage is more profitable and easier to harvest from legumes.

In addition to the yield of perennial grasses, the duration of their use is of great importance. On irrigated plots, medick sowing has become widespread in single-species crops and in grass mixtures, providing up to 200 centners of hay per 1 ha. Grasses are more long-lasting: awnless brood, silvergrass, ruminants, timothy grassland, fescue, bluegrass and meadow foxtail. From legumes, clover is more durable.

The time of regrowth of perennial herbs in spring is also important: those that grow back are estimated higher. In this respect, meadow foxtail, reed fescue, awnless brome and medick are valuable.A comparative study of most species of perennial grasses has shown that the productivity of grasses sown in single-species crops and grass mixtures is very unequal. Some species have high yields, others are less productive, but grow in early spring, and others are more durable and multi-cage. Legumes are usually less durable, but contain more protein. Therefore, under farm conditions, it is necessary to use a specific set of forage crops, which provides the maximum of high-quality feed per unit area with a uniform supply of them during the growing season of plants.

CHAPTER 2 GRASSES

2.1 General characteristics and chemical composition

Cereal crops play the main role in field feed production. Grain requirements are increasing every year due to the increase in the level of national consumption of food products. From 50 to 80% of the calories of a person's daily ration are grains and foods derived from grains. The demand for feed grain is particularly increasing due to an increase in the production of meat, milk and other animal products.

Grain is the main source of energy and protein, it is readily eaten by animals, and it is highly digestible and nutritious. This concentrated feed in a small volume contains a large amount of easily digestible nutrients, in it 60-70% of nitrogen-free extractives, of which 55-57% are starch (Table 4).

Table 4

Chemical composition and nutritional value of cereal grain (according to M. A. Smurygina, 1997)

Culture	Chemical composition,%						Content in 1 kg of feed		
	protein	phytalbumin	fat	cellulose	ash	nitrogen-free extractive substance	dry matter, kg	feed units	digestible protein, g
Wheat	13,1	10,4	2,3	2,7	1,7	67,2	0,87	1,20	117
Rye	12,3	10,4	2,0	2,4	1,9	68,4	0,87	1,18	102
Oat	11,0	10,2	4,7	9,8	3,4	58,2	0,87	1,00	85
Barley	10,1	9,5	2,1	4,0	2,8	68,0	0,87	1,21	81
Corn	10,4	9,5	4,1	2,2	1,6	68,7	0,87	1,37	78
Sorghum	11,2	10,1	2,8	3,0	2,2	67,8	0,87	1,18	90
Millet	11,1	10,0	3,7	9,2	3,7	56,6	0,87	0,95	79
Triticale	15,1	12,6	2,4	2,3	1,8	65,5	0,86	1,15	121

Grain of cereals contains on average 10-14% of protein, which is 85-90% represented by phytalbumins. The fat content in cereal grains ranges from 2 to 5%. Fats in the grain are mainly in the embryo, contain unsaturated fatty acids, which contribute to the formation of soft fat in animals, especially when fed with oats and corn.

Macro- and microelement composition of grain of cereals are presented in tables 5 and 6 (according to the reference book "Feed". M., 1997).

Grain grasses have poor ash elements, especially calcium. For 3-4

parts of phosphorus there is one part of calcium, and calcium is required for cattle almost 1.5 times more than phosphorus.

Table 5

Macroelement composition of cereal grain, g / kg

Culture	Calcium	Phosphorus	Potassium	Natrium	Magnesium
Corn	0,7	0,3	2,7	0,2	0,9
Oat	1,4	3,4	5,3	1,8	1,1
Barley	1,6	3,9	6,0	0,7	1,0
Rye	0,8	2,7	4,8	0,1	1,0
Wheat	1,1	4,8	3,3	0,2	1,0
Sorghum	1,1	2,9	10,1	0,3	1,2
Millet	0,9	5,1	4,3	0,1	1,1

Table 6

The trace element composition of the grain of cereals, mg / kg

Culture	Iron	Cobalt	Copper	Iodine	Manganese	Molybdenum	Zinc
Corn	300	0,029	0,187	0,014	1,07	0,091	19,5
Oat	41	0,065	4,861	0,100	56,53	0,442	22,5
Barley	50	0,049	3,423	0,220	22,25	0,410	21,4
Rye	63	0,076	6,864	0,085	35,40	0,287	20,0
Wheat	50	0,029	1,868	0,062	37,46	0,320	19,0
Sorghum	50	0,008	2,960	0,080	28,40	0,600	2,6
Millet	40	0,032	16,560	0,016	17,90	0,187	35,0

The vitamin and amino acid composition of grain of cereals is presented in tables 7 and 8 (Feed, M., 1997).

There are few vitamins in cereal grains, especially carotene, riboflavin (B2), pantothenic acid (B3) and others. The lack of one of the vitamins causes a metabolic disorder in the organism of animals, a decrease in their productivity and reproductive functions.

Table 7

Vitamin composition of cereal grain, mg / kg

Culture	E	B_1	B_2	B_3	B_4	B_5
Corn	30	3,0	0,5	7,0	400	14-20
Oat	50	4,3	0,6	10,0	900	8-14
Barley	44-63	3,1	0,6	8,5	1000	60
Rye	21	2,6	0,6	10,0	450	8-18

Culture	E	B_1	B_2	B_3	B_4	B_5
Wheat	35-135	5,0	0,8	11,0	900	47

Table 8

Amino acid composition of grain of cereals, g / kg

Culture	Li-sin	Methi-onine	Triptop-hane	Argi-nine	Histi-dine	Leu-cine	Isoleu-cine	Pheny-lalanine	Thre-onine	Va-line	Gly-cine	Cys-tine
Corn	2,9	1,9	0,8	4,1	2,1	12,2	4,6	4,8	3,5	5,4	2,6	1,0
Oat	3,6	1,6	1,4	6,6	1,9	7,8	5,0	5,5	3,5	5,9	2,9	1,6
Barley	4,4	1,8	1,6	5,2	2,4	7,7	4,9	5,9	3,7	5,9	4,6	1,8
Rye	4,4	1,7	1,1	5,8	2,7	7,4	5,2	5,8	3,8	6,1	3,7	1,8
Wheat	3,9	2,1	1,8	7,0	2,9	9,4	5,9	6,9	3,9	6,0	–	2,0
Sor-ghum	2,8	1,1	1,0	3,7	2,4	14,2	5,6	4,8	3,0	5,1	3,0	1,8
Millet	2,4	2,6	1,5	3,2	1,9	10,6	4,3	5,3	3,6	5,3	2,7	–
Triti-cale	4,1	1,3	–	5,4	3,2	5,9	3,1	4,7	2,4	3,9	4,0	2,0

Despite these drawbacks, grain and its products are an important source of energy for animals. Without concentrated feed, which includes, above all, cereal grains, it is difficult to obtain high animal productivity. This is the most significant group of forage crops.

For cereal crops include wheat, rye, oats, barley, maize, sorghum, millet. Cereal cereals occupy the first place in the world agriculture in terms of area of sowing among all agricultural crops, since food supply and the development of animal husbandry depend on this.

2.2. Structure and development of cereal crops

Morphological features. Grain breads belong to the family of Meadowgrass (Cereal) Poaceae (Gramineae). They are annual herbaceous plants.

The root system of cereal cereals is fibrous. When the weeds germinate, germinal primary roots are formed. The number of germinal roots is different in different crops: in spring wheat, most often 5, in winter wheat - 3, in oats - 3-4, barley - 5-8, winter rye - 4, in millet, sorghum, corn - 1. Of the underground stem nodes form secondary or nodal roots; in corn and sorghum, from above-ground nodes, which are called supporting or aerial, they ensure plant resistance to lodging. The main part of the roots of cereal crops is located in the top layer of soil 20-25 cm

The stem of cereals is hollow inside – straw (in maize and

sorghum, filled with parenchymal tissue). The stem of the cereals of the first group of 5-7 internodes, the second group of bread – corn, sorghum – from 13-20 internodes. The number of internodes corresponds to the number of leaves. The straw in the nodes is thickened, sometimes rounded, oblate.

Leaves alternate, linear, arranged in two rows. The leaf consists of a leaf sheath covering the stem and a leaf blade.

The flowers are small, often bisexual, in maize – same-sex. Perianth underdeveloped and consists of films - flowering scales.

Inflorescence in cereal grains – ear (wheat, rye, barley) or panicle (oats, sorghum, millet, rice). Corn on a plant has two inflorescences: a male with male flowers and an ear with a female. The spike consists of a bar-bent rod, which is a continuation of the stem, with spikelets on it. The whisk represents a central axis with lateral ramifications, which also branch and form branches of several orders of magnitude, at the ends with spikelets. A spikelet consists of one or several flowers and two glumes.

Fruit grains, in which the seed is covered with seed and fruit membranes. In grain crops, it is covered with flowering scales, tightly fitting the grains or growing together with it, for example, in barley. At the base of the weevil is an embryo consisting of a bud, covered with rudimentary leaves, the primary stem and root. The germ is connected by a scute to the endosperm of the weevil.

Mesophilic cereals are most prevalent for hay and pasture use – wheat grass, awnless brome, seedless and creeping couch grass, meadow and red fescue, cat grass, white bent grass, wild rye.

Xerophilous cereals – fescue, feather grass, bluegrass bulbous and other typical plants of the dry steppes, semi-deserts and deserts, mainly of pasture use in the early phases (before flowering) are well eaten, but the potential level of their productivity is low.

Hygrophilic and hydrophilic grasses grow mainly in the water along the banks of rivers, lakes, on wetlands, in places where the duration of flooding exceeds 40 days, for green fodder these plants are best used at an early age - before earing. This group includes: reed, oatmeal, manna water, are close to this group cane reed and sloughgrass.

Salt grasses– these include cereals growing on the salt marshes and saline soils of the steppe, semi-desert and desert areas. Most of them are readily eaten by animals before the onset of the earing phase. Typical representatives of this group are the puccinellia and riparian.

The following is a brief description of the main species of the bluegrass family in the following sequence: 1 – mesophilic grasses, 2 – xerophilic grasses, 3 – hygrophilic and hydrophilic grasses, and 4 –saltgrasses.

In preparing the material, publications on this issue were used by I. V.Larin (1969, 1975, 1990), S. I. Dmitriev, V. G. Iglovikova, N. S. Konyushkova, V. M. Ramenskoy (1974, 1982), N. G. Andreeva (1983) and a number of other authors.

The development of cereal crops

Plant development is understood as the qualitative changes that occur in them during the vegetative period, associated with the formation of vegetative and generative organs.

Cereal crops in the process of growth and development go through a series of stages characterized by certain morphological changes and physiological processes. Morphological changes associated with the formation of vegetative and generative organs are commonly referred to as phenological phases. The duration of each phase of grain crops varies and varies depending on the type of plant and soil and climatic conditions from one week to three.

In grain crops, the following phases of development are distinguished: sprouting, tillering, going into the tube (stalking), earing (or budding inflorescences), flowering and ripeness. The beginning of each phase is considered the day when at least 10% of the plants enter this phase, and the complete phase is at least 75% of the plants.

Shoots. The beginning of the life of cereal grains is swelling and growth of grains. First are germinal roots sprout, then stem and leaves. On the surface of the soil there is an escape in the form of an awl, covered with a cap (coleoptile). The seedling phase occurs when the coleoptile is torn and the first green leaf appears. Most cereal grains have green seedlings, rye has purple-brown, and barley has a bluish-smoky.

About a week after the appearance of the first leaf, a second one appears from his sinus. With the same intervals of time, the third and fourth leaves appear. At the same time, the root system grows, by which time the primary roots penetrate the soil to a depth of 30-35 cm.

Tillering. After the appearance of the third - fourth leaf, an underground branching of the stem from the buds located in the leaf axils occurs. The zone of the underground part of the stem where the branching occurs is called the tillering node. With the advent of lateral shoots, the formation of the secondary root system begins in the tillering node; this is the beginning of the tillering. By this time, the primary roots penetrate the soil to a depth of 40-50 cm, and the secondary roots grow mainly in the surface layer.

The number of side shoots is different depending on the external conditions: the presence of moisture, the optimum temperature, the supply of batteries, and good illumination. Under favorable conditions, several

dozen shoots can form on a single plant.

The dynamics of the formation of lateral shoots and the occurrence of secondary nodal roots in different crops are different. In rye and oats, nodal roots are formed simultaneously with underground branching, that is, during the appearance of the 3rd 4th leaf, in barley and wheat, they arise later than the beginning of tillering. Breads of the second group: millet, maize, sorghum - nodal roots are formed before the beginning of tillering, before the formation of the 6th 8th leaf. This explains the ability of millet; corn, sorghum is better to tolerate a lack of moisture in the first periods of growth.

Pick up the phone. This is the phase of the appearance of stem nodes over the soil surface at the main shoot. The growth of the stem begins with the lengthening of the first internode located above the tillering knot. After a week or two, the elongation of the second, third and subsequent internode begins - by growing meristematic tissue located in the lower parts of the internodes. The growth of internodes ends at the end of flowering. At the same time, in this phase, the root system continues to develop in plants, and generative organs are formed - embryonic inflorescences, spikelets and flowers.

Earing. The beginning of this phase is considered the appearance of half of the inflorescence (ear or panicle) from the vagina of the last upper leaf of the plant. At this time, the growth of the stem and leaves continues and there is an increased need for nutrients and moisture.

Bloom. As a rule, flowering begins after full earing. In the flowers of cereals at the base of the flower scales there are two thin films (lodicules) that swell at the beginning of flowering and open flowers - stamens appear with pollen sacks and stigmas of the pistil.When the anthers mature, the pollen falls on the stigma of the flowers of the same plant or is transferred to other plants — by wind, insects, and cross-pollination occurs. In self-pollinated grain crops (barley, wheat, oats, millet, rice) the anthers ripen before the flowers open, so the pollen falls on the stigma of the same flower, self-pollination occurs. In maize, rye, cross-pollination occurs.

In the flowering phase ends the growth of the stem, inflorescence and leaves.

Maturation is divided into three periods: the formation of grains, filling and ripening. Under the formation of grains understand the period from fertilization to establish the final length of the weevil. In bulk, we understand the process of starch accumulation in the endosperm of the weevil, from the watery state to the milky and pasty state. Duration of loading grain – 20-25 days.

After the termination of the flow of plastic substances into the

endosperm of the kernel, its maturation begins, which is divided into two periods of ripeness: wax and solid. During the period of wax ripeness (up to 6 days), the endosperm of the weevil is waxy, resilient. During the period of hard ripeness, it becomes hard, on a fracture - either mealy or vitreous, endosperm membranes become dense, leathery.

Spring grain crops occupy the first place in the area of sowing and gross grain harvest. The main food crop is spring wheat, which is also used for fodder purposes. Barley, oats, maize, and sorghum – the main grain crops – occupy a large share in the production of grain. Cereal crops – millet, rice – are also used for animal feed.

2.3 Mesophilic grasses

*Mesophilic grasses.*Awnless brome[1] – Bromopsis inermis Leyss. Long-term riding rhizomatous grass, 70-150 cm tall. It is widely distributed in forest, forest-steppe and steppe zones, in floodplain meadows. In the steppe and forest-steppe it grows on deposits of fertile soils and in the floodplains of rivers with soils of light mechanical composition or in floodplains with large sediments, flowing to form clean thickets. On pastures before flowering, as well as in hay, it is well eaten by all types of livestock. When mowing before flowering gives a second cut due to the elongated and shortened vegetative shoots.

Average yields vary widely, depending on the area and soil and on fallow lands – from 12 centners on light chestnut soils to 80 centners per hectare and higher on floodplain meadows. Harvest seeds 3-4 c with 1 ha and above.

The following varieties are approved for use in the Republic of Kazakhstan: Akmolinsky 91, East Kazakhstan, Limanny, SibNIISHOZ 88, SibNIISHOZ 189, Stepnoy.

Meadow brome (straight) – Bromopsis riparia Rehm.). Perennial horseback (or half-top) short-root cereal, 30-120 cm tall. Introduced to culture as a hay and hay-pasture plant. Well eaten by livestock, the plant is suitable for surface subsowing on downed pastures, especially on slopes. Mid-season and low-capped, the maximum yield gives the 3-4th year of life. The Tselinograd grade is allowed to use 30.

Chess grass – Bromopsis variegata (Bieb.). Long-term riding loose-bunchgrass, 40-80 cm high (in favorable conditions up to 120 cm).

[1] More detailed information about the awnless brome, wheatgrass and a number of other cereals, as well as medick, espartace, and clover used in the field sowing of Kazakhstan, is described in the second section of the textbook.

After mowing in the flowering phase gives a small amount of aftermath. It is well eaten by cattle on pastures before flowering, later it is bad. When tested in culture forms powerful bushes with wide and gentle leaves. Deserves attention as a plant, promising for introduction into the culture.

Slender wheatgrass – Elymus trachycaulon (Link.) Nevski. Loose-bunch riding mid-summer grass, 50-100 cm tall. It is widely distributed in culture in forest-steppe and steppe areas. When crops are planted, often in the first year it blooms and bears fruit. In the pasture, it is well eaten by livestock only before earing and then quickly grows coarse. In the hay is eaten satisfactorily. By eating cattle is below almost all cultivated grains.

The maximum yield yields for the 2nd or 3rd year of life, from the 4th year the yields drop sharply, not more than 4-5 years in herbage remains. The average yield for clean sowing is 25-30 centners per hectare. Seed yield 2-4 centners per hectare. Used for haymaking and very rarely in pasture. Allowed to use varieties: Karabalyksky 86 and Kolutonsky (Armand).

Fiber ragneria – Roegneria fibrosa (Schrenk) Nevski. The loose-sprouted riding mid-summer grass, which is similar in appearance to rootless wheat grass, but has more tender leaves. Occurs in floodplain meadows, tolerates significant salinization of the soil.

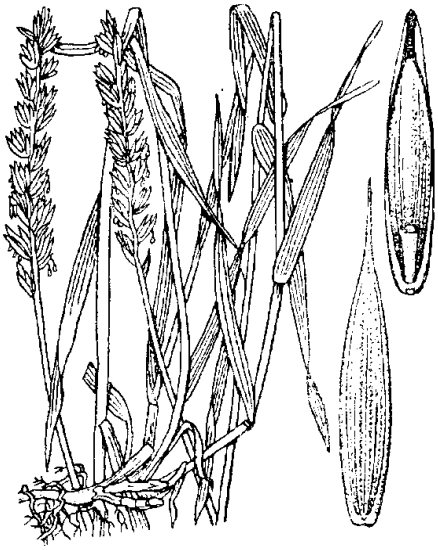

Fig.2. Couch-grass

Couch-grass, Arzhanian, Bidaiq – Elytrigia repens (L.) Desv. Ex Nevski (Agropyron repens (L.) Beauv. Long-term riding grass with long rhizomes, height 50-170 cm, in the crops of weeds. Widespread in floodplains and estuaries, where it is often the main plant (Fig. 3). It tolerates long-lasting flooding in spring (up to 30-40 days) and significant salinization of the soil. It is eaten on pasture by all types of livestock well from the beginning of the growing season to the middle of the earing, like its growth, and later less readily. Protein in the tillering stage 19.4%, flowering 11.1%. Yield on deposits of up to 8-12 cent of hay, or 30-45 centners of green mass per 1 ha; in floodplain meadows and 20-25 centners of limans per hectare, and in favorable conditions up to 60 centners per hectare and even more. Mid-season, gives one and less often two aftershocks. Valuable grass for planting on estuaries with strongly malignant, saline-saline soils, on which cultural fodder plants die by irrigation.

Intermediate wheatgrass, intermediate, gray, tarlau– Elytrigia intermedia (Host.) Nevski (Agropiron intermedium (Host.) Beauv.). Long-standing semi-upper rhizome cereal, up to 60-100 cm high. It grows mainly on the slopes and outcrops of limestone. Cattle eat quite satisfactorily weeks longer than the cock's-foot grass. Gives one, rarely two aftermaths. In crops it develops well on the slopes, on chestnut, fertile and salt soils. Its average yield is 25-30 centners of hay during sowing with natural moisture and up to 70-90 centners per hectare with irrigation. Allowed to use varieties: Karabalyksky gray, Omich and Rostovsky 131.

Siberian wheatgrass, sandy– Agropyron sibirikum (Willd.) Beauv. (Cum yerkek); Desert wheatgrass, narrow-capped– A. desertorum (Fisch. ex Link) Schult. et schult. f. (erek jol ekek); regular wheat-grass – A. (A. pectriniforme Roem. et Schult (ericchek bidayk) and fairway crested grass(A. cristatum Gaerth). Loose-bunch semi-upper grasses. Siberian wheatgrassis a typical plant of plain and marginal sands and light mechanical composition of aerials steppe, semi-desert and northern desert. Desert wheatgrassgrows on loamy and clayey light chestnut soils and salty semi-deserts. Regular wheat-grass and fairway crested grass are typical for clayey and loamy dark chestnut soils of basins and meadow soils of semi-desert All sorts of wheatgrass are highly frost-resistant plants and are good fodder grasses Accepted to use varieties: *Aktobe narrow local, Aktobe local wide, Batyr, Tolagai, Dolinsky 1, Karabalyksky 202, Krasnovodopsky 414, Krasnokutsky narrow 305, Progress 85, Taukum hybrid, Ural narrow-headed* and local varieties.

Siberian wild rye, Kiyak – Elymus sibiricus L. Perennial loose-grasses, 60-120 cm tall. Occurs in floodplain meadows, dry land, deposits in

forest and forest-steppe regions of Siberia. In old camps and fallow lands, it often forms pure grass stands, yielding 20-30 centners of hay per hectare.

It is eaten well enough in pastures before heading, then quickly grows coarse. Volosna hay is eaten worse than other feed grains. Introduced into culture: sort Guran, zoned in Akmola region for sowing with a radical improvement of pastures. Allowed to use the variety Guran, as well as the cultivar of Daursky grassland Narynkol.

Fig. 2. Siberian wild rye

Melur, melur branched, sedge – Elymus ramosus (Trin.). Perennial grass, 30-50 cm tall, with a long rhizome of monopodial type. It is widely distributed in the steppe areas in crops as a malicious weed. It is more drought-resistant and salt-tolerant than creeping grass and replaces it on drier saltyfertile and chestnut soils. During riping, it grows coarser than wheatgrass creeping from the end of the earing phase is badly eaten, and in the flowering phase it is almost not eaten at all. Mown in the flowering phase and even fruiting in the hay is eaten by livestock well. Protein in the tillering stage is 15.2%, flowering - 11.1%. After haymaking or grazing, aftermath ability is low. Hay harvest is 4-6 c, or 12-20 c of grass per 1 ha. The hay of the fox in the places of its growth is valued above the hay of all other cereals.

Lime grass, tufted hair grass – Deschampsia caespitosa (L.). Long-term riding dense-grass cereal, 60-150 cm tall. Distributed in the forest, forest-steppe zones on wet and damp soils. The cattle eats satisfactorily only the leaves before earing, later the plant becomes very coarse and hardly

eaten by livestock. In the hay harvested no later than the beginning of flowering, it is eaten satisfactorily, refers to low-value plants. Often forms hummocks and contributes to the bogging of meadows, making it difficult to mow and graze animals. On cultivated meadows is considered as weed.

Fig. 3. Melur branched

Fig.4. Lime grass, tufted hair grass

Bushgrass – Calamagrostis epigeios (L.) Roth. Long-term top rhizome grass, 60-120 cm tall, grows at the site of the reduced forests, in the floodplains of rivers, in places with large deposits of sandy flow. In the forest-steppe is one of the main plants on alkaline and alkaline soils. With age, it quickly grows coarse and eats satisfactorily on pasture only before earing. Satisfactory hay is obtained only by mowing the plants before flowering.

Reed canary – Pharytoides arundinaceae (L.) (Digraphis arundinaceae (L.) Trin. Or Phalaris arundinacea L.) is a long-lasting, rhizomatous grass, 50–200 cm high. Distributed in forest and forest-steppe zones and in mountainous areas on wet swampy lowlandmeadows, in the floodplains of rivers, often forming solid thickets. On pastures it is well eaten before heading. Quite satisfactory hay is obtained by mowing at the end of heading. Natural hayfields with canary fruit produce hay crops up to 20-50 centners per hectare. All other top out of grasses with exceptionally

fast growth since spring, as a result, it can serve as early green forage. When mowing in the heading phase, it gives one or two full-fledged losses. The highest yields are obtained when reed canary is cultured on wet soils with close groundwater, but in culture it develops quite satisfactorily on moderately wet podzolic soils of the forest zone.

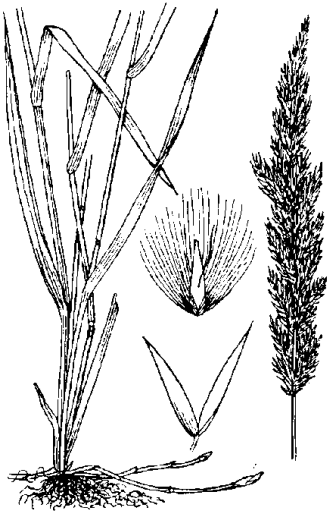

Fig. 5. Bushgrass

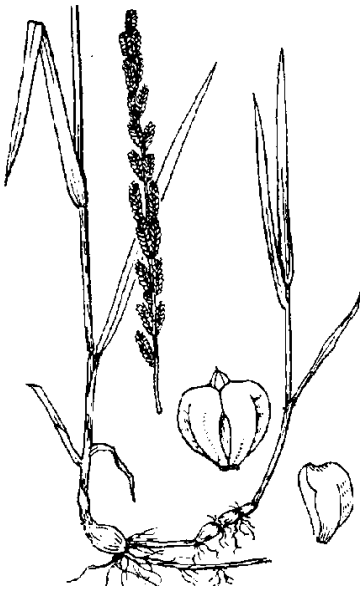

Fig. 6. Beckman's grass

Beckman's grass - Beckmannia eruciformis (L.) Host. Long-term riding rhizomatous grass, 50-150 cm tall. It is found in a small amount in the floodplains of the rivers of the forest and forest-steppe zones and on the marsh-saline soils of the estuaries. Before flowering, it is well eaten by animals, mowed no later than the middle of flowering gives good hay. Hay harvest in estuaries 12-20 c per hectare. Introduced into culture in drained marshes.

Meadow fescue – Festuca pratensis Huds. Mid-summer loose-bunch grass, 75-120 cm in height. Meadow fescue is widespread in the forest zone, forest-steppe and in the forest belts of the mountains, high-yielding grass. In spring it grows quite early, but then it develops slowly and blooms only in the second half of June, the seeds ripen in July, reaches full development in the third or second year of life, it lasts 6-8 years in grass mixtures. Perfectly eaten by all types of livestock, and when used for

haymaking it gives 2 mowings, it can be planted on pasture 3-4 or even up to 5 times. Compared with timothy, meadow is more drought-resistant and cultivated in forest-steppe (on leached, fat, and even on ordinary fertile soil). Approved for use in the Republic of Kazakhstan varieties: Kargalinskaya and Penza.

Reed fescue – Festuca arundinacea Schreb. Perennial riding grass, 80-150 cm tall, has long been introduced into culture. In yield exceeds all cultivated cereals, but the hay from it is coarse. At the first mowing in the earing phase, it gives 3 cuttings, and the hay is quite satisfactory. Promising for culture on wet soils.

Red fescue – Festuca rubra L. Long-standing grass, 30-70 cm tall. There are forms of bush, rhizomatous and mixed - rhizome-and-loose-bunch grasses. It is widespread in forest and forest-steppe zones, occurs on floodplain, lowland, upland meadows. Since spring it is developing rapidly, it grows well after venting, in the fall it gives an aftermath, which goes under the snow in a green state, eats well before earing, and later - worse. In terms of its feeding qualities, it is inferior to meadow grass and white-field grass. It is of interest for sowing on sports fields, lawns, etc.

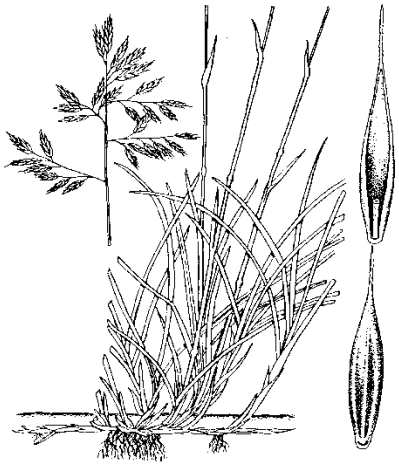

Fig.7. Red fescue.

Timothy grass – Phleum pratense L. Sredneletny high-grassed grasses, 60-120 cm in height. Timothy is widespread on dry valleys of the forest zone, on the riparian meadows of the forest and forest-steppe zones and in mountainous areas. It is beautifully eaten by all types of livestock, both in pasture and hay. On nutritional value is not inferior to other good

grass. It is the most common cultivated grass of the forest zone. It is kept in seeded grassland for 3-4 years, but in favorable conditions up to 6-8 years and more, it is used for hay and grazing, when used for haymaking it gives 2 cuttings, it can be grazed 3-5 times on pasture.

Cock's-foot grass – Dactylis glomerata L. Perennial loose-sprouted riding or semi-upper grass with numerous long basal leaves, with an average height of about 100 cm. It is found in forest and forest-steppe zones, as well as in short meadow meadows. In the spring, it begins to grow very early and gives early pasture forage, and is well eaten before topping. In the first and subsequent years - a very aggressive grass - supplants other herbs, therefore it is better to sow it in its pure form, and in mixtures its share should not exceed 30% in the grass stand. Allowed to use varieties: Zailiyskaya, Karkara 90.

Meadow grass – Poa pratensis L. A long-term downstream rhizomatous and less commonly loose -bunch-rhizomeous grass, 30-60 cm high, is a very common plant in the forest and forest-steppe zone, it is found on dry valleys, floodplain meadows. Reaches full development on the 3-4th year after sowing; in pasture grass mixtures, on soils with neutral or weakly alkaline reaction, from the 5-6th year, replaces all other perennial cereal grasses. From the mesophilic cereals the best pasture plant is eaten by all types of livestock, grows well after grazing, suffers little from trampling and keeps on pastures for a long time. Typical grassland - produces small yields of hay, because it is included in the composition of only hay-pasture and pasture grass mixtures of long (5-6 years) use. The meadow grass seeds are often found in significant amounts in the soil, and it appears on pastures without sowing.

Narrow-leaved bluegrass – Poa angustifolia L. – by all its main characteristics is close to meadow grass. It grows in the forest-steppe and in the north of the steppe, on deposits and in the floodplains of the steppe and semi-desert zones. It is more drought-resistant than meadow grass; therefore it can be used as a part of pasture grass mixtures for radical improvement in the forest-steppe and northern parts of the steppe zone.

Fowl bluegrass – Poa palustris L. Occurs on floodplain meadows of prolonged flooding as a noticeable admixture to other plants. Usually introduced into the composition of hay grass mixtures on over-wetted soils of the forest zone.

Perennial ryegrass, English ryegrass – Lolium perenne L. Long-term low grassy grasses 25-65 cm tall, 50-100 cm in culture. Found in the wild (or as wild) occasionally in areas with a mild climate - in the Baltic States, west of Belarus. When used for haying for 3-4 year perishes. It keeps in a green state until deep autumn, leaves in winter with green shoots. It is

well eaten by livestock, grows well after grazing, tolerates strong soil compaction, gives a high yield already in the year of sowing and is therefore the most valuable pasture plant. The wide distribution of this grass limits its low drought resistance and especially low winter resistance - after little winters it dies even in areas with a mild climate.

English bluegrass, Australian ryegrass – Lolium multiflorum Lam. Underage riding ryhlokustovoy cereal, 50-120 cm tall, very unsustainable, heat-resistant and short-lived - it falls on the 3-4th year. It is perfectly eaten by livestock in the pasture and in the hay. The one-year variety, called ryegrass, can be mowed 2-3 times, and it is often used as a cover crop for perennial grasses.

Both ryegrasses are successfully cultivated in the forest zone, in the western regions of Ukraine, Belarus, on irrigated land mixed with medick in Central Asia.

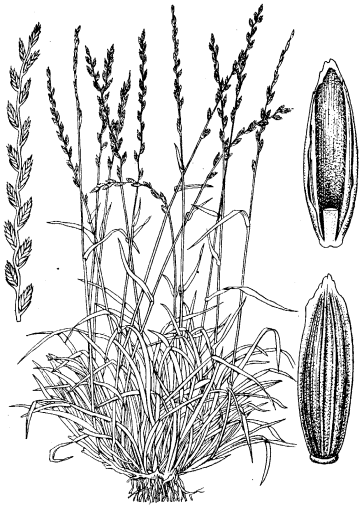

Fig. 8. English bluegrass.

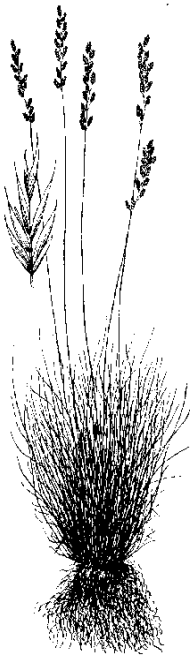

Fig. 9. Fescue, striated fescue

Oat grass – Arrhenatherum elatius (L.) J. Et C. Presl. Juvenile riding loose-bunchgrass, 50-200 cm tall. It suffers from spring frosts, does not tolerate cold winters with little snow, flooding and high temperatures,

and blooms and produces high yields in the year of sowing, gives the maximum yield of hay and seeds in the second year of life, when sown in grass mixtures for 3-5 years.

2.4 Xerophilic cereals

Fescue, striated fescue, betege.Festuca rupicola Heuff. (F. sulcata Hack.;). Long-standing grassroot dense grass, 20-45 cm tall, with a large number of gray-green basal leaves. On virgin soils and old deposits in the steppes on black earth and chestnut soils, fescue is the predominant plant. It makes even good grazing, and therefore, in pastures often displaces all other plants. Since spring, it begins to grow earlier than other grains by 5-10 days, in the fall it gives a significant aftermath, which goes into winter in a green state. Protein contains in phases - tillerings on average 16.2%, flowering 9.7%. In the steppe and semi-desert in spring, early summer, autumn and winter is considered the best grazing plant for horses, sheep and goats, before flowering, it is also well eaten by cattle and camels. The average yield is 2.5-4 centners dry and 5-10 centners of green mass per hectare.

When testing the fescue in the conditions of the Omsk and Orenburg regions, up to 15-17 centners per hectare of eaten dry weight per hectare were obtained. In durable grass mixtures for the 6-7th year it becomes the main plant.

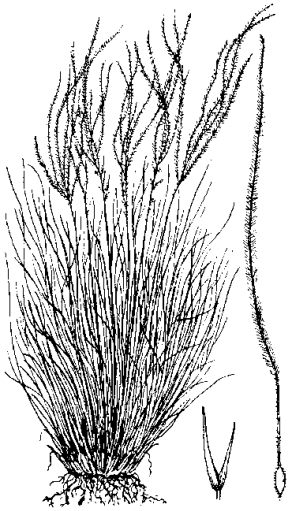

Fig. 10. Lessing's feather grass, feather grass.

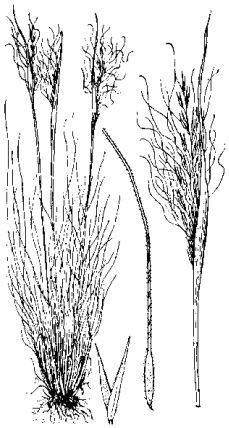

Fig.11. Feather grass, broad-leaved cat-tail.

Lessing's feather grass, feather grass, seleu – Stipa leccingiana Trin.et Rupr. Long-standing dense grass cereal, 40-50 cm tall. Widely distributed in virgin and old-land lands in the steppe, forest-steppe and in the steppe zones of the mountains. By eating and nutritional value is one of the best plants of all the horns. In early spring, it is difficult to distinguish from fescue and is also eaten well, but by the beginning of the earing cattle begins to eat it reluctantly and almost does not eat from the beginning of flowering. Before flowering, the average protein content reaches 15.7%, during the flowering phase it decreases to 11%. The average yield of dry mass is up to 4-6, green - 8-12 c / he.

Feather grass, broad-leaved cat-tail – Stipa capillata L. Tufted (long-life cereal, 50-90 cm tall. After the most common feather, it blooms a month later. Occurs in forest-steppe, steppe, semi-desert and in the mountains of desert regions. In spring, it is well eaten by horses, little worse by cattle and even worse by sheep and goats; by autumn it gives aftermath, also eagerly eaten by cattle, in the phase of earing and flowering is almost not eaten. Hay harvested in the flowering phase is well eaten by all types of livestock. From the flowering stage, eating it becomes life-threatening for the sheep. Hay harvest 5-7 centners per hectare, or grass eaten 15-20 centners per 1.

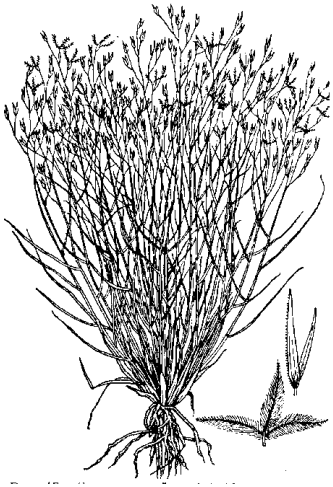

Fig.12.Aristide small.

Aristide Karelin – Aristida karelinii (Trin. Et Rupr.) Roshev.; Aristide small – Stipagrostis pennata (Trin.) de Winter (Aristida rennata var.

minor Litw.). Long-term rooted plants of mobile sands of deserts and less often semi-deserts. Both aristides are coarse plants; in pastures in spring and summer cattle are almost not eaten. In a dry state, in the autumn after rains and in the winter they are eaten satisfactorily. The feed quality of aristide small is higher than aristide Karelin, but it is found in smaller quantities.

Scotch, Bermuda grass – Cynodon dactylon (L.) Pers. Long rhizomatous grass, 15-60 cm tall. It is widespread in irrigated areas of deserts, semi-deserts and less often in steppes, it is notable for its high salt tolerance, drought tolerance and frost resistance, it quickly grows after bleeding and tolerates trampling well. In crops of cotton and rice – a malicious weed. In the southeastern regions of the United States on large areas cultivated as a pasture plant.

Giant ryegrass, sand oat - Leymus racemosus (Lam.) Tzvel. (Elymus giganteus Vahl.). Long-term rhizomatous semi-upper xerophilous grass, 120-150 cm tall. It is typical plant of barchan and hilly sands of semi-desert. It grows in Akmola and other regions of North and Central Kazakhstan. Leaves are hard, and has rough stems. It grows as separate clumps and with good development of bushes it gives about 10-15 centners of hay of low quality and up to 5 centners of seeds. Seeds are eagerly eaten by horses and almost equal in nutritional value to oats. On pastures, leaves and stems are satisfactorily eaten by livestock only in the tillering stage, and an ear is eaten from the milk maturity of the seeds. It is a valuable plant for sowing on broken sands as a hay and forage plant. At the same time it can also be used for sand fixing.

Russian wild ruttishness – Psathyrostachys juncea (Fisch.) Nevski (Elinrus junecus Tisch). Long-term short-rind cereal, 45-80 cm tall. It is widely distributed in saline soil and salty soils, as well as on the gravelly slopes of the steppe and semi-desert. Develops in early spring; in fall, it gives a good aftermath, quickly grows coarse and therefore livestock eats well before earing, later it is bad, it contains a lot of protein in its young state, one of the most promising plants for cultivation on semi-desert saline soils and in the north of deserts, valuable plant for securing slopes prone to erosion. The average yield of dry matter in Northern Kazakhstan reaches 25-28 c / ha, and the content of crude protein is up to 16-17%. In Kazakhstan, in recent years, it has been introduced into culture as a pasture plant; it is used in the radical improvement of pastures in the dry steppe and steppe zones. The Bozoi variety bred by the Kazakh Scientific Research Institute of Grassland Farm and the Shortandinskaia variety - KazNIIZH selection has been zoned.

East Indian bluestem – Bothrioch eoa ishaemumd (Andropogon ischaemum Trin.). Long-term short-leaf cereal, 50-80 cm tall. Widely

distributed in piedmont and mountainous areas on light chestnut, dark chestnut soils. Young leaves are eaten well with cattle; in the flowering phase, the plant grows coarse and is hardly eaten.

Jiji grass – Achnatherum splenes (Trin) (Lasiagrostis splendens (Trin) Kunth. Long-term turf plant, 50-250 cm tall. Distributed in semi-deserts and deserts. It grows on soils of various mechanical and chemical composition and almost always in places with closely-lying groundwater, suitable for drinking or watering livestock, vegetation is often a good indication of where to dig wells.The stalk is strong and coarse, leaves are harsh, therefore it is eaten by livestock only before earing. Used for grazing or for second mowing.When mowing before earing, it yields a crop of hay up to 10 centners per hectare.

Fig.13. Jiji grass.

Bulbous meadow grass, viviparous, bass is Poa buldosa L. A long-term small grass with a bulbous thickening at the base of the stems. The average height is 20 cm. It is one of the main plants on desert and semi-desert pastures of the foothills; in semi-desert and steppes in large numbers it develops in downed virgin and old-lying pastures. In the spring, it starts growing immediately after the snow melts, and within 40-60 days it completely finishes its development and dries out, in the fall after the first rains it grows again, it is perfectly eaten by all kinds of cattle. It contains protein before earing up to 23.5%, in the flowering phase up to 11.2%. The harvest, depending on the weather conditions of the year and the soil, ranges from 2 to 30 centners of green grass per 1 ha.

2.5 Hygrophilic and hydrophilic grasses

They grow mainly in water, along rivers and on wetlands. In the flowering phase, they are very coarse; contain 6-7% protein and 35-45% fiber. On pastures are best used at a very early age (before earing).

This group of cereals includes: reed, blowout, manna, Arctophila fulva, canary and Beckman's grasses are close to this group.

Fig. 14 Common reed 1

Common reed - kudak – Phragmites communis Trin, often incorrectly called reed. Long-term rhizomatous grass, from 25 cm to 9 m in height, the average height is about 2 m. It grows in water and on land, mainly where groundwater is close, tolerates very significant salinization of water, grows almost always with clean thickets. At a young age it contains a lot of sugars and is therefore readily eaten by horses and cattle, however, before the panicle is thrown out, its fiber content rises to 30% and the protein decreases to 7-8%, therefore it is usually poorly eaten during the sweeping period. Hay is harvested before the panicle is thrown out, when 5-6 leaves are developed on the stems, a significant amount of hay is harvested in deserts. On the silo mowed in the middle - the end of the sweeping. The yield of reeds ranges from 80 to 400 kg of air-dry matter per 1 ha.

2.6 Salted grasses

This includes grasses that grow on saline soils of steppe, semi-desert and desert areas. A significant number of them are well eaten by animals until the middle - end of the earing, then they quickly grow coarse, and the cattle eat them reluctantly. Representatives of this group are puccinellias and saltgrasses.

Alkaligrass, mulberry, ak-makyk – Puccinellia distans (L.), or Atropis distans (L.) Griseb and other types of potworms. Loose-bunch lower perennial cereals, 30-60 cm tall.

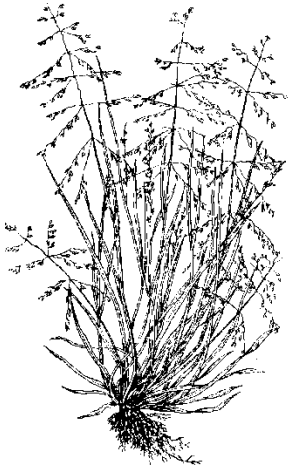

Fig.15 Alkaligrass.

On the outskirts, fields in forest-steppe, in steppe estuaries and semi-deserts, alkaligrassesoften constitute almost pure communities on large areas, tolerate strong soil salinization, but develop poorly in dry salt marshes. In terms of fodder quality among the cereals of this group, it occupies one of the first places: on pastures it is perfectly eaten by horses and cattle, a little worse by sheep, goats and camels. In the hay are well eaten by all types of livestock. From the beginning of flowering, they become very rough and are eaten badly.

Mediterranean saltgrass, ajryk – Atluropus littoralis (Gouan.) Parl. Long-standing rhizomatous grass with reclining, well-leafy stems, widespread in the salt marshes of desert and semi-desert areas. On the surface of the stems and leaves always contain some amount of crystallized salts, as a result of which the plant rottes very slowly, the stems by the autumn of the next year still retain their elasticity and can be eaten by cattle. It is readily eaten on pastures only before flowering, hay of quite satisfactory quality. Perhaps an introduction to the culture in wet salt marshes with close groundwater.

2.7 Annual grasses

In the early phases of the growing season (before flowering), they often contain more nutrients than members of other cereal groups: in the beginning of the heading phase, the amount of crude protein in them often exceeds 15%, and the fiber content is less than 25%. Among them can be

called mortuk, wheatgrasses, barley, wild wheat.

Wheatpyron – Eremopyron triticeum (Gaertn.) Nevski; East mortuk, Arpagan – E. orientalis (L.) Jaub.et Spach.; Bonaparte's pyron – E. Buonapartis (Spreng.) Nevski. Annual ephemeral cereals in favorable conditions reach a height of 30-50 cm, often on average 10-15 cm. The wheat pyron is most typical for dry steppes and semi-deserts, and only in small quantities can be found in the northern desert; eastern port and Bonaparte, on the contrary, are much more numerous in the desert. In the steppes and semi-deserts in virgin lands, the mortuks represent only a small admixture to other plants, but with intensive grazing, it is often possible to find areas of several hectares, covered with only mortuks. In the desert, on saline soils, on fallow lands, fixed sands and especially on piedmont gray soils, they often constitute the main mass of grass stand.

Fig. 16 Bonaparte's pyron 1

Since spring, mortuks develop very quickly and then within 30-40 days they complete the entire development cycle and dry out. Perfectly eaten by horses, sheep, goats and cattle, and quite satisfactorily by camels. In terms of nutritional value in a young state, they are not inferior to good leguminous plants, and even in the late phase of fruiting, they have 60 kg of feed units (for absolutely dry matter) 60-70 feed units and 5-8 kg of digestible protein per 100 kg. After fruiting, sheep willingly eat the spikelets of mortuks that fell to the ground. They are used almost exclusively as grazing plants. The average yield is 5-7 centners of grass per hectare.

Drooping brome– Bromus tectorum L. Annual cereal - Bromus tectorum L. Annual cereal, 10-40 cm tall. It is widespread in forest-steppe, steppe, semi-desert and desert zones, it is found in significant amounts on fixed sands and in the foothills of deserts, it grows in early spring and dries out by the beginning of summer. It is well eaten in the spring by cattle and horses, worse by sheep and camels, in summer due to the long spines damaging the oral cavity of animals, they are hardly eaten.

Yellow-foxtail grass, cat-tail millet – Setaria glauca (L.); green foxtail – Sviridis (L.) – annual grasses up to 60 cm tall, malicious weeds in the fields. Since spring, they grow and develop slowly, before earing, they are eaten by cattle well, and starting from the flowering phase they can be

harmful to livestock – spherical formations accumulate in the stomachs, often resulting in the death of animals. When using mice on hay, it is necessary to mow before flowering.

Cock's-foot grass, chicken millet – Echinochloa crugialli (L.) R. et Sch. Annual cereal, 10-60 cm tall, is found in forest-steppe, steppe and desert areas. It grows along river banks, in wet places, like a weed in crops, on fallow lands, etc. It is well eaten by all types of livestock on pasture and in hay before flowering, later coarsens, gives a large number of seeds, which are good fodder for poultry.

Wild oat, empty oat – Avena fatua L.; Louis Oats – A. Ludoviciana Dur. Annual cereals, very similar to the cultural oats, malicious weeds of fields in the forest-steppe and steppe zones. Leafy grasses, 50-120 cm tall, can produce hay yields of up to 15-20 centners per hectare, are well eaten by livestock before flowering, and after flowering the sprouts curl around the grains, become strong, and then they eat the mouth cavity and the stomach animals, so oat should be mowed before flowering.

Low love grass – Fragrostis minor Host is a small turf plant, reaching an average height of 10-20 cm. There is a dry steppe and semi-desert on sandy soils, it is well eaten by cattle and horses, slightly worse by sheep.

CHAPTER 2 LEGUMES CROPS

2.1 General characteristics

This chapter deals with an important group of crops that are of great importance not only for agricultural workers, but also for all the people of our country and most countries of the world. These are leguminous crops: soybeans, beans, peas, vetch, peavine, lentils, beans, chickpeas, lupins.

The area under cereal legumes is constantly increasing. In world agriculture, they exceed 90 million hectares, which is 11% of the area of all grain crops, and in the countries of Southeast Asia, this percentage is much greater.

Why are legumes so highly rated? The rapid growth of world productiondevelops due to their rich chemical composition and widespread use in the diet of the population, as well as for animals and birds. For example, in the US, in addition to the energy component – corn or barley grain – soy flour is the main protein component for the preparation of animal feed. The successful development of animal husbandry in the United States has become possible thanks to the creation of a powerful feed mill industry that produces balanced feed using seeds of legumes.

The production of vegetable protein is a very important issue both in addressing human nutrition and in feeding animals. Seeds of leguminous cultures contain 2-3 times more protein than grains of cereals. This, above all, determines their nutritional and feed value.

The chemical composition and nutritional value of seeds of grain legumes are given in Table 9. 1 kg of seeds contain from 200 to 300 g of digestible protein, 167-213 g per 1 feed unit, which is much more zootechnical norm of feeding animals.

Secondly, the seeds of leguminous plants contain all the essential amino acids.

The amino acid composition is shown in Table 10. By the sum of amino acids, the leguminous protein exceeds the protein of cereal crops by 3 times, and by the sum of essential amino acids, by 1.5-2 times. In terms of composition and the number of essential amino acids, this protein is close to the protein of meat, milk, eggs.

Table 9

Nutrition and chemical composition of seeds of legumes (reference book "Feed", 1977 under the editorship of M. A. Smurygin)

Culture	Contained in 1 kg of seeds:			Chemical composition,%					
	dry matter, kg	feed units	digestible protein, g	protein	albumin	fat	fiber	ash	NFS
Peas	0,87	1,17	195	22,2	19,8	1,9	5,4	2,8	54,1
Beans	0,88	1,15	237	27,3	24,4	1,6	7,7	3,2	48,2
Soybean	0,89	1,38	290	34,5	33,0	17,4	5,7	4,6	26,8
Lupine	0,85	1,07	230	33,4	29,7	4,8	14,3	3,7	29,0
Vetch	0,86	1,16	200	25,8	23,1	1,3	5,3	3,0	50,6
Peavine	0,87	1,06	220	26,9	24,3	1,2	5,3	3,0	50,8
Lentils	0,87	1,18	212	24,6	21,5	1,3	4,3	3,1	53,6
Chick-peas	0,88	1,15	143	20,1	17,6	5,1	5,1	2,8	54,6

Table 10

Amino acid composition of leguminous crops
(in g per 1 kg of seeds, according to the book "Feed", 1977)

Culture and protein content in grains,%	Lysis	Methi-onine	Cys-tine	Try-ptophan	Argi-nine	Histi-dine	Leu-cine	Isoleu-cine	Pheny-lala nine	Tre-onin	Va-lin	Gly-cine
Peas (22,7)	14,8	3,2	2,5	1,8	15,9	4,8	11,4	15,2	10,9	8,6	10,2	7,8
Beans (27,0)	16,7	2,4	-	2,4	15,9	7,3	23,8	14,8	12,4	10,5	14,8	8,1
Soybean (33,2)	21,9	4,6	5,3	4,3	25,6	7,6	26,2	17,6	17,0	12,7	18,0	11,3
Lupine (42,0)	18,9	4,2	4,6	3,8	40,0	15,1	31,5	15,5	20,6	17,2	18,5	-
Vetch (26,0)	14,8	6,8	2,9	2,1	33,5	13,8	18,7	14,8	20,0	13,5	20,5	10,2
Peavine (27,6)	20,4	1,6	-	2,5	34,5	5,8	25,1	24,0	11,6	13,0	19,3	7,9
Lentils (25,2)	15,1	2,0	2,0	1,5	19,9	5,8	14,9	12,9	11,1	8,6	13,9	8,0

In the seeds of legumes compared with cereal grains, a more favorable ash composition, especially in terms of calcium and phosphorus (tab. 11).

Table 11

Macroelement composition of seeds of legumes,% of dry matter (reference book "Feed", 1977)

Culture	Calcium	Phosphorus	Potassium	Natrium	Manganese
Peas	0,197	0,429	1,072	0,031	0,126
Beans	0,149	0,407	1,226	0,009	0,140
Soybean	0,480	0,706	2,170	0,155	0,236
Lupine	0,285	0,614	0,818	0,060	0,188
Vetch	0,180	0,407	0,935	0,041	0,143
Lentils	0,286	0,534	0,632	0,165	0,186

Calcium content varies from 2 to 5 g per 1 kg of seeds, which is lower than the zootechnical norm for animals. Calcium is the main component of the skeletal system of animals. Cell growth, the exchange rate in them depends on the content of calcium salts in the cell nuclei. To balance animal diets for calcium, you need to include ingredients with a higher calcium content, such as hay and green medick food.

The phosphorus content ranges from 5 to 7 g per 1 kg of seeds of leguminous crops, which corresponds to the zootechnical standards for feeding animals.

The trace element composition of seeds of legumes is presented in table 12.

Table 12

The trace element composition of seeds of leguminous crops, mg / kg (reference book "Feed", 1977)

Culture	Iron	Cobalt	Copper	Iodine	Марганец	Manganese	Zinc
Peas	60	0,184	7,720	0,078	20,20	1,910	26,70
Beans	61	0,026	4,280	0,053	14,28	0,580	52,85
Soybean	125	0,079	4,960	0,071	23,03	0,600	65,56
Lupine	–	0,280	3,200	0,060	40,00	4,400	27,20

Figures tab. 12 indicate that the number of trace elements in the seeds of legumes does not meet the needs of animals. For example, on 1 feed unit 8–10 mg of copper, 50–60 mg of manganese are required, and the seeds of leguminous plants contain 4–7 and 14–20 mg, respectively.

Green forage and hay from leguminous crops are better provided

with macro and microelements.

The seeds and vegetative organs of leguminous crops contain enzymes, fat and water-soluble vitamins (Table 13).

Table 13

Vitamin composition of cereal seeds,
mg per kg (reference book "Feed" 1977)

Culture	Vitamin, E	Thiamine, B1	Riboflavin, B2	Nicotinic Acid, B5	Pantothenic Acid, B3	Choline B4
Peas	60	8,5	0,9	18-30	19,0	1600
Beans	-	8,0	0,9	28,0	18,0	3400
Soybean	-	12,0	0,8	27,5	14,7	1870
Lupine	-	7,0	0,9	24,5	19,0	2600

The data from the table. 13 indicate that the seeds of legumes have a rich vitamin composition that meets the needs of animals. Only vitamins B2 and B5 are present in insufficient quantities.

The inclusion of leguminous crops not only balances the diet of animals for protein, essential amino acids, mineral elements, but also supplements with vitamins, enzymes and increases the digestibility of other feed. The favorable protein composition of leguminous plants causes a high digestibility in the body of animals. The coefficient of digestibility of legume seed proteins is 85-89%.

With relatively lower carbohydrate content, cereal legumes are an important source of protein with a high biological usefulness, a favorable composition of amino acids. The rich chemical composition, high digestibility and nutritional value of feed from leguminous crops determine their wide distribution and variety of use.

The value of leguminous plants lies in the fact that proteins in them are formed when nitrogen is absorbed from the atmosphere. As a result of symbiosis with nodule bacteria, atmospheric nitrogen is absorbed, which goes to build the body of microorganisms, which form nodule growths on the roots. When bacteria die off, the soil is enriched with nitrogen. According to the academician D. N. Prianishnikov, leguminous crops can accumulate in the soil up to 150 kg of nitrogen per hectare.

The positive impact of leguminous plants on soil fertility is not limited to this. Legumes are able to absorb calcium from the deep layers of the soil and move it to the arable layer. The formed humus and calcium cations promote coagulation of soil colloids; improve the agro-physical properties of the soil. Therefore, leguminous plants more effectively restore soil fertility compared to other plants.For example, lupine is able to assimilate sparingly soluble phosphorus compounds from the soil and

convert them to readily soluble and accessible to plants salts of phosphoric acid.

Thus, leguminous plants help to solve important problems in agriculture – improve the quality of feed and restore soil fertility.

But along with the positive properties of legumes are negative, which must always be remembered. They contain an excess amount of protein. A high percentage of protein in legumes adversely affects the metabolism, reduces reproductive functions, can cause tympanitis in ruminants.

Most leguminous plants are difficult to ensil, because protein is a buffer compound that prevents acidification of the environment during ensiling. Therefore, leguminous plants for silage should be grown in mixed crops with cereals, and legumes for fodder purposes should be used in conjunction with other plants for mutual balancing of digestible protein, carbohydrates and other nutrients.

2.2 Growth and development of cereal legumes

The root system of legumes is rod, penetrating to a depth of 2 meters. Numerous lateral branches of the root are located mainly in the fertile arable layer of the soil. The stems of lupine, chickpea, beans and bush forms of beans are strong, retain their upright position. Stems of peas, vetch, ranks, lentils thin, fragile, lodging to the beginning of ripening.

Legumes– Fabaceae Lindl. (Leguminosae Juss.). This group includes grasses, shrubs and trees of the legume family. One of the most extensive families of the globe: over 500 genera and over 12,000 species belong to it, about 78 genera and about 1,850 species occur in the CIS, taking the second place after the composite flowers in the number of species. The important role is played by legumes in the creation of the grass stand (up to 10–20%) of natural hayfields and pastures in the forest zone, less than them in the forest cover of the steppe and steppe, in the semi-desert the proportion of legumes is quite small and increases again in mountainous areas. In the grasslands of the forest-steppe and steppe zones of Kazakhstan, legumes make up only 2-6%. Bean grasses are of great importance when improving natural forage lands and when sowing them in crop rotations and outside crop rotations. The following genera of legumes are rich in species: astragalus (155), medick (78), vetch (72), clover (60), espartit (39), peavine (39), peas (25), sharp-leaved (22), fenugreek (20), clover (17) and Caragana (11).

According to the structure of the leaves, legumes are divided into three groups: with feathery leaves, with ternate and with fingertips. In

addition, the leaves are paired-pinnate, ending with antennae (peas, chin, lentils, vetch, beans), and pinnate, ending with one apical lobule (chickpea).

The shoots of plants with parotid leaves sprout suprameerbal part (epicotyl) and do not tolerate the cotyledons to the surface of the soil, which facilitates their shoots. Therefore, the seeds of these plants can be embedded deeper and pre-emergence harrowing.

The plants with trifoliate include soybeans and beans, with palm leaves - lupine. Shoots with trifoliate and palmate leaves germinate by the semi-nuclear part (hypocotyl) and bring cotyledons to the soil surface, which makes their shoots difficult. The seeds of these plants need to be potted smaller and it is undesirable to harrow before germination.

The fruit of legumes – bean of various sizes, shapes and colors. It contains from one to 10 seeds, depending on the type of plant.

In the grain legume crops in the process of growth and development, the following phases are noted: 1) germination, 2) shoots, 3) branching of the stem, 4) budding, 5) flowering, 6) formation of beans, 7) ripening, 8) complete ripeness.

2.3 Common cultural and promising for the introduction of the culture of legumes

Sowing medick, blue – Medicago sativa L. Sredneletny or perennial plant, an average height of 60-70 cm, and under favorable conditions 150-170 cm. perfectly eaten by all animal species, its nutritional value is slightly higher than red clover. It does not graze well enough, with early, especially low and frequent grazing, it suffers a lot and usually falls out of pasture grass. In the forest zone, 3 mowings are possible, in the steppe – 2, when watering in semi-desert – 3-5, in the desert – 5-8 mowing.

Blue medick and medium (M. media), has the same qualities, but unlike the sowing campaign, it tolerates harsh, snowy winters quite well.

True moon trefoil, yellow medick, burkun – Medicago falcata L. A long-term or sredneletenny plant, an average height of 45-55 cm, has a sprawling bush, the root system is developed as strongly as bluemedick. True moon trefoil is widespread in forest-steppe, semi-desert, foothill and low-mountain areas, on fertile and dark-chestnut soils on deposits it is often found in significant amounts. It grows in the high parts of floodplains in the forest-steppe, steppe and even in the forest zone. Flooded ecotypes of wild-growing true moon trefoil withstand prolonged (15-30 days) flooding by spring waters and undoubtedly are very promising for use in grass mixtures in floodplains of rivers and on estuaries.

True moon trefoil is more winter-hardy, drought-tolerant and salt-

tolerant compared with medick, but it is less fruitful, yields less afterbirth than medick. Perfectly eaten by all types of livestock, but after grazing and mowing, it grows worse than medick. Introduced into culture a long time ago, but because of these shortcomings, it has not gained wide distribution. It is of the greatest importance in the dry-steppe and semi-desert zones of irrigated farming, on estuaries and floodplains of average flooding, mainly for grazing use. The following varieties are approved for use in the Republic of Kazakhstan from the above-mentioned types of medick: *Bereke, Darkhan 90, Yellow Hybrid 55, Kapchagai 80, Karabalyk 18, Karaganda 1, Koksha, Krasnovodopadskaya 8, Krasnovopad early, Progress, Semirechenskaya local, Tashkent 1, Ural blue, Shortandinskaya 2, Yaroslavna.*

Hungarian sainfoin – Onobrychis arenaria (Kit.) DC. In the wild form is found in the forest, forest-steppe and steppe zones on soils of light mechanical composition. Hybrids with sainfoin sativum are economically more valuable compared to sapparceca vicolic one. They are more durable, give 2 cuttings and often in the year of sowing they bloom and mow hay. Allowed to use varieties*: Sandy 1251, Sandy Superior and Shortandinsky 83.*

Common sainfoin, cookshead – Onobrychis viciifolia Scop., Or O. sativa Lam. Sredneletenny plant, 30-60 cm tall (in culture – 70-150 cm). Distributed in the steppe zone, mainly on the black soils of watersheds and rarely in the high parts of the floodplain. It is well eaten by all types of livestock, when eating sparcetum grass, animals do not suffer from tympanitis. Gives steady seed yields. The following varieties are approved for use: *Alma-Atinsky 1, Alma-Atinsky 2, Hybrid 110.*

White sweet-clover – Melilotus albus Medik, biannual or annual plant with a height of 70-300 cm. It is distributed mainly in forest-steppe and steppe, it develops best on fertile, salty forest-steppe soils, quite satisfactorily – on dark chestnut soils, grows well on deep saline and moist saline soils. Allowed to use varieties: *Akbas, Medet, Sretensky 1B, Shaveken.*

Yellow sweet clover, Melilotus officinalis (L.) Pall. It grows in the same conditions as white clover. More sensitive to soil salinization, but also more drought-resistant, has a strong coumarin odor. It is badly eaten on natural pastures, on planted ones – animals get used to it and eat it satisfactorily. Used in crops on solonetz. Allowed to use varieties: *Alsheevsky, Karabalyksky, Kokpektinsky, Koldybansky, Omsk early ripening, Sarbas.*

Vetch – Vicia cracca L. A long-term rhizomatous plant with weak, tender, clinging, well-leafed stems, 30–200 cm in length. It is found in the

forest zone, forest-steppe, mountainous areas and less often in the steppe on moderately humid and moist soils. Because of the bitter taste, it is eaten by cattle in its pure form badly, mixed with other plants – well. In crops, it develops slowly, the greatest yield gives only for the 3-4th year, persists in crops for more than 10 years. When pasture use is quickly replaced by other herbs and disappears from the herbage.

Birds-foot trefoil – Lotus corniculatus L., a mid-annual perennial plant, 15-45 cm tall (up to 50-100 cm in culture). In the wild state it grows in forest-steppe, steppes and in mountainous areas, it is found on floodplain meadows, it makes saline soils. It is well eaten by all types of livestock and does not cause tympanitis, after grazing it grows well. It reaches its full development on the 2-3rd year and is maintained in crops up to 5-6 years and more. The plant is relatively winter-hardy, salt-tolerant, drought-resistant, durable, grows well after mowing and bleeding.

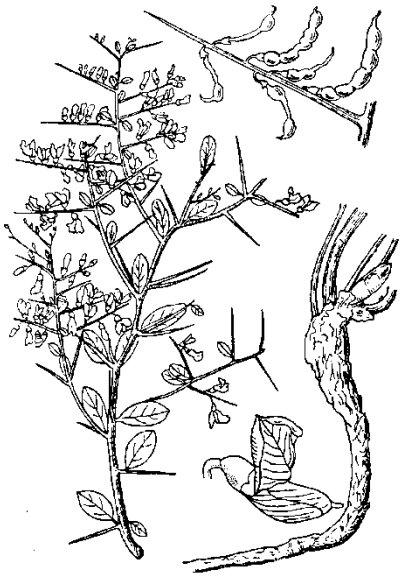

Fig. 17.Camel thorn. 1

East milk vetch – Galega orientalis Lam. A perennial plant, 80-200 cm tall. Grass and hay are well eaten by livestock, a good honey plant. In case of unseen sowing, it lasts up to 12-14 years, and in grass mixtures with cereals during inter-row sowing – 7-8 years. Winter-hardy and drought-resistant plant, withstands flooding up to 20 days. Allowed to use grade *Gorno-Altai 87.*

Camel thorn, Yantak, Dzhantak – Alhagi pseudalhagi (Bieb.) Desv. Perennial root-sprout small-leaved grass with a height of 60-100 cm, has a powerful root system up to 10 m and deeper. It is found on various soils, but mainly where fresh groundwater is deposited no deeper than 3–5 m. It is eaten fairly well by camels, sheep, and goats before flowering in the fall and in satisfactory cattle in the spring. Hay consumption is relatively low (often not more than 40-50% of the total mass), cutting and grinding hay increase the percentage of its use to 80 and above. The nutritional value of hay is relatively low: 100 kg of hay does not contain more than 3 kg of digestible

protein and no more than 37 feed units. Hay yield, depending on soil conditions, is from 6 to 40 centners per hectare (average 12-15 centners per 1 hectare). Due to high yields and given its rather high drought tolerance, yantak is considered a plant valuable to the desert.

Common licorice – Glycyrrhiza glabra L. A long-term root-sprout plant, 50-160 cm tall, grows in forest-steppe, steppe and desert, a common plant in floodplain meadows, sands, estuaries, especially well developed in the presence of close groundwater. Leaves, stems, fruits contain a significant amount of tannins, therefore licorice on pastures is used satisfactorily only in the case when there are no best forage plants. Her camels, sheep, goats readily eat, and horses and cattle much worse. After grazing or mowing, afterbirth quickly grows. The nutritional value of licorice refers to the feed of average quality, and the yield ranges from 10 to 40 kg per 1 ha. Hay is eaten satisfactorily.

Astragal – Astragalus L. By the number of species is the most extensive genus, common in all zones, but in the herbage of pastures and hayfields, with very rare exceptions, they are only a small admixture. Most of them taste bitter or bitter, some are eaten well, most of them are satisfactory and bad due to prickliness, strong hairiness and, possibly, the presence of poisonous substances.

Red clover, meadow – Trifolium pratense L. Sredneletenny plant, 40-70 cm tall (50-110 cm in culture). Plant forest, forest-steppe zones and mountain areas. Red clover is beautifully eaten by all types of livestock, both in pasture and hay. The variety *Zyrianovsky local* is allowed to use.

Pink clover, hybrid, Swedish – Trifolium hybridum L. A juvenile plant, 30-50 cm tall (40-100 cm in culture). In the wild, it is distributed almost everywhere in the forest and forest-steppe zones and in mountainous areas, preferring rather wet places. Compared to red clover, it is a more cold-resistant plant and rarely freezes. It has a bitter taste, so it is eaten by livestock a little worse than red and white clover in pasture and in hay, but it is eaten well in a mixture of cereals.

Creeping clover, white – Trifolium repens L. A long-term plant, 15-50 cm tall, forms long creeping rooting wintering shoots, therefore it is kept on pasture for many years, distributed in forest and forest-steppe zones and in mountainous areas, it is found on various soils, but it is better Most develops in moderately wet habitats. It tolerates quite long flooding, tolerates the proximity of groundwater, poorly tolerates shading.

In moderately humid natural meadows there are many live seeds of white clover, which germinate under favorable conditions and often when not planted. It makes grazing well and grows quickly after venting; it is of little use for haymaking - it is the best pasture forage plant.

Of the annual legume grasses, the peavine is of great importance - Lathyrus sativus L. The annual forage crop is cultivated in the southern half of the steppe zone, where it may be of great importance in winter and summer feeding of livestock.

CHAPTER 3 SEDGE AND MOTLEY GRASS

3.1 Group of sedge

Sedge - Cyperaceae J. St.-Hill. The sedge family includes perennial, rarely annual herbs. Unlike the cereal stalks of them without thickening and nodes, inside are made with a core. About 85 genera and over 3000 species belong to this family. Small sedges have the greatest feeding value, the rest - considerably smaller. Representatives of the sedge family are widely distributed in swamps and in wet lowland and floodplain meadows; they often form the basis of plant groups. Most sedges of wet habitats have hard and coarse leaves, along the edges of which heavily silicified spines are located, the eating of which causes irritation of the mucous membrane of the digestive tract in animals.

According to the food value, sedges can be divided into 3 groups: 1) moisture-loving sedges, mostly large, with hard leaves, food-hungry or poorly eaten; 2) moisture-loving sedges, but satisfactorily or well eaten; 3) well-eaten small sedge steppes, deserts and mountainous areas.

Large and hard sedges found in the forest and forest-steppe zones, along the banks of rivers and on grassy marshes, some of them form hummocks, are poorly eaten, or are not eaten later. Hay harvested in the flowering phase is poorly eaten by animals, so if necessary, hay harvesting should be carried out before flowering or these sedges should be used for ensiling. These sedges include: cyperus sedge– Carex pseudocyperus L., bladder sedge– C. vesikata Meinsh. (C. vesicaria L.), streambank sedge – C. riparia Gurt., tufted sedge – C. caespitosa L., etc.

The following species can be attributed to sedges large, satisfactory or well eaten.

Tufted sedge– Garex gracilis Gurt. Widely distributed in forest, forest-steppe and steppe zones. It is confined to places with excessive moisture, or places of more or less prolonged flooding by spring waters, often forms clean thickets and mowing for hay. On pastures in all zones and all types of livestock is poorly eaten. Hay harvested no later than the flowering phase is eaten satisfactorily by livestock.

Sedges in the salt meadows: brown sedge – C. disticha Huds., separate sedge – C. divisa Huds. and others. They are satisfactorily eaten by livestock on pasture and well in hay.

Well-eaten small sedges are mainly small plants, 5-30 cm in height, are found in the steppe, semi-desert, desert on the mountain and less often on the watersheds and high parts of floodplain meadows in the forest and steppe zones. Even in the flowering phase, they contain 16.1% protein

and only 24.4% fiber.

They are well eaten on pastures with all kinds of animals, especially sheep, goats and cattle, not only in green, but even in dry condition. Due to the low growth, a small yield of pasture grass is given - 1-5 centners of green mass per 1 ha (0.3-3.0 centners per 1 hectare in terms of dry weight). This group includes the early sedge, thick-column, swollen and mourning.

Early sedge– Garex praecox Schreb. It is found on high floodplain meadows, in mixed grass steppes, on light forests in forest, forest-steppe and steppe zones and in mountainous areas. In the herbage often is an impurity in the range of 10-15%.

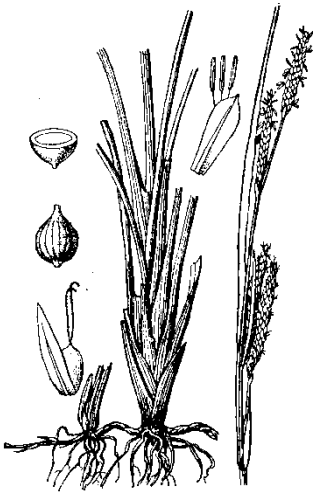

Fig. 17. Tufted sedge

Sedge thick-column, rank, Karabash – Garex pachystylis Gay. In the desert, in the foothill and lowland areas, often together with bluegrassand sea (desert) wormwood forms the basis of the herbage.

Beaked sedge, sandy, illac, rank – Garex physofdes M.B. Distributed in considerable numbers on the hilly sands of the desert. Typical ephemeroid. It is the main fodder plant of Karakul sheep in Turkmenistan and Uzbekistan.

3.2 Group of herbs

The group of herbs includes plants of all families, except for cereals, legumes and sedge.

However, for convenience in relation to the conditions of

Kazakhstan, forage plants of this group should be considered in the context of families in the following sequence (taking into account their significance in the conditions of the dry steppe, semiarid and desert zones of Kazakhstan): goosefoot, compositae, polygonaceae, cabbage, celery families and others.

Goosefoot family – Chenopodiaceae Less. In this family, there are about 100 genera and 1,400 species: biennial and perennial herbaceous plants, shrubs and less often trees. From the goosefoot family, beetroot (sugar and fodder) plays an exceptional role in cattle feeding.

In the forest zone there is almost no goosefoot family, and in the forest-steppe, on deposits, weedy places, in crops there are a lot of muchweed and salt grape; in the dry steppe and semi-desert, their role in vegetation grows noticeably, in semi-desert on young deposits salt grapealmost always dominates, etc.

Leban, Sarsazan and others often dominate in the salt marshes that make up at least 50% of the area. The muchweedsare well eaten by animals (mostly late autumn), and in the feed balance they make up at least 10% of the total food resources of the zone. As they move to the south, the fodder role of the blooming intensifies: in the southern deserts of Kazakhstan, in the fodder balance, they constitute at least 35-40% of all the fodder plants eaten. There are often plant groups with predominance of one or more blooming and especially many representatives of the saltwort genus. In the semi-desert sands and in the north of the desert prickly saltwort, lebanand others play a significant role in feeding, on the sandy pastures in the desert saxaul (Haloxylon Bunge (Arthrophytum auct.)), shrub and annual saltwort are especially important.

The use of cattle hawks largely depends on the content of certain salts in them. The presence of harmful alkaloids also affects palatability, the adverse anatomical structure — prickly bracts, leaves, strong hairiness, etc. — to a lesser extent, influences the goosefootsare well eaten by camels, slightly worse by sheep and goats, even worse by horses and poorly and not eaten at all (with rare exceptions) cattle.

Chemically, they are very different from most members of other families. Many of them contain a large amount of ash elements (over 20%), a small amount of fiber (often less than 20%), nitrogen-free extractives (30% or less), and soluble carbohydrates are often absent or no more than 2%.

The goosefoot family are mainly pasture plants, but some of them (Russian saltwort, leban, etc.) are harvested for hay, and some (from the genera of quinoa, goosefoots and saltwort, etc.) produce a high yield of green mass suitable for ensiling. There are also among the blooming plants

that give many fruits of high nutritional value (saltwort woolly, fleshy, species of halimoknemis, hard-flower, etc.), eagerly eaten by sheep and camels. According to the peculiarities of chemical composition and forage properties, the blooms can be divided into 2 groups that differ sharply from one another – the blooming dry and goosefoot juicy, but it is more convenient to distinguish a considerable number of goosefoot family into the group of translucent transient – semi-dry.

Goosefoot dry. In chemical composition, the group of dry haunches is quite close to cereals. During flowering, they contain on average (as a percentage of absolutely dry matter): ash – 12.6, protein – 10.1, fat – 2.3, fiber – 31.3, nitrogen-free extractives substances – 43.7. A significant number of plants in this group are well and less often satisfactorily eaten by livestock – camels and sheep and other types of livestock – throughout the growing season. The greatest value of this group are leban, winterfat, ebelek, camphor-fume.

Leban, prostrate summer cypress, izeni, zulturgan – Kochia prostrata (L.) Schrad. Dwarf subshrub, 30-40 cm tall (and higher), with thick roots deep in the soil (on average 1.5-2.0 and up to 5 m), with numerous lateral roots. It is found in forest-steppe, steppe, semi-desert, desert, foothill – these are typical plants on solonetsous chestnut soils, salt licks of southern steppes and semi-deserts, on sandy and gravelly soils of the foothills and lower belts of mountains, on semi-desert sands and less often in desert sand, semi-deserts, in desert sand, semi-deserts, and desert areas, one of the most drought-resistant and salt-tolerant plants.

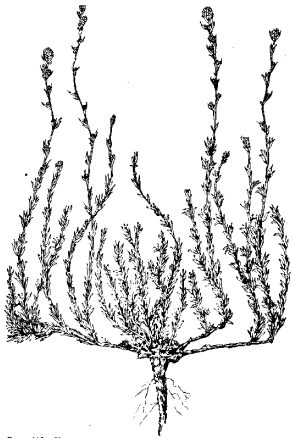

Fig.18 Leban, prostrate summer cypress.

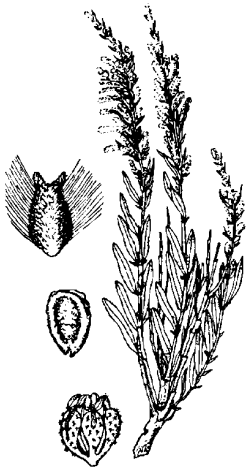

Fig.19 Gray winterfat.

Leban is the most valuable and promising plantof all the hawks,, it is well eaten by sheep, goats and camels and a little worse by other types of livestock. It begins to develop from the first spring month, blooms from mid-June to mid-August and bears fruit in September-October. Due to such a long growing season, almost all summer is eaten well, but it is better still in autumn and winter. Currently, in the desert zone it is cultivated on an area of several tens of thousands of hectares for hay and for pasture use. Allowed to use varieties: *Almaty sandy, Baktolen, Zadaryinsky.*

Gray winterfat, winterfat – Eurotia ceratoides, is a perennial shrub from the family of blooming 40-100 cm in height, it grows mainly on sandy and sandy, and rocky and rubbly soils of the desert zone of the republic, has a strong root system. Annual branches, fruits and leaves are eaten by farm animals during all periods of the year. Seeds in the desert zone of Kazakhstan ripen in October; easily crumble, especially in windy weather. On natural pastures, it gives 2.5-5.0 q / ha of dry mass, in artificial crops in the desert – upto 5.0-18 q / ha. Winterfat is recommended for sowing while improving desert pastures in a mixture with other forage plants, and in its pure form – to create protective belts. Allowed to use varieties: *Arys, KLH-2, Kyzyl Kum.*

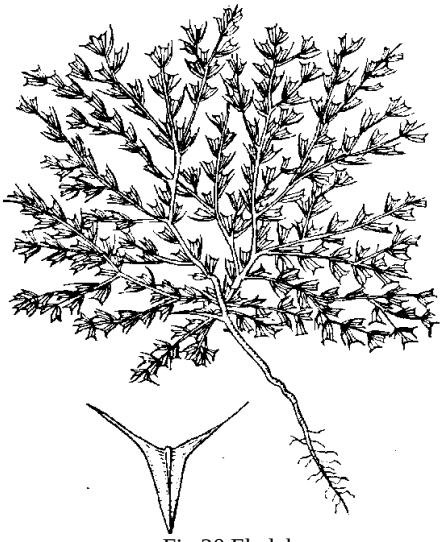

Fig.20 Ebelek.

Camphor fume – Gamphorosma monspeliacum L. and camphor Lessma – C. Lessingii Litv. Semi-shrubs, 15-40 cm in height, are found in semi-desert and desert: the first is in salt licks, the second is mainly in salt

marshes and on chalky and rocky slopes, in summer and autumn and in winter they are eaten by cattle well, promising when they master salt and salt marshes.

Ebelek – Geratocarpus arenarius L. Annual plant, forming a spherical shrub, 5-30 cm high. Bracts end in short spines, due to which the plant becomes prickly (slightly) when ripe. Widely distributed in steppes, semi-desert and desert, often on broken pastures, fallow lands. On saline and sandy light chestnut and brown soils are often clean cover. In the steppe and semi-desert, it is not eaten or is eaten only satisfactorily. In the desert, it is eaten all year round by all kinds of livestock, especially horses.

Goosefootjuicy. Succulent mirage includes plants with succulent stems and leaves, growing mainly on salt marsh and saline soils. Characteristic features of this group are high ash content (about 35% on average) and low fiber content (less than 20%). In some of the miking of this group, the amount of ash reaches 50%. Ash contains a significant amount of various salts. In this group, table salt was found up to 14.7%, glauber salt – up to 22.9%, Ca2CO3 - up to 18.4%, whereas in the legumes and cereals of these salts there is no more than 1%.

Due to the high salt content during spring, summer and early autumn, cattle do not eat them. In fall, after frosts, ash and along with it mineral salts begin to leach, their number decreases by a factor of 2-3, and then (especially in winter) the juicy grays are readily eaten by camels, sheep and goats, partly by horses. Eating increases with the fall, with the onset of cold weather, when animals less need water. In addition, at this time, apparently, begins the rearrangement of chemicals more favorable to the nutrition of animals. Some of the annual blooming of the genus of salty and other genera in the autumn is for camels and sheep with fat plants. The most frequently encountered are: marsh samphire, sarsazan, biyurgun and saltwort.

Marsh samphire – Salicornia europaea L. (S. herbacea L.). Annual plant, grows in wet salt marshes, often along the shores of lakes, rivers, in the steppe, semi-desert and desert.

Sarsazan – Haiocneeemum strobilaceum (Pall.) M. V. Semi-shrubs. It is found in large numbers in plump salt marshes in semi-desert and desert.

Saltwort, tetyr – Salsola gemmascens Pall. A small shrub. Occurs on washed-off soils, on slopes and takyrs in deserts, sometimes in significant quantities. It is eaten better than salt grass and sarsazan.

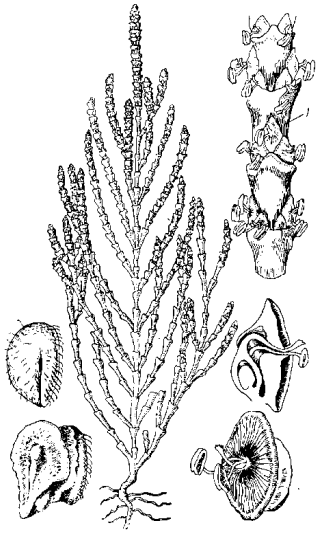

Fig.21 Marsh samphire.

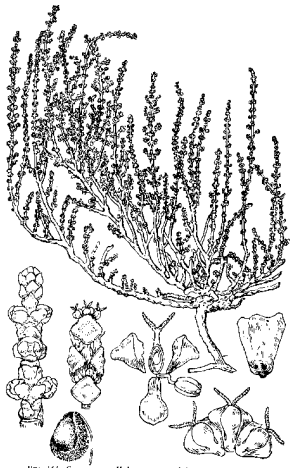

Fig.22 Sarsazan.

Biyurgun – Anabasis salsa (C. A. Mey.) Benth. Ex Volkens. Polukustarnichek, 20-50 cm tall. The most common plant on loamy and clayey saline and solonchakous soils of semi-deserts and deserts, often competing with wormwood. It is eaten by camels in early spring, autumn. In winter sheep and goats eat it a little.

*Goosefoot transitional semi-dry.*Plants that are transient include plants that, in comparison with previous groups, have an average amount of ash and fiber. Most of them are hardly eaten in summer, but in autumn and winter they are eaten well or satisfactorily. Most often found in the dry-steppe and semi-desert zones: lambsquarter goosefoot, saltwort and in the desert – clumsysaltwort, saxauls.

White saxaul, axoxul – Haloxylon persicum is a tree shrub up to 3-4 m in height from the family of goosefoot. In Kazakhstan it grows on semi-moving, medium-fixed, hilly, ridge and less often dune sands of Kzylkum, Muyunkums, sands of the Southern Balkhash. Begins to grow in early April, the seeds ripen in the second half of October, easily crumbling in windy weather. With a strong compaction of sand – the plants die off. Fruiting begins from 5-6 years of age, and intensively bear fruit from 10-12 to 25-30 years. Animals eat the young shoots and fruits: camels eat them throughout the year, sheep and goats in the winter. In artificial crops, with the improvement of desert pastures it gives up to 3-5 centners of dry weight,

in natural conditions – 2-3 times less. The plant is used to improve the sandy pastures of Kazakhstan.

Fig.23 Biyurgun.

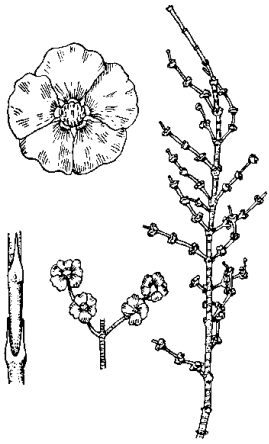

Fig.24 White saxaul

Black saxaul – karasekseul – Haloxylon aphyllun – tree shrub from the family of mariovy in favorable conditions reaches a height of 6-8 m. It grows better on sierozem and sulfur-brown soils of sandy and loamy texture, having a high filtration capacity and relatively close for the desert conditions occurrence of groundwater (from 5 to 20 m). When sown on such soils, in the first year of life it reaches a height of 60-80 cm, and at the age of 5-6 years – 4-6 m. On desert soils with compacted soil horizon it grows and develops poorly. Life expectancy is 35-45 years, and reaches intensive fructification at the age of 8-10 to 25-30 years. In the desert zone of the south-east of Kazakhstan begins to vegetate in the first half of April, the fruits ripen in the second half of October. Allowed to use in the Republic of Kazakhstan grade *Jean-Cy.*

Lambsquarter goosefoot – Chenopodium album L. An annual plant, on average 80-100 cm tall, sometimes up to 300 cm. It is found in significant amounts in deposits in the forest-steppe and steppe. In the hay and on pastures, livestock is hardly eaten, but it gives good silage. The young stems and leaves of white quinoa are eagerly eaten by pigs, especially when steamed.

Russian saltwort, kurai, tumbleweed – Salsola ruthenica lljin. Annual plant, 15-100 cm tall. Occurs and sometimes in very large numbers on young fallow lands, in crops as a weed in the steppe, in the southern part

of the forest-steppe, in the semi-desert and on the sands in the semi-desert and in the desert. It is almost not eaten on pastures, with early harvesting of hay and silage with cattle is eaten satisfactorily.

Clumsy saltwort, keyreuk – Salsola rigida Pall. Bush. Found in the deserts of Kazakhstan, satisfactorily eaten by camels, sheep, goats and horses all year round. In the desert is introduced into the culture. Allowed to use varieties: *Aidarlinsky and SEN.*

Elenia, chogon – Aellenia subaphylla var. typica Drob. (Salsola subaphylla C.A.Mey.). Shrub, 30-200 cm tall, with thickish, linearly valkovatye leaves. It grows on sands, on clay and crushed salty slopes in deserts. Starts growing in March, blooms in May-July, bears fruits in September-October. By nutritional value is equivalent to the average meadow cereals. It is eaten by sheep, goats, and camels throughout the year; satisfactory in winter, spring and summer, good and excellent in autumn. Widely used for fixing the sands of the desert. Currently, Chogon is one of the main plants in improving desert pastures. Approved to use grade *Syrdarya.*

Paletskyi saltwort – Salsola paletzkiana Litw. and Richter's saltwort – S. richteri Karel., Cherkesa. Shrubs or small trees, 1.5-4 m tall. In Paletskyi saltwort, young twigs hang with light bark and are longer than those of Richter's saponidaceous leaves, because the plant appears more succulent and green.

Richter's saltwort – Calsole richteri is a shrub with well-branched branches 2.5-3.0 m high with light green bark and milky white shiny young shoots. The root system is multi-tiered, penetrates to a depth of more than 3.5 m, reaching groundwater. One of the common desert shrubs and foothills of Central Asia grows on moving weakly fixed and fixed and weak sands, dies on strongly fixed sands. Rapid growth goes up to 7-9 years and by the age of 18-20 years - stops. Vegetation begins at the end of March, blooms in May-July, and bears fruit in September-October. Harvest in culture reaches 4-8 c / ha. Fodder is considered a valuable plant: camels eat it all year round, sheep and goats eat well in the fall and spring, bad in the winter, bad in the summer, and satisfactory in the winter.

Fig.25 Russian saltwort, kurai.

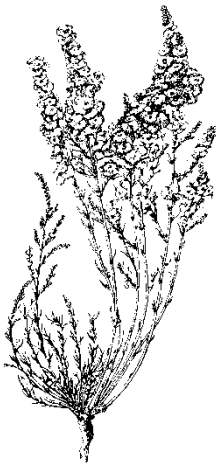

Fig.26 Clumsy saltwort.

Saltworts are common shrubs in sandy deserts, grow on mobile and weakly fixed sands. Used to improve pasture, cultivated in its pure form or in joint crops with chogon and saxaul.

Aster (Compositae) - *Asteraccae.* The Aster family includes over 25,000 species on the globe and is the most numerous; in the CIS, over 2,700 species belong to this family, or about one-seventh of the entire flora. This includes single and perennial grasses, rarely dwarf shrubs and dwarf shrubs, and shrubs. A characteristic feature of the representatives of this family is the inflorescences: the flowers are small, gathered in the capitate inflorescences, dressed from the bottom with a wrapper of small leaves, which is called a basket. In the steppe, especially in the dry, wormwoods, milfoils, thistles, erigeronsand some others take a large part in the grass stand. Their aft role, especially in fallow lands, is even greater than in forest-steppe. In semi-deserts, often the first place belongs to wormwoods, which form the basis of late autumn and winter feed.

In most of the desert areas, at least 40% of all feed is received by the compositae. Wormwood plays a predominant role, in the mountainous areas, where the forage value of the compositae is small, but even here representatives of some genera often make up a large part of the grass cover – dandelions, traguses, salsafies, inulas, heathens etc. In the flowering phase, the compositae contain (as a percentage of absolutely dry matter): ashes – 5.8, protein – 10.1, fat – 4.6, fiber – 30.2 and nitrogen-free extractives – 46, 3. According to the nutritional value eaten by cattle, Compositae above grasses: in the flowering phase, 100 kg of feed contained

(from absolutely dry matter) to 5 kg of digestible protein and 50.3 feed units.

Some plants of this group (wormwood, milfoils, chamomile, etc.) are eaten at the beginning of the growing season, and then at the end of it (from late autumn). There are among the compositae and species that are eaten only in the early phases of the growing season (creeps, thistles, cousins, milfoils etc.). Some of the compositae (wormwoods) contain anthelmintic, and in many of them - bitter, appetite stimulating substances. Of the total number of species studied (574), 29% are well and well eaten by cattle, 25% are satisfactory, and 46% are bad and are not eaten; about 9% poisonous, harmful and suspicious of toxicity.

Due to the large economic significance, *wormwoods* (Artemisia L.) should be distinguished as a special group, which has the highest feeding value.

Wormwoods by eating differs from many fodder plants, it is eagerly eaten mainly only in the fall and winter, less often in spring (at the beginning of the growing season), and in late spring and summer they are not used or eaten poorly. Best of all wormwood is eaten by sheep and goats (satisfactory, and some species are good), a little worse – horses and camels, and bad – cattle. The bad use of them in summer is explained by the fact that almost all wormwood has a sharp odor and contains many bitter substances, and some of them shed their leaves. In the autumn after flowering, especially after frost, the smell of wormwood becomes less harsh, and their bitterness decreases. Many of them contain essential and bitter substances in an amount in which it becomes possible to use them even for perfume and medicinal purposes. The nutritional value of wormwood is close to cereals, and in winter their nutritional value is higher than that of cereals.

Fig.27 Common wormwood.

Fig.28 Austrian wormwood, wormwood.

On deposits in the forest-steppe and steppe, and sometimes as weeds in the crops of cultivated plants are found: common wormwood – Artemisia absinthium L. and Seaweed wormwood – A. sieversiana Willd. These species produce a large mass and are rather well ensiled, and are poorly eaten in pastures and hay. In forest-steppes and steppes, mainly on downed pastures and fallow lands, they are often found in insignificant quantities: Austrian wormwood – A / repens Pall. ex willd. (A. austriaca Jacq.) and fringed sagebrush – A. frigida Willd. Both species are hardly eaten in the summer, and are used satisfactorily and well in the winter pastures. On sandy soils and on sands is often found in significant amounts sand wormwood Oligosporus arenarius (DC.) Poljak. (Artemisia arenaria DC.). On saline soil and solonets soils in forest-steppe, steppe and semi-desert, some of the most characteristic plants are: camphor wormwood, white, ak-jusan – Seriphidium lercheanum (Web. Ex Stechm.; wormwood black, kara-jusan – Seriphidium pauciflorum (Web. Ex Stechm.) Poljak / (Artemisia pauciflora Web. Ex Stechm. In the deserts, the main plant mass consists of wormwood, similar in appearance to camphor wormwood, but having a more woody ground surface part, – marine wormwood, aq zusan, – Seriphidium terrae-albae (Krasch.) Poljak. (Artemisia maritima Bess. Ssp. Terrae albae Krasch.

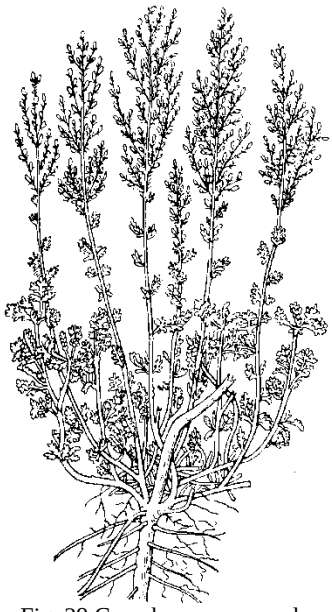

Fig. 29 Camphor wormwood.

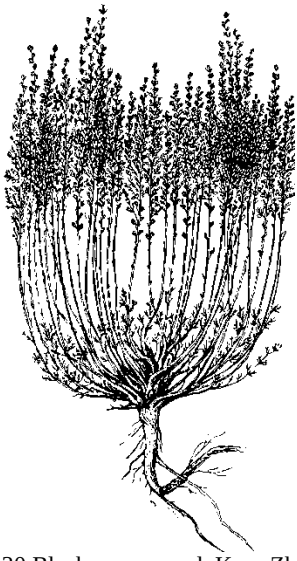

Fig.30 Black wormwood, Kara-Zhusan.

Fig.31 Sand wormwood.

From other members of the Asteraceae family, the following species are most often found on hayfields and pastures: – Medicinal dandelion –Taraxacum almaatense Schischk. (T. officinale Wigg.); fall dandelion – Leontodon autumnalis L.; yellow goatling – Tragopogon pratensis L. and species close to it, yellow sow thistle, field sow thistle, Sonchus arvensis L.; Chondrilla juncea L. and others; on the sands –

chondrilla, sagyz – chondrilla juncea L.

Poorly and satisfactorily eaten on pastures and satisfactorily in hay: Alpine aster – Aster korshinskyi Tamamsch. (A. alpinus L.), spotted saltwater, yellowcone Galatella punctata (Waldst. Et Kit) Nees; milfoil – Achillea inundata Kondr. (A. millefolium L.); cousinia (on clayey soils – Cousinia oxiana Tscherneva, on sandy soils – C. schistoptera Juz. (C. bipinnata Boiss; yellow thistle, violet thistle – Breea setosa (Willd.) Sojak. (Cirsium setosum (Willd.) Bieb; cornflower – St. Centaurea jacea L. et al.

The non-edible colored flowers contain a significant amount of bitter substances, and for the most part it is a heavy-fat plant: wild chamomile – Matricaria chamomilla L., corn yellow marigold – Leucanthemum vulgare Lam., common tansy – Tanacetum vulgare L., etc. Plants containing essential oils, with a sharp smell and bitter: daisy– Tanacetum achilleifolium (MB) Sch. Pip (Pyrethrum achilleifolium M.B. et al. Strong-cut plants: spiny clotbur – Xanthium spinosum L., spiny cousin – Cousinia alpina Bge. (C. acicularis Franch.) etc.

Strongly-cut plant cat's foot– Antennaria dioica (L.) Gäertn, not eaten by large livestock, but well eaten by deer, etc.

Buckwheat – Polygonaceae Lindl. About 750 species belong to the family of buckwheat. The most common species are from the genus: buckwheat - silverfleece vine – Polygonum, sorrels– Rumex, rhubarb – Rheum and calligonum – Calligonum.

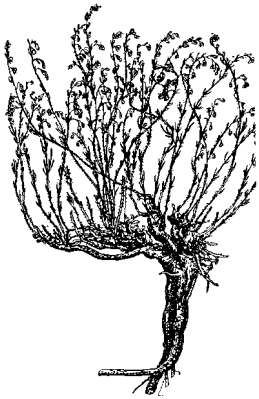

Fig.32 Sea wormwood.

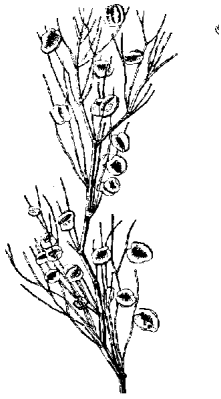

Fig.33 Leafless calligonum.

There are 71 species of calligonums (Calligonum L.). These are shrubs, sometimes tree-like. Met on the sand semi-deserts, deserts,

sometimes in considerable quantities. Young green branches and fruits of most species are eaten eagerly by camels, sheep and goats. Cockroaches are also interesting as plants fixing sand, like tanners. The most widespread – jellyfish calligonum – C. caput Seprenk and leafless calligonum – C. commune (Litv.) Mattei (C. aphyllum (Pall.) Guerke). Some calligonumsdevelop well in culture.

Jellyfish calligonum – Calligonum caput – a shrub of a family of buckwheat up to 2 m high, branched, with light gray or pink-green bark with a powerful root system penetrating up to a depth of 2 m and up to 10-15 m in side. It is widespread in the turbulent sand of semi-deserts and deserts of Kazakhstan. When eating animals above the surface of the abundant subsoil. Fruit begins with 3-5 years of age. The yield of air-dry mass may reach 10-15 centners per hectare. Vegetation begins in March-early April. In spring and early summer, green sprigs and fruits are eaten well with sheep, goats and camels. The plant is recommended for cultivation on sandy desert pastures.

The greatest nutritional value is knot grass – P. aviculare L. This annual plant is found in plenty of plenty on the ground in pastures situated near settlements. In crops and deposits, its height reaches 20-60 cm. By chemical composition and nutritional value, knot grass is very close to leguminous plants. In pastures it is well eaten by cattle, sheep, goats, pigs, birds and quite satisfactorily - by horses and camels. In fresh, chopped or steamed form is a very valuable feed for pigs and poultry. After bleeding it grows well and under favorable weather conditions it gives aftermath. High fodder qualities, undemanding to soil, long vegetation period, put knot grass to be tested in culture as one of the most interesting forage plants. A number of buckwheats giving a lot of weight are valuable plants for the preparation of silage and hayloaf. Such are *the Sahalin buckwheat, buckwheats of Weirich and the Balkan knot grass*.

Sorrelscontain oxalic acid and tannins; therefore, most of their cattle in pastures are not eaten or eaten badly. In the hay they eat, but often unsatisfactory. Badlyeaten and is a malicious weed in the meadows horse sorrel– Rumex confertus Willd.

Plants of the genus rhubarb grow mainly in semi-deserts and deserts. The most common zeal is Tatarianrhubarb – Rheum tataricum L. A perennial plant grows in early spring with large leaves containing 90-95% of water, which are readily eaten by camels, sheep and goats. Due to the high content of water in the water, camels in these pastures can cover up to 2 weeks without water. The leaves contain over 20% protein and a very small amount of fiber (6.9-10.3%) and, thus, are high-value feed.

Cabbage (cruciferous) - Brassicaceae Burnett. This family covers

about 3000 species. Distributed quite broadly, however, in the north, their forage role is insignificant, in the steppe and semi-desert it increases, and in the early spring in the desert the cabbage often forms the main feed. By fodder value, they are located after cereals, complex colors, legumes, sedge and ghosts, on the nutritional value, the ratio of chemical substances can be put on a par with bean plants. However, 35% of the studied species is not eaten or eaten badly, and only 24% is eaten well and excellent. Better than other animals, cabbage is eaten by sheep, goats and camels. Relatively poor edema is due to the presence of glucosides (synigrin, sinalbin) and garlic oils. These substances give the majority of cabbage, especially their seeds, sharp garlic (rare), sometimes bitter and burning taste, and even often a garlic scent.They cause unpleasant taste and smell of milk and cause poisoning of cattle, which occurs most often when eating seeds or plants in the flowering phase - fruiting.

In the group of good forage plants, a lot of cabbage growing in the deserts and foothill areas are mainly ephemeres, which include: turkestan malkolmiia – Malcolmia turkestanica Litv., Syrian mustard – Euclidium syriacum (L.) R. Br., dyer's weed – Isatis Emarginate Kar ee kir and some others. All these plants are united by one common (local) name - four, shatyr and appreciate them extremely high, considering them as a feed material for camels, sheep and goats. A considerable number of cabbage, found on deposits in the forest, forest-steppe and steppe zones, is also eaten satisfactorily by animals. Such plants include: field mustard – Sinapis alba L., field cabbage – Brassica campestris L., etc. Valuable feed is given to cabbage, introduced into the culture –fodder cabbage, trout, turbine, turnip, rape, mustard.

Celery (umbellate) – Apiaceae Lindl. (Umbelliferae Juss.). Perennials and less commonly annual grasses. One of the vast families of the globe, which has about 3000 species. For celery, a significant content of essential oils is characteristic: in fruits – 1-6%, in leaves – 0.01-0.05% (from raw weight); In some parts (gum carriers, donuts, etc.), especially in the roots, there is a lot of resins, and in some of them there are toxic resin-like substances (cytotoxin, enanthotoxin) and alkaloids (konin, herophyllin, etc.). A small amount of essential oils gives celery a pleasant aroma, such plants are eaten eagerly by cattle in pastures and in hay; plants contain a significant amount of essential oils, usually not eaten or eaten badly by cattle.

About half of the studied celery is satisfactorily or well eaten by cattle, 14% is poisonous and harmful plants.

In the forest zone in pasture animals only eaten only a few celery, in the desert and in mountainous areas their nutritional value increases

significantly.

Of the greatest economic significance are species of the genera of cow parsnip, hay plant, cumin, hadeas, donuts and some others.

Siberian cow parsnip – Heracleum sibiricum L. Perennial plant, 100-150 cm tall, with large leaves. It grows on floodplain meadows in Western Siberia, forest-steppe part of Kazakhstan.

Sosnovskyicow parsnip – Heracleum sosnowskyi Manden. Plant monocarpic type, 100-250 cm tall. In pastures in a young state, cow parsnipsare eaten quite eagerly by all kinds of cattle and very well wild hoofed animals.

Hay plant, yugan – Prangos pabularia Lindl. Perennial plant, 50-250 cm tall. In large numbers it is found in the forest and subalpine belts of the mountains of Central Asia. Its thickets yield a yield of 30-40 centners per 1 hectare (in dry weight). In fresh form it is almost not eaten by cattle. The leaves (mainly rootstocks) and partially the whole plant are harvested in large quantities for hay for cattle.

Caraway– Garum carvi L. A two-year or middle-aged plant, 30-80 cm tall. Widespread in forest and forest-steppe zones and in lowland areas. Sometimes it (often on deposits) gives solid thickets. Has a pleasant smell and taste, so it is eaten by cattle. An admixture of cumin improves the eating capacity of other plants, increases milk yields. It is recommended that in small quantities seeding cumin seeds in the cereal-bean grass (1-2 kg per 1 hectare).

Fetid gum, katran– Ferula assa-foetida L. A perennial plant, 80-120 cm tall, with large, spherical inflorescence and large (40 to 100 cm in length) root foliage. Large, but rarely scattered (from 100 to 2500 plants per ha), ferula bushes are found in large areas of deserts. Has a bad smell. Green plants are eaten only by camels; in dry form leaves and fruits are eaten by all kinds of cattle. Seeds are used as concentrated feed.

Panicled gum – Ferula feruleoides (Steud.) Korov. Perennial plant, 70-150 cm tall. It blooms once in a lifetime (monocarpic) at the age of at least 20 years. After flowering the plant dies. Develops large rootstock leaves. Distributed in an area of several million hectares in Central Kazakhstan, it does not form a solid thicket, but grows separately with scattered bushes (from 100 to 15,000 per hectare). They harvest leaves for the winter and use them for feeding cattle. The roots contain up to 35% of the resin that is used in the industry.

Other kinds of the celery family. In the forest zone, the forest-steppe is found in a considerable number of taller species of genera: chervil – Anthriscus Pers., mustard – PeuceganumL., ursine – Pleurospermum Hoffm, goutweed – Aegopodium L., cuttings – Libanotis Hill, angelica–

Angelica L., cultivated angelica – Archangelica NM Wolf. etc. These plants are eaten badly in the pastures and in the hay, but they falter satisfactorily and eat fattenly with eagerness willingly. Very many forest umbrellas are perfectly eaten by marals and spotted deer.

*Rosaceae – Rosaceae Juss.*In this family, garden burnet – Sanguisorba officiaaaanalis L., burnet salad – Poterium sanguisorba L. and colonel-daughter-in-law – P. polygamum Waldst et Kit are interested.

Borage family– Boraginaceae Juss. From this family, the most commonly used trench is prickly comfrey.

Prickly comfrey, camphor Caucasian – Symphytum asperum Lepech. Perennial plant, 1-1.5 m high, with large rough leaves.

Carnation family – Garuophyllaceae Juss. In the pastures and in the hay, for the most part, make a small impurity. In this family there are quite a lot of beautifully flowering plants, some of them have long been introduced into culture as decorative (cloves, pearles, etc.). About half of all species are eaten by cattle in the pasture. In a hay at a small impurity eaten mainly by sheep and goats, worse by other kinds of cattle and especially badly by horses. Most species contain saponins, and some of them are poisonous for cattle.

Dead nettles (Labiatae) – Labyatae Juss. One of the most widespread families, there are about 3350 species on the globe. Herbs, less often semi-small. Lipo-colored flowers are found everywhere, and sometimes even in the form of basic plants, almost all of them are etheroniosis, often bitter to taste. Among them there are a lot of honey and medicinal plants, most of this family is eaten badly by the cattle: side wort– Brunella vulgaris L., dead-nettle– Lamium album L., violet sage – Salvia nemorosa L., creeping thyme – Thymus serpyllum L., common origanum– Origanum vulgare L. et al.

Nettle family – Urticaceae Endl. In the foreground, the best interest is greater nettle – Urtika dioica L. and cannabis nettle – U. cannadina L. In the young state they are eaten eagerly by swine, bird, cattle and horses, especially well eaten in a chopped form, boiled in boiling water. Young nettle is a highly nutritious food. Its hay, collected in the flowering phase, contains a lot of protein (about 22-23%) and little fiber (18-20%). The hay of nettle is eaten badly, as it is extremely difficult to keep leaves during drying. It is more expedient to use nettle in green and for silage, but it is necessary to sow it in a mixture with carbohydrate feeds, because it is bad in silage.

Malvaceous family – Malvaceae Juss. The most stern interest is the species of mallow, marsh mallow - Malva.

Species of this species, found in a wild state, are eaten quite

satisfactorily by cattle, among them mildew mutant - M. verticillata L., curly malta - M. crispa L. and maluga meluka - M. meluca Graebn. By nutritional value is much higher than cereal grasses. Well fermented and quite satisfactorily eaten in green.

CHAPTER 4 POISONOUS AND HARMFUL PLANTS

Poisonous plants. Among the about 5000 species studied in the fodder relationship, unidentified 378 and poisonous 336 or 15% of the total number of plants studied were detected. Plant poisoning occurs quite often, but animals do not always die; for this reason, only a few cases of poisoning are described in the press.

Fig.34 Snakeroot.

Among the most widely spread poisonous plants are: from the calamus – black henbane (Hyoscyamus niger L.), Jimson-weed (Datura stramonium L.), belladonna (Atropa belladonna L.), bitter nightshade (Solanum dulcamara L.); from umbrellas – snakeroot (Cicuta virosa L.), poison hemlock (Conium maculatum L.); from the grasses – darnel (Lolium temulentum L.), woolly soft grass (Holcus lanatus L.), watery manna grass (Glyceria maxima (C.Hartm.) Holmb.); from the composae ones are goldenrod (Solidago L.), groundsel (Senecio Jacobaea L.), Russian centaury (Acroptilon repens (L.) DC.), milkweed (Lactuca virosa L.), poisonous hawkweed (Hieracium virosum Pall.); from ranunculus – buttercups Ranunculus L., anemone (Antemone L.), pasqueflower (Pulsatilla Mill.), cowslip (Caltal L.), wolfsbane (Aconitum L.), larkspur (Delphinium L.), adonis(Adonis L.); from the milkweed –spurge(Euphorbia virgata Waldst. et Kit.), marshy milkweed (E. Palustris L.), Seguier milkweed (E. seguierana Neck.); from the carnation – purple cockle (Agrostemma githago L.), lesser stitchwort (Stellaria graminea L.); from the fistulae –

figworts (Scrophularia L.), drug hedge hyssop (Gratiola officinalis L.), foxglove (Digitalis L.), wild radish (Raphanus raphanistrum L.).

Let's consider some poisonous plants, the most widespread on pastures and hayfields.

Snakeroot – Cicuta virosa L., sem. celery. Perennial plant with a shortened thick rhizome, 50-150 cm tall. It occurs on wet and damp meadows, in swamps, along marsh banks of rivers, on the outskirts of lakes and old people in forest and forest-steppe zones. Contains tsikutotoxin, causing damage to the central nervous system. One of the most poisonous plants. Poisonous properties do not disappear with drying and silage. Leaves and rhizomes are eaten in the early spring by various kinds of livestock, therefore, poisoning by a landmark occurs frequently. Sucking 2-3 rhizomes can cause the death of an adult animal.

Poison hemlock – Conium maculatum L., seeds. celery. One-two-year plant, 60-180 cm tall. The stools produce an unpleasant smell of murine urine. Common in forest, forest-steppe and steppe zones, in weedy places, in shrubs and along the banks of rivers. All parts of the plant are poisonous, especially fruits. Contains poisonous alkaloids, which cause damage to the nervous system and at the same time affect the heart, digestive tract, kidneys. Less poisonous roots. In silage and drying, poisonous properties do not disappear. Death can come in a few hours.

Stitchwort – Thermopsis lanceolata R. Br., Sem. legumes. Perennial grassy plant, 25-45 cm tall. It occurs mainly in forest-steppe and steppe zones. Contains alkaloids (thermoxin, pacicarpin, etc.), affecting the central nervous system and the digestive tract. Poisonously the whole plant is green and dry.

Two-colored laburnum – Cytisus biflorus L., sem.legumes. Shrub, 1-2 m high. Occurs mainly on sand, on slopes, in depressions in the steppe, less often in the forest steppe and in the forest zone. Contains poisonous alkaloid cytosine, affects the same organs as thermospsis. All overground and underground parts of the plant are poisonous. Most often, the horses are poisoned. To poison a horse enough 25-35 g of dry seeds, flowers or bark.

Amur bitterling, persecia – Sophora alopecuroides L., sem. legumes. Perennial plant, 50-80 cm tall. It is found in semi-deserts and deserts.

Russian centaury – Acroptilon repens (L.) LC., Sem. complex colors.Perennial plant, 20-70 cm tall, widespread in the steppe, semi-desert and desert, steppe and semi-desert estuaries and on deposits, as well as in crops.

Drug hedge hyssop – Gratiola officinalis L., Sem. fistulae Perennial plant, 20-60 cm tall. In small quantities it is found in wet places.

On the banks of rivers, lakes and meadows. Contains glucoside grazolin. Causes damage to the respiratory and digestive tract. All parts of the plant are poisonous in green and dry condition. Poisoning in steppe areas when grazing animals in floodplain meadows is largely due to this plant.

Of the other birdwatchers, they are considered poisonous: foxgloves, flaxseeds, muttons and others.

Descurion Sophia, flix weed – Descurainia Sophia Webb et Berth., Sem.cabbage Occurs on deposits and solonets in the steppe and forest steppe. Poisonous seeds containing glucosides, eliminating poisonous mustard oil. It poisons cattle when eating hay and grass in the fruiting phase.

In the family of pastilles, all wildlife species contain a significant amount of poisonous alkaloids (atropine, hyoscyamine, copolamine, etc.), glucosides (fisalin, dulcamerin, etc.), saponins, affecting the nervous system. Almost all of them, while drying or silage, retain toxicity. The most common are poisonous: black henbane – Hyoscyamus niger L., Jimson-weed – Datura stramonium L., bitter nightshade – Solanum dulcamara L.

About 80% of the studied species are poisonous for livestock or poisonous in the family of colostrum. Contain anhydride of euphoric acid - euphorbin, which affects the gastrointestinal tract. Of the most toxic species, the most common are: annual mercury – Mercurialis annua L. and a perennial mercury – M. perennis L., milkweed – Euphorbia virgata Waldst. Et Kit., marshy milkweed – E. Palustris L., Segiermilkweed – E. Seguieriana Neck.

In the poppy family, more than half of the species are considered poisonous or suspect of poisoning. Contain alkaloids that affect the central nervous system.

Of the family of lilacs, the most frequent poisoning of livestock is due to Lobel's hellebore, white – Veratrum Lobelianum Bernh. Contains poisonous alkaloids (protovaterrine, hermerin, etc.), affecting the central nervous system. Poisonously the whole plant is green and dry. Of this family, poisonous for cattle are the four-eye crows eyes, the medicinal leopard, the lily of the valley, and others.

Harmful plants. About 57 species are known to be harmful plants (slightly more than 1% of the species studied in feed). In fact, there is every reason to suppose that some plants that spoil milk and dairy products will have at least several hundred flora. Especially many plants that spoil the taste of milk, give it an unpleasant smell and change its color. The greatest number of harmful plants contain families of cabbage (cruciferous) and astro (compositae).

The following most commonly harmful livestock plants can be

named.

Gives a bitter taste of milk to most of the wormwood and especially bitter wormwood and Sivers wormwood. Unpleasant taste and coloring of milk in various colors appear when eating cowwheats. Garlic, spicy taste, often unpleasant smell of milk, and often the smells and taste of butter, cheese and meat are given by wild meadows and many crucifers of sorts mustard, cabbage, stuffy, stench, as well as field pennycress etc.

Milk is coagulated and is badly fed when eating sorrel and wood sorrel. When eating milkweeds, mercuries, forget-me-nots, the milk is painted in pink, red, blue, but its taste is almost unchanged. Medick, feather grass, knapweeds and othersspoil the wool. feather grass and broad-leaved cat-tail wrap the skin. The oral cavity, nasopharynx, eyes, etc. are wounded by plants, whose fruits are covered with hard spruce - oats, buttermilk, barley, raspberries, jaspers, etc. In the stomach (thistle) phytobesores (spherical formations), which interfere with the passage of food in the intestine, when eating fruits and inflorescences of pasque-flower, cotton grass, bristle grass, thistle, cotton flint and others.

CHAPTER 5 ROOT PLANTS AND TUBERS

5.1. General characteristics and importance of root crops

Root plants are called plants, whose roots are thickly thickened and become a place of deposits of spare nutrients. Root is a part of the stem and root. It has three parts: head, neck and the root itself. The upper part, on which leaves and buds are formed in the first year of life, is a shortened stem of a plant on which the socket of leaves is formed. Below the socket of the leaves is a neck of the root, growing out of the subfamily stem - hypocotyl. Root cuisine is smooth, without leaves and roots. Under the neck is formed a strongly thickened root itself with a large number of lateral roots.

Root plants are formed in biennial plants in the first year of their life. For the second year from the buds of the root crops, generative organs grow – flower-eating shoots, flowers, fruits and seeds.

Of the number of root crops, sugar and fodder beetroot, carrot, trout, rap and turbine have been widely distributed in agriculture, which are used in human food and animal feeding.

Root crops belong to different botanical families, but they are united by the property of the main product obtained from growing - they are high in carbohydrates (especially sugars), minerals and vitamins, high digestibility of nutrients.

Root vegetables are eaten eagerly by farm animals, contribute to better digestibility of coarse and concentrated feed. This is due to the fact that the juicy roots containing organic acids, vitamins and other physiologically active substances, increase the secretion of glands and intestinal peristalsis, accelerate the passage of chyme through the digestive tract. At the same time accelerates the fattening of young animals, milk cows increase milk yield. The inclusion of root crops in animal diets contributes to the partial neutralization of silage acidity, which positively affects their health and reproductive functions.

5.2 Sugar beet

Meaning

Sugar beet has a great nutritional and nutritional value. It is grown both for the production of sugar and for feed purposes. The roots of sugar beets contain an average of 17-19% sugar. The yield of sugar at processing is 11-13%. By-products of processing - pulp, molasses - are used for animal feed.

Sugar beet is the main culture for sugar, as it is grown in almost all zones. The average yield of sugar beet roots is 20-25 t / ha. Under favorable conditions 40-50 tons of roots are formed, and at irrigation 70-80 tons with 1 hectare.

Botanical features

Sugar beet – Beta vulgaris L., v. Saccharifera belongs to the Mares family – Chenopodiaceae. This is a two-year plant. In the first year, a thick root and a rosette of large leaves on long petioles form. Leaves at the base of the heart-shaped, wavy on the edges. For the second year, from the axillary buds of the shortened escape, generative shoots are formed, which severely branch out. The leaves are oblong, lanceolate, regular, with sharp edges. Flowers are collected in long spiked inflorescences. Fruit - nuts with a rigid pericarp, nuts are matured 2-3 in the calf - glomeruli.

The root system of sugar beet consists of the main root and numerous lateral, growing from the main in the direction of the placement of cotyledons.The main root has a cone-shaped shape, compressed from two sides, penetrates to a depth of 2.0-2.5 m.

Biological features

Sugar beet is a relatively cold-resistant culture of a long daylight. Inclusions appear at +6, + 8 °C, but very slowly, after 18-20 days, carry freezing to -4, -5 °C. Friendly shoots can be in 7-10 days at soil temperature +12, + 15 °C.

The best air temperature for the development of sugar beet is +20, + 22 °C. The growth of root crops and the accumulation of sugar in them continues until the end of vegetation, that is, until the average daily air temperature is lower than +5, + 6 °C.

Sugar bears are demanding to the sunlight, and its intensity is accelerated by the synthesis of carbohydrates and the accumulation of sugar. Insufficient illumination, for example, in congested or clogged crops, drastically reduces the yield and sugar content of the sugar beet roots.

Plants are very demanding for moisture. The transpiration coefficient of sugar beet varies from 300 to 400. The total water consumption from the area of 1 hectare of beet seed reaches large quantities, up to 4,000 m3. Especially a lot of water is consumed during the intensive growth of leaves and roots. The favorable soil moisture for the beet is 65-70% LWC.

The best soils for growing sugar beet are fertile soils, rich in organic matter, loamy and sandy loam with granulometric composition; better neutral or slightly acid.

The duration of the vegetative period of sugar beet in the first year of life is 110-130. In the second year from the planting of maturity to the

maturation of seeds – 110-125 days.

Technology of cultivation

It is very important to choose the precursor in the crop rotation. There are many pests in the beetles, and its crops are strongly suppressed by weed plants. The best precursor is black pairs or well-fertilized winter crops in the steam field. The sugar beet in the crop rotation can be re-sowed in the previous field in 4-5 years to avoid damage by pests, especially nematode, and a sharp decline in yields.

Organic and mineral fertilizers should be added to the soil to produce high yields, preferably from the autumn - under the basic soil preparation. Phosphate fertilizers are very effective when introduced into rows during sowing (10 kg per hectare per hectare).

Organic and mineral fertilizers need to be introduced for basic soil treatment. An effective method is the introduction of superphosphate in rows when sowing in a dose of 10-15 kg d. per 1 hectare. When irrigating, mineral fertilizers can be added to the feed when intermediate treatment of crops. Microfertilizers for sugar beet, especially boron, manganese and copper (1.5-2.0 kg per 1 hectare in terms of trace elements), are very effective.

Given the production of sugar, it is not advisable to add nitrogen fertilizers in doses of large calculi, since the excess of easily soluble nitrogen compounds prevents crystallization of sugar during its production.

Preparation of soil for sugar beet cultivation is carried out under the system of soil cultivation for spring crops.

In the spring, early harrowing is performed to smooth the field and reduce the evaporation of moisture. Then pre-sowing cultivation is one or two times depending on the specific weather conditions and the field's contamination. For pre-sowing soil treatment, effective application of herbicides, for example, "Hurricane Forte" in a dose of 1.5-2.0 l / ha to a depth of 3-5 cm. After cultivation, it is desirable to immerse the field with ring rollers for leveling the soil surface, uniformly sealing the seeds when sown and obtaining uniform friendly seedlings.

Preparation of seed beets for sowing involves calibration on seeding machines. Seven-on the fractions 4-5 and 5-6 mm in diameter are calibrated on openings with round holes. Large amounts of seeds are used for planting, which provide a higher yield. It is desirable to treat them with microelements and to drag the nutrient mixture from the crushed and sieved through a sieve with holes to 0.5 mm humus with the addition of trace elements and adhesive, for example, colloidal clay.

The dates of sowing the sugar beet depend on the specific soil and climatic conditions. The best term is when the soil is warmed up to the

depth of the seed till +7, + 8 ° C. Premature sowing in cold soil leads to mowing of seedlings and reduction of yield, as early crops are strongly damaged by pests and frosts. Laying with seeding is also undesirable because the top layer of soil may dry up and shoots may not appear. In addition, at a late seeding period, the period of vegetation is shortened, and the yield and sugar content of the roots decreases. A method of sowing a sugar beet broadly with a row spacing of 45 cm.

Norm sowing for single-seeded seeds with high sowing qualities with a planting density of 100 thousand. plants per hectare is 8-10 kg / ha. Sowing is carried out by the sowing system of accurate sowing ССТ-12Б. For multiplying rate increases to 18-20 kg / ha. The depth of sealing of sugar beet seeds on light soils is 4-5 cm, in heavy soils it is 3-4 cm.

Care of crops

The first method for caring for sugar beet crops is rolling with rollers to improve the contact of the seeds with the soil and more friendly seedlings. When precipitation is frequent, rolling is not carried out to avoid compaction of the soil and the difficulty of seedlings. Before shoots of beets, the effective introduction of the Dual Gold herbicide is 1.3-1.6 l / ha.

The second method is the loosening of soil for the destruction of the forming crust. Flushing is carried out by light teeth or net harrows through the rows at low speed: 3-5 km per hour. In the case of retardation of seedlings and the emergence of weed plants, harrowing is done twice, but before the appearance of centimetric seedlings of sugar beet. The depth of the harrowing should be less than the depth of the seed seal, so that there is no displacement from the rows.

When designating the rows of beetroot, the first inter-row treatment is carried out to a depth of 4-5 cm with flat-cut razors. To destroy annuals of cereal weeds, the herbicide “Fyzilad Forte” is added – 0,75-1,0 l / ha.

During the formation of beets the first pairs of real leaves need to cut the plants in rows through 20-30 cm. The distance between them at the same time will depend on the purpose of sowing. When cultivating sugar beets for feed purposes, it is advisable to leave 75-80 thousand plants per 1 hectare.

Under industrial technology, with accurate seeding of single-breeding beet seeds, thinning is carried out mechanized by special cultivators-cleansers (USMP-5,4). But often this is done manually, especially when sowing multicolored seeds of beets. In this case, the first bouquets are cut in rows with cultivators-cutters, and then they carry out manual checking and thinning of bouquets, leaving in it two plants at a distance of 18-20 cm.

After thinning of the plants, the subsequent interlinear treatments are carried out as necessary to a depth of 10-12 cm. They are combined with fertilizer application with mineral fertilizers. When cultivating a sugar beet, a great deal of attention must be paid to protecting plants from pests and diseases, with a clear forecasting system, and systematic monitoring of the occurrence of pests. Agrotechnical and chemical measures of control should be applied in a complex manner, according to the available recommendations. For example, against the beet fleas, weevils, employees of Syngenta company recommend spraying with Karate Zeon - 0.15 l / ha or "Akketyk"– 1.0-2.0 l / ha.

Before the start of harvesting, the bottle is peeled off with a special harvesting machine MB-6. Beet leaves are used on green fodder or fused together with dry components (straw, haylage). Roots are cleaned with beet-harvesters RKS-6, KS-6. The collected root crops are handed over to the beetroot points after hand-cleaning.

If sugar beet is grown for feed purpose, then the roots are laid in storage near the livestock farms. The best storage facilities are standard with forced ventilation and adjustable temperature. The optimum storage temperature of beet root is 0, +2 °C at a relative humidity of 90-95%.Types of feed from sugar beet and their nutrition

Sugar beet is a valuable feed for all types of farm animals, especially for cattle. The root crops of sugar beet are very firm, therefore it is better to feed them in small-sized form. The leaves are fed whole or silo in admixture with the sucrose components. In the absence of special storage, the roots of sugar beet can be sliced in a shredded form together with silosed plants - mixed sowings of annual fodder crops and perennial herbs.

Sugar beetle is an important source of carbohydrates, mineral salts and vitamins. The nutrient content of sugar beet is given in Table 14.

In the leaves of sugar beet, the ratio of carbohydrates and proteins is favorable for feeding animals. For 1 feed unit there are 110-115 grams of digestible protein. In leaves 2-3% of fiber, therefore they are used for feeding pigs and poultry. The digestibility of the dry matter of the leaves is high (80-90%), but it is necessary to know that they contain an excess of organic acids, especially oxalic acid. Therefore, feeding the bottle in large quantities causes animals to disturb calcium metabolism and digestive disorders. The daily rate of giving the roots to the animal should not exceed the zootechnical standards for sugar, so as not to cause the disease of animals.

Table 14

Nutrient content in sugar beet feeds (A. P. Kalashnikov et al., 1985)

Kind of feed	In 1 kg of feed is contained, g							
	dry substance	Digestive protein	Raw fat	Raw fiber	Starch	Sugar	Feed units	Exchangeableenergy, MJ
Roots	230	7	2	14	6	120	0,24	2,84
Leaves	175	19	7	27	5	15	0,16	1,67

According to P. S. Ivarovskyi (1985), in the conditions of the forest-steppe zone of Western Siberia, the sugar beet yields is lees than the yield of the roots of the fodder beet, and on the yield of the leaves exceeds it. For the collection of feed units with 1 hectare sugar beans surpass other root crops.

The leaves of the sugar beet are silage with the addition of dry components: 15-20% crushed straw or haylage from perennial herbs. Feeding capacity 1 kg of this silage 0,16-0,18 feed unit with a content of 16 g digestible protein.

The normalized essential amino acids in the leaves are greater than in the roots: lysine 0.9 g, methionine + cystine 0.7 g per 1 kg of leaves, and in roots 0.5 and 0.2 g respectively.

The food is also used for the production of sugar beet production: pulp, molasses. Snake is a sugar-free beetroot shaving. Fodder molasses – a waste of sugar production, is a carbohydrate feed containing up to 60% invert sugar (fructose, glucose).

5.3 Potatoes

Potatoes – one of the most important and widespread crops in agriculture – food and feed, which is of great economic importance. Potatoes are used in human food, for feed and technical purposes. According to scientifically-based standards of nutrition for one person per year, at least 100 kg is needed. Potatoes are a raw material for the starch-patch, alcohol, textile and paper industries. From 1 ton to get up to 170 kg of starch or 80 kg of glucose, or 112 liters of alcohol.

The potatoes have a great deal of adaptability to the conditions of production, and due to this, crops are widespread throughout the world.

Botanical characteristics

Potato (Solanum tuberosum L.) is a perennial herbaceous plant, belongs to the family Paschal – Solanaceae. In culture, potatoes are used as an annual plant, and propagate it mainly in a vegetative way - tubers.

The root system of potatoes grown from tubers is a bluish, consisting of the roots of the oocyte kidneys and the roots formed on the stolons in the nodal areas. The bulk of the roots are in the arable layer, the rest penetrate to a depth of 150 cm, and up to 90 cm to the side, has an active absorption capacity.

Potato stalks are strong, non-reciprocal, 60-100 cm tall, depending on the variety and conditions of cultivation. In the early-seeded varieties, they are shorter, with fewer interstitials than late-spit. In the cross section, the stems are ribbed, three or quadrilateral, partly omitted. The number of them in one bush depends on the variety of potatoes, the size of the seed tuber and the number of sprouted kidneys. Large tubers, as a rule, give more shoots and provide a higher yield.

Stems are often green. In the underground part of the stems of the axillary kidneys, lateral thin shoots of white color, called stolons, are formed. Their length depends on the variety of potatoes, and at the ends of the tubers formed, representing a shortened, thickened underground escape. In the axils of the scaly leafs of the tuber, kidneys are called, called eyes. In each of them there are 2-3 kidneys; At the first germination, the more advanced kidney is in growth, the rest remain spare. If the germ breaks off or gets damaged, the spare buds sprout.

On the kidney buds are located in a spiral. The club's attachment to the stolon is called the base, and the opposite part is the top. More kidneys are laid on the top of the tuber; they are more viable and germinate before the kidneys are located on the basis of a tuber.

For each variety is characterized by its own form of tubers. They distinguish tubers round, oval, flat, elongated oval. By color they are white, yellow, pink, red, blue-violet, which depends on the pigmentation of the cellular juice and the thickness of the cork layer of the cortex.

When maturation of potato tubers, they are covered with a peel of cork tissue, the shell of which cells are impregnated with suberin and become impervious to water and gases. The protoplast of these cells dies; the cork tissue protects the tubers from drying out, diseases and mechanical damage.

Leaves of adult potato plants are scattered, intermittently unpaired-feathered with 7-11 leaves of different sizes.

Flowers are gathered in inflorescences-curls from white to blue-violet. Fruits - spherical green berries, whitish at ripening. In food, fruits cannot be consumed, they contain poisonous alkaloid solanin. Seeds are small, light yellow. Mass of 1000 seeds – 0,5 g.

Biological features

Potatoes are a heat-loving plants, the germination of tubers below

+7, +8 °C is very slow. Rapid and friendly potato shoots appear at +15 °C, +18 °C. The optimum temperature for growth and development of potatoes is +20, +25 °C. An increase in the temperature of air above +25 °C strongly depresses the growth of potatoes, sometimes even causes shooting kidneys on the newly formed tubers, the formation of secondary small tubers without overground inclusions occurs. The increased temperature of the soil leads to increased branching and growth of stolons, and the formation of the tubers is delayed, yield is sharply reduced. Evenings and adult plants are not resistant to frosts. The bottle perishes at -1, -1.5 °C, and the tubers at -2 °C lose their ability to germinate.

Potatoes are related to moisture-loving plants. It is particularly acute in moisture, starting with the budding phase and until tuber formation is completed.

Optimum soil moisture for potatoes is 70-75% LWC. The transcription coefficient varies from 400 to 600.

In the period of shoots and at the beginning of growth, potatoes use moisture reserves of the seeded tuber and at the same time successfully tolerate the lack of moisture in the soil. In subsequent phases, the decrease in soil moisture below 60% of LWC depresses plant growth and tuber formation.

Potatoes are very demanding for soil fertility, needy in loose, well-aerated soils with organic fertilizers. The best fertilizer for potatoes is manure. The root system and potato stolons consume a lot of oxygen, especially during the period of tuber formation, so to get a good crop, the soil should be kept in a loose state with a soil density of no more than 1.1-1.2 g/cm^3. High yields of potatoes are obtained on the lungs by granulometric composition of soils at the application of large doses of organic and mineral fertilizers.

For each ton of tubers with an appropriate amount of potatoes, potatoes take 5-6 kg of nitrogen, 2-3 kg of phosphorus and 9-10 kg of potassium from the soil on average. Most of the main nutritional elements potatoes absorb potassium. Potassium is involved in carbohydrate metabolism, has a great influence on starch content in tubers, increases potato resistance to diseases in the process of growth and in the storage of tubers.

Potatoes do not tolerate saline soils, it grows better on weakly acidic acids with pH = 5-6.

Throughout the length of the growing season, all potato varieties are divided into woundless (70-90 days), medium-sized (110-120 days) and late-noodle – (135-150 days).

Potato cultivation technology

Potato predecessors can have different cultures, but most importantly, so that the soil is fertilized with organic and mineral fertilizers and well purified from weed plants. Not suitable for potatoes only heavy granulometric composition of soil. The potatoes satisfactorily tolerate re-planting in one field, provided that the soil is thoroughly treated and the fertility rates calculated.

Preparation of soil for planting potatoes is carried out in a system of soil management for spring crops.

The planting of potatoes begins when the soil is heated at the depth of the garden to +8, +10 °C. In Northern Kazakhstan, such conditions are created in the second - beginning of the third decade of May. Earlier planting of potatoes is undesirable, since at temperatures below +7 °C, shoots are delayed to 25-30 days, and the plants are affected by mushroom diseases (black scab). At a temperature of +16, +18 ° C, seedling potatoes appear uneasily within 10-12 days.

To plant, you need to use zoned potatoes. Preparation for planting consists in the selection of healthy intact tubers, sorted by the same size. It is desirable to make the tubers air-heat heating and partial germination. Higher potato crops are obtained when planting tubers weighing up to 100 g. The average seed fraction is considered to be tubers weighing 60-80 g, which are most often used for mechanized landing.It is important to grow potato tubers in front of the garden, especially for areas with a short vegetation period. After winter storage at a reduced temperature of +2, +4 °C, bud buds are at rest, for the awakening they need to raise the temperature. Typical storage facilities have special facilities for germination of seed potatoes. The temperature is raised to +14, +15 °C in well-lit and ventilated rooms for 15-20 days before planting. The duration of germination depends on the potato variety and the specific conditions. It is necessary to ensure that the length of germs does not exceed 1-2 cm before the landing. The sprouted tubers provide quick, friendly shoots, which promotes the rapid growth and development of plants and increases the yield.

The method of planting potato broads with a width of between 60 and 70 cm. The density of planting of tubers depends on the variety, the purpose of potatoes and soil and climatic conditions. The optimum landing density is 45-50 thousand bushes per 1 hectare. On irrigated areas the density is increased to 60 thousand bushes / ha. To produce seed potatoes the density of planting is also increased to 60-70 thousand bushes / ha.

The rate of landing tuber consumption varies from 2.5 to 3.5 t / ha in dependence on the accepted planting density and tuber size.

Caring for landing

Care for planting potatoes usually begins with an outbreak harrowing for the destruction of weed seedlings and loosening of soil. Potatoes begin to crush 3-4 days after planting and repeat 2-3 times before shoots appear. Harrowing heavy and medium teeth harrows clear the field from weeds. After emergence of shoots and designation of the rows, inter-row processing is carried out for loosening the soil and destroying the weed plants. Intermediate cultivation is repeated as needed.

In the development of potato distinguish four characteristic periods. The first begins with the germination of the kidneys before the emergence of shoots, when all processes are carried out mainly due to the nutrients and water of the planted tubers. In this period, the root system is intensively formed.

After shoots with the appearance of green leaves begins a second period, characterized by rapid growth of stems, leaves, and begin to grow stolons. At this time, before budding, it is necessary to loosen the soil and to plant the bushes to create favorable conditions for branching the underground parts of the stems. Occasionally, they are done twice. When there is a lack of moisture in the soil do not work.

From the phase of budding and the beginning of flowering begins the third period of intensive development of stolons and the beginning of tuber formation. Growth of the bottle ends, and the formation of tubers is particularly intensified, reaching 2 t / ha per day.

The fourth period is characterized by yellowing of leaves and drying of stems. At this time, the accumulation of starch in tubers is completed; they are covered with cork cloth (peel), maturation of tubers and transition to rest.

Harvesting

The harvesting of potatoes begins at physiological ripeness, when the bottle dries, and the tubers are covered with peel, which protects against mechanical damage when cleaning. But not always the cleaning begins at full physiological maturity of the potatoes, mid-hilly and late-spring varieties have to be cleaned earlier because of the danger of early autumn frosts or damage to the phytophthora. Frozen tubers cannot be stored, they quickly spoil, rot and infect healthy tubers.

In the conditions of Serenog Kazakhstan potato harvesting begins in the second half of September. In case of defeat of potato, the phytophthora bottle is peeled off 10-15 days before harvesting and removes it from the field. On healthy plantings, potatoes are sliced 3-5 days before harvesting, because it accelerates the ripening of the tubers. Potatoes are cleaned with potato harvesters, and transporting potatoes is best spent in

containers, crates or baskets.

The removed potatoes are sorted at the sorting points. Healthy, intact tubers fall asleep for storage in storage.The first two to three weeks set the temperature +15, +18 °C, periodically including fans to remove moisture and oxygen supply. After this period of maturation of the tubers, the temperature is gradually reduced by 1 ° C every day and adjusted to +2, +4 °C at a relative humidity of 85-95%.

Potato nutrition

Potatoes are valuable juicy fodder for cattle. Feeding the tubers is better in the steamed state, because the digestibility of it is higher than raw. Potatoes are used to prepare combined silage. The feed is used for the production of starch (mezzanine) and alcohol (bard). Potatoes are unwanted for animal feed because it contains alkaloid solanine.

By content of dry matter and nutrition, potato is equated with sugar beet. In the tubers of some varieties, the dry matter content reaches 25%, with a starch content of 20-22%. Potato tuber digestibility is high 85%, protein content is low. Potatoes are an important source of carbohydrates and, above all, starch.

It is necessary to know that up to 0.01% of poisonous alkaloid solanin is kept in the peel of greenish-green peas. Therefore, germinating and greenish in the sun of the tubers cause severe animal poisoning.

5.4 Artichoke (Ground pear)

Meaning and areas of cultivation. Artichoke is cultivated for crop, feed and technical purposes. The clubs are used in food in varnom and canned. They contain up to 30-40% of carbohydrates, mainly inulin.

Artichoke is a valuable feed for farm animals, especially for cattle. Use tubers and overhead shoots.

From artichoke tubersfructose, alcohol, winevinegar, beer, and fodder yeast are also obtained.

Artichoke is grown in many countries of the world, but on small areas, more in France. In the RK it is grown everywhere, but also on small plots.

The average yield of artichoke tubers, like potatoes, is 10-12 t / ha, and the aboveground part is 20-30 t / ha. High crops cultivate up to 25-30 tons of tubers and 70-100 tons of green feed per 1 hectare.

Botanical features

Artichoke (Helianthus tuberosus L.) perennial tuberous plant belongs to the Asteraceae (Compositae) family.

Root system for reproduction of tubers - bluish, well developed,

penetrates to a depth of up to 2 m. Stems are strong, erect, up to 4 m high, branching both above the soil surface and in the soil. The above-ground branching from the grooves of the leaves - along the length of the stem. In the underground part of the stalk forms lateral shoots - stolons, whose length is 5-40 cm, depending on the variety and conditions of cultivation. Endings of stolons thicken, transformed into tubers of different shapes and colors. The shape of the tubers is oblong-oval, pear-shaped with hillocks, on which the kidneys of resumption are formed. Coloring of tubers from white and yellow to pink and reddish-purple. In one bush is formed up to 20-30 tubers, the mass of which is 20-100 g, depending on the variety and conditions of cultivation.

The leaves are large egg-shaped, pointed at the ends, coarse-toed edges. The lower leaves are opposite, the upper ones are regular.

Inflorescence - a basket in diameter of 2-5 cm, with 12-15-yuyzychkovyh flowers. Inflorescences are formed on the main and lateral shoots. The number of them depends on the nature of the branching of the above-ground part of the stems.

The fruit is very small. Weight 1000 seeds 5-9 g.

Biological features

Artichoke is a cold-resistant plant, so it can be grown in northern areas, up to 65 ° north latitude. The ground organs of the earth pear carry short-term freezing to -6, -7 °C. Artichoke well tolerates and high temperatures in hot weather in the summer, does not degenerate during drought. This plant is a short light day, requiring sufficient sunlight. With thickened plantings, the yield of tubers is sharply reduced.

In relation to soil moisture, artichoke is relatively drought-resistant compared to potatoes. In areas with insufficient number of precipitation, artichoke provides a higher yield of tubers than potatoes, it lightens the lack of moisture in the period from seedlings to the formation of stolons. The need for moisture increases at the beginning of budding and tuber formation.

To grow and develop, artichoke needs loose fertile soils with a deep arable layer, does not tolerate sour and saline soils. Well replies to the introduction of manure and mineral fertilizers.

More common varieties of artichoke or ground pears are Skorospelka, Nakhodka, Volzhskaia 2, Belaia Vozrozhaia and others. The hybrids of artichoke with sunflower (for feed and technical purposes) are obtained.

Technology of cultivation

Preparation of soil for landing artichoke is carried out on a system of soil cultivation under spring crops. Organic and mineral fertilizers should

be introduced for basic soil treatment. Nitrogenous fertilizers are more livelier to introduce for pre-seeding soil treatment.

The artichoke tubers are planted in the spring or autumn, in the spring before the potato, when the soil is warmed to +8, +10 °C. In autumn, artichoke tubers are planted after harvest in late September - early October.

The method of landing artichoke is broad-rooted, with rows of 60-70 cm.The distance between the tubers in a row depends on the soil-climatic conditions, the variety and the size of the tubers. In fertile soils, with sufficient rainfall, the tubers are planted 30-40 cm, with insufficient soil moisture - through 50-60 cm from each other in rows. More suitable planting tubers weighing 40-50 g.

Depending on the specific soil and climatic conditions, the artichoke varieties and the tuber size, the landing rate is 1.0 to 2.0 t / ha. Its clubs do not form a cork layer, therefore they are poorly stored in the stores. In this connection, tubers are planted from the soil before planting in spring or autumn. It is impossible to store tubers in the open, they are very cold. If the planting is delayed, then the tubers need to be sprinkled with soil.

Care for planting artichoke in the first year after planting is the same as for potatoes. For the second year, the remaining tubers and stolons in the soil after incomplete harvesting or grazing of pigs give new shoots. When the seedlings grow up to a height of 15-20 cm, then cut the rows with the cultivators. In the future, care consists in inter-row treatments and topping biting, as in the first year.

Harvesting of artichoke

By the cleaning of artichoke begin in the second half of September. First, cut the above-ground part of plants silage harvesters. It is necessary to cut down at a height of up to 30 cm from the surface of the soil in order to ensure that the remaining parts of the stems undergo further outflow of nutrients into the tubers. Cutted plants feed on animals in fresh form or silage. At the end of September, the tubers are removed for animal feed or for the harvesting of combined silage. If this is not necessary, then cleaning can be carried forward in the spring - the tubin tubers are well stored in the soil.

In the spring, before the germination of the kidneys in the eyes of the tubers, they are dug and used for feed purposes. Artichoke plantations can be used to graze pigs before the onset of kidney germs. After the pig grazing, the soil surface is aligned with the cultivators, followed by harrowing.

Nutrition of artichoke

The aboveground part of plants and tubers are a valuable food for animals, and are used both in fresh and in silage form. In tubers and in

green plants, artichoke accumulated a lot of polysaccharides of inulin (in tubers up to 30-40% of dry matter), which in the gastrointestinal tract of animals under the influence of enzymes turn into easily digestible monosaccharides. Green plants and tubers are well-fermented, including with other crops, for example, with mixed sowings of annual fodder crops. Silos are eaten eagerly by cattle, sheep. In 1 kg of artichoke silage there is contained 18-20 g of digestible protein, nutritiousness of 0.18-0.20 fodder units per 1 kg of fresh green feed 0.20-0.25 fetal units.

Artichoke tubers have a higher nutritious content: 1 kg - 0.25-0.30 feed unit. They contain up to 2% protein, many vitamins of the group B. The clubs are eaten eagerly by cattle and bird. The young of the tubers are given in a crushed form.

Mineral composition of artichoke is close to the composition of potato, but it contains more iron – 36 mg, zinc – 5,3 mg and manganese – 14 mg per 1 kg of tubers. In tubers artichoke more vitamin B4 – 280 mg – and less than vitamin B3 – 0.8 mg per 1 kg, compared with potato tubers.

CHAPTER 6 OILSEEDS

6.1 Sunflower

Sunflower is important as a food, technical and feed culture. As an oilseed crop, sunflower takes first place in terms of the amount of seed oil output, and according to taste, sunflower oil is one of the best. It is used for nutrition, for the production of margarine, canned food and confectionery, contains phosphatides, vitamins (A, D, E, K). Seeds of grizzlies of sunflower varieties are used as food.

Sunflower oil is also used in the soap and lacquer-juice industry, used for the production of stearin, linoleum, linen. Sunflower seeds are suitable for the production of fodder yeast, furfural, used in the manufacture of plastics, non-sticking glass.

Sunflower is a valuable fodder crop, it is used for green fodder and silage. The by-product in the production of oil – pulp and barley are concentrated feed. Sunflower crumbled sunflower baskets are used for feed.

Sunflower as an oilseed crop is grown in most areas of the Russian Federation on an area of more than two million hectares. On large areas in Western Siberia, sunflower is also grown on silage.

The average yield of sunflower seeds is 1.2-1.4 t / ha, and the average silage yields 25 - 30 t / ha. High yields of seeds - 2-3 t, green feed - 50 -60 t / ha.

Many varieties and hybrids of sunflower are produced.

Botanical characteristics

Sunflower (Helianthus annuus Z.) is an annual plant, belonging to the Asteraceae family (Compositae). Sunflower Cultural Helianthus cultus Wenzl.

Root sunflower root system, penetrating up to 4 m in depth and up to 1 m in sides. The stem is erect, durable, strongly woody at ripening, up to 2.5 m in height for varieties grown for seeds, and up to 4 to 5 meters in silage varieties. Stem thickness up to 5-7 cm, inside it is filled with loose parenchymal cloth, rusty outside.

Leaves are regular, petiolate, heart-shaped with pointed ends, edges of their branches. Leaves are thick, rough, large. One plant usually has 15 to 30 leaves, depending on the varieties.

Inflorescence - a basket, very large, in diameter up to 20 cm in oilseed and up to 40 cm in grass species. In one inflorescence, from 600 to 1200 productive tubular flowers with light yellow and dark orange crowns. Flowers cross-pollinated with insects, mainly bees.

The fruit is a squamous seedlings squeezed from the sides, oblong,

with a skin-colored pericarp (peel). Inside the acne, a nucleus with a thin seminal membrane, the nucleus does not grow together with the pericarp. The peel of the seeds is different: white, gray, striped, black. The proportion of peel, or scab, relative to the seed mass varies from 20 to 40% depending on the varieties. Weight 1000 seeds 40-125 g.

Feed value of sunflower

Sunflower is a valuable forage plant. Good harvested silage varieties provide high yields of green feed and for silage harvesting. According to the general data of scientific institutions, 1 kg of green sunflower meal contains, on average, 200 g of dry matter, 12 g of digestible protein, 1.4 g of calcium, 0.4 g of phosphorus, 35 mg of carotene. Feeding 1 kg of green food in the bloom phase 0.12-0.14 fry. unit

The sunflower is silage both separately and in combination with other silage crops. For animal feed, crushed shredded sunflower baskets and high-value waste are used after the processing of seeds into butter: pulp and broth.

Sunflower silage contains a lot of calcium and potassium, the rest of the macroelements are normal. In the pulp and, especially in the sparse, the lack of calcium and excess phosphorus per 1 feed unit.

The content of iron and manganese in silage from sunflower is high, there is a lack of copper, cobalt and iodine. In walnut and spit, the content of iron and copper is high in 1 feed unit.

6.2 Rape

Rape is grown as oil and feed culture.In the seeds of rape contains 35-40% of vegetable oil, which is used in soap and other industries. High quality rapeseed oil, which does not contain erucic acid, is used for nutritional purposes.

As a feed rape culture, it is used on green fodder, silage and grazing. Waste in the production of butter-bulk, –is a high-quality animal feed.

Rape is a good honey. It is cultivated on seeds almost everywhere in Russia. In Western Siberia it goes to forage purposes, often as an intermediate crop in crop rotations. Rape provides 15-20 tons of green feed and 1,4-1,5 tons of seeds per 1 hectare. High rape crops on green feed up to 40 t / ha.

Botanical characteristics

Rape – Brassica napus L. ssp. Oliver Metzg. – an annual grassy plant, belongs to the family Celery (Crests) – Brassicaceae (Cruciferae). Cultivated rape of two biological forms: winter – biennis and spring –

annual (Fig. 47).

The root system of rapeseed rod is well developed. The stem is rectangular, strong, branching, 80-120 cm tall. The stem and leaves are covered with a waxy gray-green color. The lower leaves on the petioles are liquid, upper seated, at the base of the stem embossing, whole and oblong.

Inflorescence – a brush, flowers with golden-yellow petals. The fruit is a pod that opens when it ripens to the two flaps from the bottom up.

The seeds are attached in a longitudinal septum - globular, small, in diameter 1,5-2,0 mm, coloring them black, dark brown. Weight of 1000 seeds 3-7 years.

The most widely spread varieties of spring rapeseed: Kuban and Evvin, winter: Snitinsky and VEM, which do not contain erucic acid.

Crumb and barley – by-products from the processing of rapeseed oil to butter - are valuable high-nutritional feeds. The yield of spike from seeds is more than 50%, in it 25-26% of digestible protein.

By the content of macro- and trace elements, the normalized amino acids and vitamins of the rape feed are similar to those of sunflower.

CHAPTER 7 PLANTS THAT HAVE ADVERSE EVENTS ON ANIMALS

7.1 Plants with a predominant effect on the gastrointestinal tract

1. MILKWEED – Euphorbia virgata L.

Family of milkweed – Euphorbiaceae.

Perennial root crop plant. The stems are 30-70 cm tall, branched at the top. Leaves are lanceolate, sharp, with a spit at the end. Inflorescence umbrella-broomy with green-yellow, blossoming leaves. Fruit is a box.

Milkweed grows in zones of unstable and sufficient humidification in Western Siberia. Its characteristic feature is the presence in the stems and leaves of milky juice containing the euphorbin poison. When eating milkweed is affected the mucous membrane of the mouth, there are severe disorders of the gastrointestinal tract (vomiting, diarrhea, convulsions), and with severe poisoning animals die. Most often, the sheep are poisoned by this plant, mainly during the period when the herbs in the pastures are burned out from summer drought, and milk remains green vegetative plant.

2. JACOB'S-LADDER – Linaria vulgaris Mill.

The Figwort family – Scrophulariaceae.

A perennial root crop plant, 30-70 cm tall, densely populated to inflorescence. Leaves are lanceolate, sharp. Flowers are yellow, a double-edged crown with a spur. Inflorescence is a brush. Fruit is a box. Linen is a malicious weed in fields and pastures, contains glycosides, poisoning cattle.

3. EUROPEAN GLORYBIND – Convolvulus arvensis L.

The Bindweed family – Convolvulaceae.

Perennial herbaceous root crop plant with curly stems. Leaves petiolate spears. Flowers are single, in the axilla of leaves with a white pink funnel. Fruit is a box. A field field is a common weed plant. His eating causes diarrhea in cattle and horses.

4. FIELD DODDER – Cuscuta L.

The Dodder family – Cuscutaceae.

Species of hawthorn: honeybee, clover, linseed, European, etc. Summer parasitic plants. Treats do not have chlorophyll, are deprived of green color and are not capable of photosynthesis, feed on juices of autotrophic plants. Root suckers are introduced into the cells of the host plant and parasitized on it. Stems are yellowish or brown, leaves are absent. The flowers are gathered in the headed inflorescences of pink or white color. Fruit is a box.

Field dodderscontain alkaloids: kurkutin, konvolvulin, etc., cause poisoning of horses, cattle, both when eating freshly, and in the hay from

the plants in which the vulgaris parasitizes. Signs of poisoning - salivation, weakening of cardiac activity.

7.2 Plants with action on breathing and digestive tract

1. FIELD MUSTARD– Sinapis arvensis L.

The Celery family (Crested) – Brassicaceae(Cruciferae).

Perennial plant, pubescent with hard hairs. The lower leaves are hemispheric petioles, the upper ones are sessile. The flowers are yellow. Fruit - a pod with a long nose and 3-5 veins on the leaf.

The field mustard contains glycoside, which, when splitting, releases a hot oil that has a burning effect. Mustard oil causes irritation and inflammation of the mucous membranes. Symptoms of poisoning are manifested in the form of colic, diarrhea, and bulging scars in ruminant animals.

CHAPTER 8 THE SYSTEM OF IMPROVEMENT NATURAL FORAGE LANDS

Basic techniques for improving hayfields and pastures

The land hayfields and pastures located in the steppe, dry-steppe, semi-desert and desert areas of Kazakhstan have very low yields: in the steppe and dry steppe zones from 1.5 to 6 centimeters, and in the desert and semi-desert, and even less – from 0.5-1 , 0 up to 3-4 centners per ha of dry weight. The low yield of natural forage land of forest-steppe, steppe and dry-steppe zones is connected, firstly, with the fact that the best fertility and other indicators of the land have been mastered for field crop rotation, while non-spreading lands have been left with low abundance – infertile, on the slopes, with a low level of humidification, to some extent rough, as well as saline soils. Secondly, a significant part of the pasture is cut down by cattle; in grass stands, low-value grasses prevail - weedy, and often even poisonous, large areas are subject to wind erosion. The constant change of vegetation leads to the formation of unproductive phytocenoses with the predominance of smooth-gland cereals.

In semi-desert and desert areas, as a result of unsystematic grazing and at high load on pastures, these lands are cut down by cattle, while the most valuable in the forage plant are disappearing, and the land is constantly exposed to wind erosion and desertification. In connection with this, there is a need to increase the productivity of natural forage land, as well as work on maintaining productive longevity of grasses. All these techniques, carried out on hayfields and pastures, are commonly called “improvement”.

There are two systems for improving natural forage habitat: the root system - the system of on-site production of unproductive hayfields and pasture land and surface area - a system for receiving current care for natural, as well as seeded (newly created) forage farms.

The system of radical improvement natural forage lands envisages the complete destruction of natural vegetation and the creation of hereditary hayfields and pastures in her place. As during the implementation of this system a new type of forage is created, the whole complex of measures for the transformation of the land is called a radical improvement.

Experience has shown that a high effect on the improvement of natural forage land can be achieved on lands with a relatively high biotite, better hydration, fertility, etc. Researches carried out in the 70’s and 80’s showed that more than 180 million hectares of natural forage crops listed in the republic are suitable for a radical improvement of no more than 10-12%.

The experiments carried out by the scientific institutions in different soil and climatic zones of the republic in the 60-80s of the 20th century showed the high effectiveness of the radical improvement. For example, according to generalized materials, KD According to the data of 9 scientific establishments of the steppe zone of Kazakhstan for 11 years (1955-1966) – North-Kazakhstan, Kustanai, Kokchetav, Tselinograd, Karaganda agricultural experimental stations, the All-Union Scientific Research Institute of Grain (Prednevkova, 1972), created after the radical improvement of sowing hayfields on land, according to the data of 9 scientific establishments of the steppe zone of Kazakhstan for 11 years farms, the Northern Research Institute of Livestock, the Lviv Experimental Field (Kustanai Region), and the Pavlodar Experimental Station for the Protection of Soils against Wind Erosion), the collection of hay of perennial herbs ranged from 10 to 38 centners per hectare, with yields on natural hayfieldsfrom 1.6 to 4.0 kg / ha. The maximum yield was achieved in areas with high soil fertility and good moisture – floodplains, estuaries, etc.

A high effect was also achieved in the semi-desert zone: in the experiments carried out at the Aktobe Experimental Station feeds and pastures, the average yield of seine perennial grasses per hectare was 11.4 centners per hectare, while in natural hay, only 2.9 c / ha. Even in the desert zone, improving pasture by planting adapted to local conditions of wild, perennial forage grasses had a high effect.For example, in the pre-dormancy of Saritaukumov in Almaty region, sowing stick pastures yielded a dry mass yield of 16.6 pounds per hectare on average over 5 years, while natural wormwood-ephemeral-ebelecktic– 3.4 p/ha (S. N. Prianishnikov, 1972).

In the republic, a great deal of work was done on improving forage land: only in the 70’s and 80’s on farms, according to the reporting, there was a radical improvement of about 7 million hectares of natural forage farms.

The system of surface improvement of natural forage forests provides a complex of measures in which natural vegetation is preserved in whole or in part. The application of surface improvement technology allows the maintenance of hayfields and pastures in the best stages in the feedstock (rhizosphere and rhizobulous) by creating conditions for the long-term conservation and development of rhizomatous, loose-bunch and other valuable grasses.

The system of surface improvement provides for the elimination of factors causing deterioration and alteration of the botanical composition of the plant, the reduction of productivity - primarily the improvement of the water, air and food regimes, the care of turf and herbage, allows the most time to maintain herbs in the state of greatest economic values when these

lands are still in the rhizome and fossil stage.

At the onset of the phytoremediation stage, and in those cases where the hayfield is severely cut out, there is a need for radical improvement and the creation of seedbed forage areas.

Conditions for carrying out and measures for the superficial improvement of meadows and pastures

Surface improvement should be carried out primarily on highly productive fodder lands, where in the herb retains at least 35-45% of valuable forage grasses, on mature grasses, but in the presence of no more than 20-30% of malicious weeds. In the hayfields and pastures with the worst grass, the surface improvement of the high effect does not allow - in these cases, these areas should be subjected to radical improvement

Surface improvement of natural fodder lands in the steppe zone of Kazakhstan yields to its indigenous efficiency: the increase in average yields 40-60% in comparison with the undeveloped, although individual techniques, in particular, estuarine irrigation, contribute to a significant increase in the yield of grasses in all soil-climatic zones of the republic.

All activities included in the system of surface improvement of natural forage land can be grouped into the following groups for the soil-climatic zones of Kazakhstan:

1) Cultural engineering – removal of bumps, the abandonment and creation of shrubby and semi-shrubby bands in meadows, slopes, sand, and others;

2) measures to improve and regulate water regime – snow cover, gutting, drainage of stagnant surface waters, drainage, irrigation, flooding;

3) improvement of the food regime (introduction of mineral fertilizers, manure, manure);

4) activities for the care of turf and grass, rejuvenation of grasses (harrowing, discs, milling, combating weeds, grass sowing, etc.).

Cultivation works on hayfields and pastures (removal of bumps, etc.). It is expedient to carry out work on the destruction of the bumps only in those cases where a small part of the soil surface is occupied by the swamps.Original hillocks are divided into the following groups: moss, sedge, earthmoving, made by moles, water rats and muscle rodents, ants, formed by cattleon pastures as a result of untimely grazing of livestock on wet soil, and excessive grazing of livestock. In the pastures, most of the pasture land is occupied by slaughterhouses, as well as sedges – in areas of excessive moisture of the soil. It should be borne in mind that the destruction of individual nodules is appropriate in cases where they occupy no more than 25-35% of the total area, with a greater number of radical improvements.

Depending on the nature of the hillocks, they are destroyed by various means: mink and ant are best eliminated in the early spring or autumn, using harrows and cutters for this purpose; small hillocks are well aligned with plows and harrows, followed by rolling rollers; dense earthy shoots are cut or milled by marsh cutters; small sedge ones are destroyed by heavy disk harrows, medium and large – cutters. For the destruction of small nodules of weak turf there is only one cutout cut; dense, durable hillocks are destroyed by two aisles of cutters.

In all cases, when after the cut of the bumps remains the naked surface of the soil, sowings of crops should be carried out: one year old – oat, barley, etc., as well as perennial grasses capable of growing under these conditions. It is better to carry out all work on the destruction of the bumps in the autumn or early spring, when there is less danger of falling asleep grass.

Improvement and regulation of water regime. Meadow perennial grasses for the period of vegetation spend up to 3-5 thousand tons of water, and best grow at the least soil moisture capacity of about 70-80% when the pores in the soil are filled with water.

In the conditions of the steppe zone of Kazakhstan, measures to improve the water regime are one of the most important elements for maintaining the productivity of hayfields and pastures. Improvement and regulation of water regime can be achieved by the simplest agrotechnical methods: snow-holding, gliding, disintegration, milling, mixing, fertilizing, etc., i.e. methods that help preserve and improve the species composition of herbs and increase yields.For a deeper change in water regime, it is necessary to carry out high-cost hydrotechnical melioration – drainage, irrigation.

Good results on the accumulation of moisture in the dry-steppe and semi-seam zone gives the abandonment of uncrossed strips of 0,3-1,0 m wide through 10-15 m with the arrangement across the dominant winds. According to the experiments, this technique allowed to increase the yield of herbs by 30-70% next year. When leaving several bands of old-age and mature herbage, “self-seeding” of them occurs, and on uncrossed strips the grass “rest” from intensive use and create all conditions for increasing yield next year. In addition, cutting and cutting should be done in hayfields and pastures so that the height of the stubble or herbs is not less than 8-10 cm, which also helps to keep the snow and its uniform distribution across the area.

In the floodplain and estuarine meadows, on the slopes, a good effect to accumulate moisture gives a fainting. The slurry is cut by slangers SHCH-2-140 or other implements in the autumn period across the slopes

with repetition in 2-3 years.

In dry-steppe and semi-desert zone, a good result on natural forage lands gives estuarine irrigation with the use of water of various reservoirs - rivers, rivers, streams, lakes, reservoirs, which during springtime spills are directed to natural estuaries. In the valleys of small rivers, rivers, streams, spring flooding of meadows is carried out by creating earth dam or dams with drainage, which contributes to a 1.5-2 time increase in the yield of grasses. The limans should be flooded in the spring by 20-25 days with a layer of water of 30-35 cm, which contributes to the predominance of grassy fields of the creep of the creep, the chestnut, on the wheat grass, medick grasslands, the duration of flooding should not exceed 7-12 days and the water layer is 20-25 cm. It should be taken into account that spring flooding of steppe and semi-desert vegetation on chestnut and saline soil soils can lead to a natural change of vegetation to a more productive at least 5-10 years, therefore it is necessary to carry out improvement (indigenous or superficial) in these areas with the sowing of the most productive in these conditions of herbs (dandruff, crutch, etc.).

In forest-steppe and steppe regions, snow-holding, according to experiments conducted by scientific institutions, contributed to an increase in yields of grass by 16-55%. Conducting snow retention helps not only better development of grasses, but also somewhat delay the timing of grass burning, which prolongs the period of use of herbivores in pastures. The technology of carrying out works and implements for snow storage is the same as that used on arable land.

Fertilization of natural forage grounds. Under the influence of hay mowing and grazing on hayfields and pastures, the intensity of physic-chemical and biological processes in the soil decreases, and in connection with the constant removal of nutrients and crops, their content in the soil decreases, and yields are constantly decreasing from year to year. Regular application of fertilizers helps to preserve the most productive herbs in the grass field, which helps to maintain high productivity of the land for a long period of time.

According to V. R. Williams Institute of Nutrition Forage taking with herbs at pasture use is – 2.9-3.0 nitrogen, phosphorus 0.56-0.66 kg and potassium 2.8-3.0 kg per one centner of air-dry weight, and with a hay harvest, respectively 1.5-1.9; 0.44-0.64 and 1.5-1.6 kg (Table 15).

Table 15

Removal of nutritive elements with grass of hayfields and pastures (VNII of V. R. Williams forage)

Type of land and vegetation composition	Take out of 1 c air-dry weight harvest, kg		
	N	P_2O_5	K_2O
Grass from grass and herbage pastures	3,0	0,66	3,0
Herb with bean and cereal grassland	2,9	0,56	2,8
Hay from cereal and grass hay	1,5	0,44	1,5
Hayfrom bean-cereal seed-nose	1,9	0,64	1,6

Based on the analysis of about 2000 experiments conducted on natural forage areas of the European part of Russia, P. I. Romashev made the assumption that the annual application of nitrogen fertilizers provided an increase in yield of 9.3 centners / hectare, phosphorus – 5, potassium – 7.3, phosphorus-potassium – 12, and full mineral fertilizers – 18 centners per hectare. The effectiveness of mineral fertilizers is highest in wetlands and habitats, and in the case of lack of phosphorus in the soil, it is impractical to introduce nitrogen fertilizers. During the process of surface improvement on natural forage areas, both mineral and organic fertilizers should be used.

Manure and manure substance are used as organic fertilizers, however, when manure is applied superficially, large losses of ammonia nitrogen occur, but manure is a good source of phosphorus and potassium. For fertilizing, it is best to use half-transhipped manure, which contains up to 0.5% nitrogen, 0.25% P2O5 and 0.6% K2O on average. The best result from manure can be obtained by applying it to well-humidified meadows. The dose of 30-40 tons / hectare provides a period of 3-5 years, the best time to apply – in spring after the snowfall, the increase in yield annually reaches more than 50%.

In order to improve the nutritional regime of herbs in hayfields and pastures, the honey organic fertilizer is manure, containing an average of up to 99% water, 0.25% nitrogen, 0.55% K2O and 0.01% P2O5. The digestibility of nutrients from slurry is usually high, and it is better to use in the form of fertilizers. Before applying, dilute with water in a ratio of 1: 2-4, and the dose is established on the basis of the introduction of nitrogen – 40-50 kg per 1 hectare - an approximate dose of 20-30 t / ha of undiluted zigzag. It is efficient to add to the dung liquor superphosphate in the amount of 2-3 ts for 20-30 tons of slurry. The best time for the introduction of dung slurry is early spring, on haymaking it is possible to make after a slip, and on pastures – after each blasting.

Care of turf and herbage hayfields and pastures. In virgin and old-

dependent hay meadows and pastures, the soil gradually becomes denser, its aeration deteriorates over time, resulting in deterioration of the conditions for the course of microbiological and biochemical processes, the most valuable forage grasses fall from the grass stand, the share of tall and low-value plants increases and as a consequence – asharp decline in yields, as well as a decline in feed quality. The following should be considered as the main activities for the care of turf and herbage:

1. Improvement of the air mode by harrowing, discs, milling, soil fracturing;
2. Replacement of grasses by milling, pepperminting and sowing of grasses.
3. Fight with weed plants.

Harrowing is used to loosen the turf and the surface layer of soil, but numerous experiments conducted in different soil and climatic zones have shown that harrowing damages the root system of herbs, degrades their vegetative propagation, and therefore no stable positive results were obtained.

The efficiency of harrowing is obtained only when working on floodplain meadows, during which time during the flood a large amount of niche is deposited, and in grass the rhizome grasses prevail. The application of the discovery gives an increase in the yield on the pyron, sedge deposits, in the floodplain and estuarine hayfields, if, moreover, before mineralization, mineral fertilizers are introduced.

At the same sites, a small (12-15 cm) replowing, which should be carried out in spring or autumn, when sufficiently high soil moisture, can yield a high yield increase (40-80%). Small bulk replowing, as well as milling according to a number of experiments, contributed to increasing the yield and improving the quality of grassland on solonets – salt marshes, solonets, salty meadow, waterlogged solots. Milling as a means of rejuvenating meadows gives a good result in the forest, forest-steppe and steppe zones in the presence of rhizome and loose-bunchgrasses in the herbage (creeping grass, sedges, etc.).

On cut pastures and hayfields, in areas with rarefied grasses, after removing the bumps by disking, milling at naked places, a sowing of herbs should be carried out. In the dry steppe zone it is necessary to sow grass mixtures of wheatgrass, fescue, chickpeas, or straight with hybrid medick, sweet clover and others. The best period of grass seeding is early spring, however, in the steppe and forest-steppe zones this work can be carried out depending on the conditions of humidification and precipitation falling in the summer. and in the autumn. Within 1-2 years after sowing the grass in these areas, you should not graze livestock, and use them as hayfields. To

create and improve winter pasture in semi-desert and non-desert desert it is recommended to plant shrubs – saxaul, calligonum, saltwort, as well as semi-hardwood – wormwood, leban, dense saltwort.

Dredging of soil as a means of grass care under arid conditions leads to a significant increase in the yield of forage land. Cutting the slits can be carried out as special tools –paraplough –SHCHN-2-140, as well as five-shell plows, which dump all the housings, and in the place of the first and fifth corps put knives - slit-cut, cut to depth up 50-60 cm, their width is 4-5 cm, and the distance between them is 140-150 cm.

In the natural forage areas, the proportion of weed vegetation increases with the passage of time.

To weed plants in the grasslands include:

1. High-grossly weedy weeds - horse sorrel (Pumex confertus), wormwood tall, and others;

2. Extreme poisonous plants that lead to a deterioration of the condition of animals and even death – yellow-foxtail grass, feather grass, hen's-foot, etc., or spoilmeat and milk – all kinds of onions, garlic, flask and others;

3. Poisonousplants that cause a disease of animals and even death – hellebore, hellebore, snakeroot, hemlock, hawker poison, etc.Measures for control of weed plants are as follows: timely mowing of all clogged areas (before their insemination), mechanical measures for combating rough weeds – horse sorrel, hellebore, etc. – digging, pruning, pulling out, etc.; in case of severe clogging, a deep overlap with subsequent ingestion, as well as the use of chemical weeds, herbicides, for example, treatment 2,4-D, which destroys broadleaf weeds, but does not damage the cereal grasses.

Among the measures for the care of herbs, the destruction of the non-skewed or partially unused old pastry grass (old ones) last year, which worsens the quality of hay, reduces yields. For this purpose it is better to use horse or tractor rake. Often, for this purpose, burning is used, which often leads to the formation of steppe and forest fires and causes great harm to the environment. Burning has great harm to grasslands on semi-desert and desert pastures, consisting of wormwood and shrubs.

Burning is permissible to be carried out in the late or early spring period, observing the measures of fire safety - deflection around these areas with triple stripes of furrows of a width of at least 1 m each and with the same distance from each other, and burning in unheated weather under intensive observation.

CHAPTER 9 BODY IMPROVEMENT OF UNPRODUCTIVE FORAGE LANDS. SYSTEM OF CREATION ARTIFICIAL HAYFIELDS AND PASTURES

Low-yielding, beaten with mature grasses, occupied by low-quality grass, forage lands should be subjected to radical improvement, i.e. the complete destruction of the available grassland and the creation of new sowing hay meadows and pastures.

For the creation of hayfields and pastures, grass of the mesophylic type is commonly used, and therefore the improvement of natural forage areas should be carried out primarily in areas with high moisture levels, low parts of the relief - cavities, estuaries, etc., where a sharp break in the summer moisture supply of grasses is almost it happens. Not suitable for the improvement of infertile soils with a large amount of mineral inclusions (large sand, pebbles, cartilage), and also when the rocks go to the arable layer.

The following basic elements of the technology should be distinguished in the system of radical improvement of natural forage grounds:

1. Preparation act of turf to plowing (processing of turf before plowing it and methods of plowing virgin or layer);
2. Plowing season in conditions of natural zones of Kazakhstan;
3. Counting doses of fertilizers and their introduction;
4. Processing the formation after plowing;
5. Combining grass and grass mixtures for the creation of seed hay and pastes;
6. Application of accelerated seeding or sowing of preliminary crops;
7. Seeds of sowing of herbs;
8. The method of sowing of grasses (sub-patch or unpatched);
9. Care for grass in the year of sowing (the first year of life of herbs);
10. Care for grass in subsequent years of use.

All sown hayfields and pastures can be divided into two groups: one-year-olds planted with annual plants and used during one vegetation period, and perennials occupied by perennial grasses with usage periods without transplant for at least two years.

In turn, perennial hayfields and pastures are divided into three groups:

1. Short-term, used up to 3 years;
2. Middle-term– 4-6 years;

3. Long-term – with the use of 7-10 years or more.

By the way of use, seeded forage plots are divided into 4 groups: a) hayfields, b) pasture, c) mixed hay meadows and d) special herbs, which are used for the preparation of haymade, herbal flour, silage, and hay.

Taking into account the above classification, it is necessary to carry out a corresponding selection of crops, grass mixtures, to determine the doses and methods of fertilizing, etc.

*Ways of plowing virginsoil (formation).*Primary treatment of virgin lands (formation) should be carried out in such a way as to create more favorable conditions for the subsequent engagement of the land. For sowing perennials, it is especially important to create conditions for their growth and development in the first year of life - the period of formation of grass, which determines the productivity of herbs for all subsequent years.

Seeds of perennial grasses can give good shoots, well preserved in the first year of life, grow well and develop in the first and subsequent years of life in areas with good soil moisture, in the absence of weeds, with the creation of a favorable regime for the mineralization of organic matter.

In this regard, virgin lands (or a layer of perennial grasses) should be treated in such a way that the turf is completely destroyed, weeds are destroyed, the soil is loosened, which ensures the enhancement of biochemical and microbiological processes in the soil, but is achieved by careful treatment, the technology of which depends on the soil, nature and the capacity of the turf, the cultural state of the improved territory.

When working on salty complex soils, sand, slopes, flood plains, estuaries, etc. the primary treatment of the soil should fulfill the anti-erosion and reclamation role.

In the primary processing of turf, depending on the conditions, blasting or flat cutting can be used. Depending on the density and capacity of the turf, the type of soil, the state of the surface of the cultivated area, the following technology can be applied:

1. Plowing is carried out with a plow with skimmers to a depth depending on the humus layer of the soil from 20 to 27 cm on low-grained, upland and floodplain clean meadows

2. In heavily sodded areas with dense turf, it is advisable to improve the quality of plowing by pre-disking with heavy disc harrows such as BDNT-2.2, BDT-3 with subsequent plowing with a plow with a skimmer.

3. On wetlands with a large number of large bumps, a good result is achieved by using a marsh mill type FB-2.0 with subsequent plowing or without it.

The timing of plowing virgin soil (formation) in the forest-steppe

and steppe zones is dictated by the presence of moisture in the upper soil layer, since only with good moisture of the plowed layer can good soil tillage be achieved, and since the most reliable moisture conditions occur here since the time of soil thawing (the second half of April and until mid-June) – this is the period of plowing and should be considered the best.

Plowing in the second half of June, not to mention the later dates, gives a lumpy surface, poor seeding of turf, moreover, the later the plowing is done, the less time is left for steaming the site, which will make it difficult to sow in the spring of next year to get full shoots and ensure high survival and preservation of plants.

The lands abandoned under the reservoir in the mid-90s of the 20th century require a special approach in preparing for the plating. According to the above material on vegetation change on such deposits, it can be concluded that in preparing them for tinning, the technology used to plant perennial grasses in field crop rotations cannot be applied, but the technology used in preparing the soil for muddy soil virgin lands old "Target" deposits. Of course, this issue requires special study by setting field and production experiments. However, already at the present time, based on our field experiments, we can draw the following conclusions.

1. It is not necessary to hurry with the sowing of perennial herbs immediately after treatment, because on these lands very large weeds, including owls, worms, etc., so the crops are drowned in the first year weeds.

2. On these lands it is necessary, as well as on natural forage estates, after parting mandatory staging for at least one season.

3. Before plowing, it is necessary to mowing, slaughtering and burning of turf.

4. Soil preparation, timing and methods of sowing, sowing rates and other elements of the technology should be applied in analogy with the methods of application on natural forage areas with radical improvement, applying, depending on the conditions, both accelerated extraction and seeding of preliminary crops.

The calculation of fertilizerdoses should be carried out according to the generally accepted methodology, taking into account the removal of nutrients from the crop, and for phosphorus fertilizers, taking into account the number of years of herbivorous use, the withdrawal of the sum of crops for all these years, since phosphorus fertilizers are most prudently introduced under plowing, and nitrogenous – annually early in the spring – in the form of feeding.

Reference materials for the removal of nutrients depending on the composition of the grass field and the nature of its use are presented

in Table 16.

Soil treatment after plowing of the virgin soil is carried out with disk implements throughout the summer (steaming) depending on the quality of the plowing: when the abrasion of the arable land is carried out by the heavy tillers BDT-3,0, BDNT-2,2, and with good plowing – by the lawn mowers LDP-10. 2-4 treatments during the summer allow you to break the turf, align the surface of the field and destroy the emerging weed plants. For the last stages of treatment at the end of the summer, the harrow needle BIG-3, BMSH-15, BMSH-20 can be used for this purpose.

The selection of herbs and herbal mixes depends on the soil and climatic conditions, the moisture content of the site and the purpose of its use –hayfield or pasture, with the grass can be sown both in pure form and in the grass mixture.In the steppe zone on land for haymaking purposes, it is possible to apply pure crops to drought-tolerant grasses – wheat grass, sainfoin, and also sedge. In areas with good moisture, the application for hay meal can be carried out by planting grasses in its pure form – wheat grass, awnless brome, medick hybrid varieties, sand sainfoin, as well as their mixtures – mainly double beans and cereals.

For pasture use at the ingestion should be included in the composition of grass mixtures fescue (oatmeal furrow), and Russian wild ruttishness. For hay meadows and pastures of long-term use, grasses that are the most long-lasting (10-15 years old) cereals –quitch-grass, bluegrass, and awnless brome, colonies should be introduced in the grass mixtures, using the three groups of herbs – rhizomatous and loose-bunch cereals and legumes.

It should be taken into account that steppe grassland species - wheat grass, sainfoin, brought to the stage of ripening ripeness (flowering) after harvesting do not practically give afterbirth, after all can be expected only with earlier mowing or grazing (on pastures) and good wetting because of a radical measure should be considered sowing on these lands pasture grasses – Russian wild ruttishness, striated fescue (fescue). Russian wild ruttishness forms a powerful shrub in which the bulk is basal leaves, grows well after bleeding, the leaves retain their green color until autumn. In the steppe zone of Kazakhstan in the wild is found everywhere.

Thus, for pasture use in grass mixtures, grass with different ripening periods should be included - early ripening, mid-ripening and late ripening, well-growing after grazing, including grass plants such as fescue, Russian wild ruttishness, yellow medick, meadow grass, birds-foot trefoil an oth.

Standards for seeding seeds in pure form and grasses. Former All-Union (now All-Russian) NII feed them. VR Williams, based on studies in

various soil and climatic conditions and experimental data from research institutes and experimental stations located in different natural zones, were given, along with the zoning of perennial grasses, recommendations for the calculation of norms according to the calculation of seed sowing norms in pure form and grasses (Table 16).

The species composition of the planted grass mixture depends on the biological peculiarities of the plants, which are part of its composition and conditions of their growth. Usually, in the second year of life, legumes, like fast growing plants, prevail, in the following years the leading place is occupied by cereals.

Table 16

Standings for seeding grass seeds in pure form at unplatched sowing and grassland in the steppe zone (in kg of seeds at 100% economic expediency)*

Grasses	Sowing norms			Notes
	in pure seeding	in grass mixtures		
		soils of high moisture	soils of low moisture	
Hybrid medick	12	7-8	5-6	1) When sowing grasses with a sub-cover, the seeding rate increases by 15-20% 2) In double grass mixtures, the seeding rate is 65-75% of the norm in pure form 3) When two species of one biological group are introduced into the mixture of one species, the seeding rate of each of them is halved
Yellow medick	10	7-8	5-7	
Hungarian sainfoin	40	25-30	25-30	
Sweet clover	16	8-9	7-8	
Awnless brome	22	13-16	11-13	
Wheat grass	10	9-10	5-7	
Slender wheatgrass	16	13-14	9-12	
Foxtail	18			
Straight brome	22			
Leban	3-5			
Quitch-grass	22			
Striated fescue	12			
Russian wild ruttishness	14			

* Note: Recommended sowing rates for radical improvement of natural forage lands are significantly higher than when sowing herbs from field crop rotations, which is associated with worse cultivation and lower bonitet of these lands, in connection with which field seed germination, safety and survival plants the same.

With excessive thickening in grass mixture intensively develop shade-tolerant plants - wheat grass, awness brome and others, and non-shade-tolerant ones die, i.e., the process of density self-regulation herbage as a result of self-thinning and falling out of grass that is not adapted to harsh soil and climatic conditions or not holding up interspecific competition (the struggle for security with environmental factors).

The botanical composition of the sown grass mixture is also influenced by the techniques of agro-technology — the quality of soil preparation, fertilizers, the time and methods of sowing, the cover crop, the quality of seeds, their seeding rates, the depth of seed planting, and plant resistance to diseases and pests. The agronomic techniques are also influenced by the botanical composition of the sown grass mixture: the quality of soil preparation, fertilization, timing and methods of sowing, cover culture, seed quality, sowing rates, depth of semen, resistance of plants to diseases and pests.

Depending on the nature of the use and the number of years of use of grass mixtures are proposed (I. V. Larin, 1990) and some clarifications to the ones in Table 12 materials and an approximate ratio of seeds of bean-cereal grasses is given at the time of sowing them in grasses (Table 17).

So that the planted grass mixture is full for a long period of use, all effective elements of the cultivating technology should be applied, paying particular attention to the selection of components of the grass mixture, the rate of seeding, the ratio of seeds to the grass mixture, and, subsequently, to the husbandry practices and regimes of sowing hay meadows and pastures.

Table 17

The ratio of seeds of different biological groups when they are sown in grasslands in the conditions of the south of the forest-steppe, steppe and semi-desert zone,% to the seeding standards in pure form

Nature of use	Number of years of use	Legumes	Grasses
Hemp	2-3	60-70	60-70
	4-6	50-55	85-90
Grassland Pasture	7 and more	45-50	110-120

Ways of tinning. After plowing the virgin soil or a layer of old-growing grasses on seeded hayfields and pastures and subsequent fallowing, during the summer only the following spring begins the actual work on sprigging. There are two main methods of ingestion –accelerated and through seeded pre-cultures.

Annual crop plants are fed as pre-crops (a field crop culture) - Sudan grass, millet, cereals, oats, barley, etc., as well as cereals (if the soil meets the requirements for their cultivation) - wheat, barley, oats, millet and even corn. The use of pre-crops has a number of positive aspects: during the field period, which can last from one to three to four years, there is an intense decomposition of turf, moisture accumulates, effective fertility is well used for the formation of crops of annual crops, besides, these soils are pure from weeds, and the decomposition of turf creates more favorable conditions for later growth and development of perennial grasses. The use of pre-cultures during one or several years prior to ingestion may also be dictated by other causes, for example, the lack of feed and the need for them to be obtained in the first year after the treatment of virgin. In this case, the system of green conveyor for cutting or grazing from annual crops can be laid. In years with high yields, they can partially be used for hay, haylage, silage.

In the steppe zone, Sudan grass, morgh, sorghum, plague, winter rye, barley oats, as well as peas, peavine mixed with oats and barley may be planted for these purposes;In the forest-steppe zone – a seedling vetch with oats or barley. In semi-desert zone, winter crop rye, spring barley, safflower, Sudan grass, sorghum, grapes are used as pre-crops.

In the desert zone, it is possible to cultivate the same annual fodder crops as in the semi-desert, but the best result is obtained with the winter rye, sorghum, safflower here. In the future, work on the ingestion is carried out using the same technology as in the old-farm land in the left-handed crop rotations.

Accelerated ingestion, that is, multiyear grass seeding next year after parting the site was most widespread in the creation of seed hay meadows and pastures on land, in floodplains of rivers, drained marshes, etc.

*Method of seeding grasses.*Perennial grasses can be planted under the cover of annual crops or uncovered. The choice of the method of sowing is determined primarily by the moisture supply of the region and the reserves of productive moisture in the soil before sowing. It should be borne in mind that the shoots of most perennial grasses are sensitive to shading, quality of light, lack of moisture, nutrients. The grasses under the sub-planted method of sowing for the next year (the second year of their life) are lagging behind in growth and development from unseeded crops, and their yields are reduced, as a rule, twice, although the underproduction of the crop is compensated by the cover culture. At the third year of their life, they are aligned both on stemflower and on yield with unsealed crops.

The under-sowing method of sowing often in years with arid spring

and summer results in low field germinating seeds, poor plant survival and, as a consequence, extremely mature herbage, which is not capable of producing high feed intake in subsequent years. Therefore, in order to create the most favorable conditions for the formation of grassland in the year of sowing and a reliable guarantee of the harvest of herbs in subsequent years, preference should be given to predominantly unpeeled method of sowing or semi-coarse, in which the cover culture is planted broadly.

It is not expedient to carry out the subsoil method of sowing in the steppe zone, especially in the southern part, in the semi-desert, in the desert, in the cortical colonies, in salt-soaked soils in brown, sandy and serous soils, in drained marshes rich in organic matter, on strongly eroded slopes, in flood plains and estuarine meadows of long and medium flooding, in the creation of high-yielding hayfields and pastures of durable use, as well as in the cultivation of herbs in the seeds.

Seeds of perennial grasses vary greatly in size, density and fluidity, but because they are seeded both in pure form and in the grass mixture, it is difficult work, given that their sowing standards are not high and the depth of covering is only 2-3 cm.

Seeds of legume grasses are rounded, smooth and have a high flowability. Highly flowing is the seeds and some cereal grasses that have a smoothed surface, - meadow fennel, fescue, awness brome and slender wheatgrass, Russian wild ruttishness, cock's-foot grass and others.

A considerable part of the seeds of cereal grasses is a chestnut and a straight and straight, fennel sitnik and Siberian, a red oatmeal, and wheatgrass have either strong oats, or rough pubescence, or sharply outstanding scales, or have low density, and therefore have poor fluidity - non-sowing seeds .

Non-flowing seeds are found in plants such as leben, camphor, teresken, saxaul, cherkesa, alenia, and others with wings. The seeds of non-flowing crops should be pre-treated (in particular, on the clovering, vegetable graters – in this case, they can be sown with any seeders.

For planting of herbs special grains-grass (two-three-row) seeders of the type NWT-3.6, STS-2.1, as well as ordinary grain CZ-3.6, SZS-2.1L, SZS-6, CWP-3, 6 and others are used. Two-sided grain-grass seeders are adapted for sowing of cover culture and simple mixtures of herbs, however they can be used for sowing complex grasses.

For high-quality seeding, the seeds should be continuously mixed during the movement of the seeder, filling in the seed box less than half its volume, and when using unapproved seeders, especially for loose seeds, use filler – granular superphosphate, sawdust, etc., which would exceed the mass of seeds 3-4 times, which provides seeding of a relatively small seed

norm and uniform distribution of the area.

In semi-desert and desert areas, perennial forage plants - saxaul, leben, teresken, kamforosma, etc. are seeded in a scattered way with sewage pipelines removed. This approach is often used when planting SZS-2.1 on the loose soils to avoid over-depleting seedlings of wheat, corncrake, medick, sweet clover, etc. – the seed hopper is disconnected and tied to the rear of the coulter.

Depth of sealing seeds. Most perennial grasses have small seeds with a weight of 1000 seeds 1,5-3,0 g, therefore the supply of nutrients is very small, at germination form a very thin and weak escape, which, with great difficulty, penetrates into the surface of soil, and therefore at depths Seeds even on seeds 4-5 cm in normally wetted soils do not appear.

In the steppe zone on fertile and chestnut soils, the depth of sealing of seeds of grasses should not exceed 2-3 cm, with the exception of sainfoin, whose seeds can be sealed to a depth of 4-5 cm, at the same depth, it is possible to fill seeds of herbs in light sandy soils. An interesting feature of the seeds of marmots, terescence, saxaulus, camphorosms, wild ruttishness, large and small selins, elenia, meadow grass – the best shoots they give without interruption to the soil or, if sealed, not deeper than 1-1.5 cm.

In grassland, one of the main conditions for success is the acquisition of full-fruited seedlings, and taking into account that this will depend on the depth of sealing of seeds and moisture at that depth, which in turn will be determined by the quality of soil cultivation and the good moisture of the upper layer of soil, therefore the secret of success in many respects will depend on the right choice of the time of sowing.

Timing of seeding of herbs. Since in the year of primary processing of turf and steaming the soil becomes suitable for sowing since autumn, therefore the most important next issue is the choice of the sowing date.

The choice of the sowing date is determined by the biological characteristics of the culture and the conditions of humidification during the sowing and after the emergence of sows, whereas, if the obtaining of friendly shoots is mainly due to moisture in the upper (2-4 cm) layer of soil, then the survival of the plants in the first period after Shoots may depend on the autumn sowing period from the phase in which they leave in the winter, and in spring – from the phase in which they can fall under the summer (June) drought.

If the cereals did not have time to lean, and the legumes did not manage to create a stock of nutrients and dug the root cervix into the soil, then the probability of the death of the plants both in winter and in the June drought would be very large. For these reasons, the best seeding time for all

herbs, both legumes and cereals, is the early spring, and when the rainfall is abundant, the early years (end of June - beginning of July), for cereals are accepted in years with good moisture - late (first half) of August (time of sowing of winter crops), in dry years –semi-winter (first half of October).

Taking into account that in the year of spreading of virgin soil and steaming the soil can be well prepared for high quality seeding, it is best to cultivate the grass when harvested both in pure form and in grasses in the early spring period (the second half of April - the first decade of May), while still in the upper layer of soil there is moisture, while no pre-sowing soil treatments should be carried out as it is not necessary, and the cultivator or disk implements will lead to loss of moisture and loss of time. In the extreme case, it is possible to limit (if necessary) harrowing to 1-2 tracks with tooth harrows BZSS-1,0 or BSTST-1,0 and immediately – to sow, and after sowing it is useful to crochet with ring-spur rigs from the KKSh-6.

The care system in the year of sowing includes weeds strain (if they appear), in subsequent years – early-morning feeding with nitrogen fertilizers and harrowing with teeth harrows.

When grazing under pasture in the first and second years of life, the herbs should not be used for their intended purpose: until the grass reaches full development, the turf will not be strengthened; they should only be used for haymaking purposes. Subsequently, all those grass care measures are carried out, which help to increase the longevity of the use of forage grasses described in detail above.

Features of improvement of floodplain meadows and estuaries. Under the radical improvement should be allocated areas with a short flood duration, with the main application - the treatment of soil. It is possible to disperse these areas in several terms: after the fall of water, after mowing and autumn.In the gutted meadows before plowing, the milling with a marsh FBN-1,5, FBN-2 milling or hard disking - BDT-3,0, BDT-7,0 and others, and then plowing with a plow with plows, followed by the treatment of soil with disk implements, is performed by the type of steam. The depth of the main treatment is determined by the proximity of the occurrence of the sand or solodized horizons. The selection of herbs and grass mixtures is carried out depending on the conditions (soil, type of meadow, duration of flooding). The most suitable in these conditions for sowing in a pure form are medick medium and yellow, awnless brome, quitch-grass,bluegrass, slender wheatgrass, wild rye, meadow fescue, as well as their 2-3-component bean-and-cereal grasses. The high efficiency of the ingestion of these lands can be achieved by using mineral fertilizers introduced according to the principle described earlier.

Features of inoculation of steppe saline soils. Work on the sowing

of saline soils requires high material costs, does not always pay off high yields, besides, at present, when more than 15 million hectares of arable land are not used, this issue has lost its relevance for the coming years, but a general familiarity with this problem is being tried to resolve.

Saline soils of Kazakhstan, depending on the conditions of their formation and development, are diverse and diverse. Consequently, all types of saline soil cannot be improved by the same technology, but in all cases the only way to successfully reclaim saline soils is to break the solid capillary message of the arable horizon with the soil-forming rock, giving the arable layer a solid lumpy structure by appropriate soil treatment and sowing of the salt-tolerant perennial herbs.

According to scientific institutions, including KazNIIZH, the most promising agrotechnical improvement of saline lands with the help of two phytomelioration methods.

The first method (surface treatment of the horizon A followed by deep loosening of the A + B horizon and the sowing of grass mixtures) is most justified in meadow steppe and steppe saline soils of strong sulphate-chloride salinity and low-power horizon A (small and cortical saline soils). It provides for the preservation of the fertile A horizon on the surface, the loosening of the saline horizon B with irrigated guns, and the cultivation of deep-crested salt-resistant crops. This technology is not suitable for steppe solonchak soils, vast plains of saline soils, overlying surfaces, predominantly cartilaginous-gravel with deep (more than 40 cm) thick bedding.

The sequence of performing the operating technology of the steppe saline soil seeding is as follows:

1. Overwhelming multiple disks of cortical and small saline soil, or small blubber to a depth of 10-12 cm.
2. Shallow loosening by cultivators-deep-blowers or other rippers to a depth of 25-30 cm.
3. Selective early-spring harrowing in 2 tracks with heavy harrows and rolling with rollers.
4. Transport the sweet clover and wheatgrass (for prolonged ingestion) or other suitable for these crops. Norm sowing at routine sowing 14-16 kg / ha, seed depth – 2-3 cm. After sowing, it is desirable to mulch a layer of straw or manure.
5. Every annual spring harrowing.

The second way of improving the saline soils (plantation plowing of the A + B horizons with the subsequent sowing of perennial grasses) is acceptable on steppe solonets with a close presence of carbonates and gypsum, as well as high content of absorbed sodium. This includes:

1. Placing or three-level plowing on a depth of 35-40 cm in the steaming system. For this purpose, it was designed and applied in the 70-80s of the 20th century as an experimental three-tier plunger PTN-40, which, however, due to the imperfection of the structure, performed its task in one way or another only on solonets with horsepower A-13-15 cm .
2. Discovery (after rain falls, the second half of the summer).
3. Early harrowing and rolling in spring.
4. Planting grasses from sweet clover and wheatgrass or other suitable crops for these lands.

When performing these agroprimes, the volumetric mass of the soil decreases, which predetermines saline dehydration and, consequently, increase the yield of fodder crops.

Particularly important, besides soil treatment, selection of the most suitable for these conditions of crops for sowing and ingestion. On the basis of long-term studies of KazNiZH, a grouping of crops, salt tolerance and salinity resistance was proposed, which should be guided by the development of solonets (Table 18). Based on this grouping of cultures on salt and saline stability, depending on the specific conditions and economic feasibility and necessity, it is possible to select the appropriate crops for sowing.

Table 18

Grouping of crops by salt- and solonets resistance for the conditions of the dry steppe

Degree of stability	Salt resistance.	Solonets resistance
Perennial herbs		
Very strong	Slender wheat grass	Sweet clover (white and yellow)
Strong	Barley low, sweet clover (white and yellow)	Wild rye, slender wheat grass
Medium	Bluegrass, Russian wild ruttishness and wild rye, регнерия, multi-coloured and blue hybrid medick, wheat grassand brome	multi-coloured, yellow and blue hybrid medick, wheat grass, brome
Low	Sainfoin	Sainfoin
Annual cultures		
Very strong	Mustard	Mustard
Strong	Barley	Barley
Medium	Millet, wheat, grain, grain millet, oats	Oat, grain millet, Sudan grass
Weak	Sorghum, Sudan grass	Wheat

Features ofsprigging in a semi-desert zone. In a semi-arid zone, the root improvement is preferably carried out according to the following technology. The picked area is plowed late in autumn (after precipitation or "thawing" of the soil) to a depth of 18-20 cm. In early spring, the plowing of grass is discarded with harrowing and then the barley is sown. After harvesting barley, performing the role of preliminary culture, the plot is again plowed, then, in the spring after harrowing and rolling the hay, perennial grass is sown. As a cultivator, an elderberry is seeded with a seed rate of 12-13 kg / ha at a depth of 1-3 cm. On very light soils of semi-desert, vine leaves are strewn in strips directly into the stubble of barley, after which the soil is rolled up. Areas with heavy soils for radical improvement are not feasible.

Features of improving mountain meadows. The root improvement of the mountainous areas allows 5-6 times to increase the yield of hay in comparison with natural herbs. In the mountain meadow belt of the Tien Shan mountain system, perennial grasses of the hayfield type are the most promising – sandstone sainfoin, meadow fescue and cock's-foot grass and their mixtures, under similar conditions of the Altai mountain system – Zyranovskyisainfoin, slender wheat grass, timothy grass and mixtures thereof. On the northeast, more humid slopes in the grassland should include red clover (N. I. Mozhaev, I. P. Kopytin, 1986).

The agrotechnics of accelerated reparation of mountain hayfields have some features. The mountain slopes can be processed only when they are no more than 120 km. Plowing is carried out in the spring across the slopes to a depth of 22-25 cm with a plow with coulters and disk knives and harrows, which ensures a good turnover of the reservoir and facilitates its further cutting. After plowing, the layer is loosened with disc harrows in 2–3 tracks, on the last pass they are discarded with simultaneous harrowing. Be sure to before and after planting rolling, to provide the necessary depth of seeding and obtaining friendly shoots of perennial grasses. Preference should be given to the non-blooming method of sowing, and the spring term for sowing both legumes and perennial grasses is more justified.

The norms of seeding the first class seeds: sandy sainfoin– 55-60 kg / ha, Zyrianovskyi sainfoin– 65-70, red clover – 10-12, timothy grass – 6-8, cock's-foot grass – 13-15 and slender wheat grass – 16-17 kg /Ha. In simple two-component grass mixtures, the share of each component should be 60-70% of the norm of sowing them in pure form. In weight terms this will be: red clover – 9 kg / ha, sandysainfoin– 40-50, timothy grass– 4, cat grass– 10 and slender wheat grass or buckwheat – 12 kg / ha.

In triple grasses, the seeding rate of each component should make

up 40-50% of the norm in its pure form. The trawls, both in pure form and in the mixture, should be planted with special grain-grass seeders NWT-3.6 and others, and in the absence of them Apply ordinary, mixing small seeds with dry sifted sheep dung, husk or well-dispersed (refracted) granular superphosphate. The depth of seedlings is 2-4 cm. A little deeper it is possible to fill seeds of sainfoins. Care of sowing perennial grasses in the first year of their life is common – cutting of weeds, feeding, etc.

CHAPTER 10 THE RATIONAL USE OF HAYFIELDS AND PASTURES

The rational use of pastures and hayfields includes:

1. Creating conditions for obtaining high productivity of the land.
2. Saving valuable composition of grassland during possible lengthy period.
3. Provision of pasture feed in full need of the largest number of animals.
4. Getting the maximum possible yield of high-quality livestock products in the summer.

All these questions can be solved only with the knowledge and account of the biology of growth and development of grasses, accumulation and consumption of herbs of spare nutrients during pasture use, observance of periods of rest, terms, height and number of blasting, providing a normal load of pastures, etc.

Value of pasture feed and periods of its use

Grasslands provide the most valuable and the cheapest feed, although they are less productive in comparison with other lands – arable land, hayfields, forest lands. Grasslands provide not only the cheapest but also the most biologically most valuable feed, and for the pastoral period, at least 60% of the annual milk yield is provided, as well as a significant part of the animal gain.

With young grass, animals receive all the nutrients necessary for the body. According to calculations P. G. Tokmakov, a ton of good young pasture grass, provides 270 kg of milk, the same grass used in the form of feeding, - 160 kg, and hay – only 90 kg. In 100 kg of pasture grass (translated into dry food) contains up to 98 feed units, 10 kg of digestible protein and 10 times more vitamins than in the hay. It is eaten with all kinds of livestock, this applies not only to grasses, but also to semi-stalks and other plants.

Grassland use is the only opportunity to get crops from hard-to-reach areas. With pasture content of livestock, there is no major alienation of nutrients, as excrement into the soil is returned to a significant amount of nitrogen, phosphorus, potassium, calcium and other nutrients. Animals in the pasture become resistant to diseases, give a healthy litter. It is no coincidence that the best breeds of cattle were cultivated in areas with large areas of pasture land: high-yielding breeds of sheep - Kazakhstan thin-walled and South Kazakhstan meristic and cattle – Alatau and Kazakh Golodovaia, as well as Kushum horses, were created in the pastures of Kazakhstan. Along with this, pasture feed is the cheapest in comparison

with forages obtained in the field of forage production and hay harvesting: the cost of 1 feed. unit on the pasture is 2 times lower than in the hay, 3.5 times less than in the grasslands, and 2.5 times in the grains. Therefore, the cost price of livestock production in the pasture period is 2-3 times lower than in the stall (N. I. Mozhaev, I. P. Kopytin, 1986).

Natural vegetation has an important agronomic significance – it increases the fertility and structure of the soil, protects it from erosion – a dense and powerful mass of roots protects it from demolition by wind and washing with water.

Depending on the soil and climate zone, as well as the livestock, the pasture period varies, for example, in the forest zone is 130-160 days, in the forest zone and steppe 150-200, in the semi-desert 220-280, in the desert – all year round, with the duration of grazing of dairy cattle is the smallest, and sheep, horses, camels is maximal and may depend on the depth of the snow cover, the density of snow and other factors.

In the annual ration, pasture feed in the conditions of the Republic is comprised on average – from sheep to 58%, horses to 60% and camels up to 73%.

In *forest-steppe pastures,* the yield of the feed increases naturally from spring to mid-summer, they start to be used at the end of May, they are available in autumn until October, and the pasture mass accumulates only by the end of the spring period. In the years of cold spring, the normal use of these pastures is possible only from the beginning of summer.In autumn, as a result of the dying of grass-grains of grasses – fescue, wormwood, quitch-grass, milfoil, bedstraw, and others, the productivity of forest-steppe pastures drops sharply. In late autumn, due to adverse climatic conditions, grazing on such pastures is generally difficult. Thus, the active pasturing period in this zone does not exceed 165 days, and the shortage of pasture feeds in the spring and autumn should be supplemented with forages obtained in the field of forage production. For a long stall period, it is necessary to harvest the required amount of hay, silage, hay, grain and other forages.

On the mountain pastures a similar situation is formed. The shorter of the period is the use of high-yield fodder plants (quitch-grass, timothy, awnless brome, cock's foot, meadow foxtail, bluegrass, red clover, kobrezia, meadowsweet, cow parsnip, geranium, etc.). It usually begins early in the summer and ends at the beginning of autumn. The use of mountain pastures at other times of the year is not possible due to adverse climatic conditions aggravated by complex relief.

In the steppe zone, the beginning of pasture use of herbs occurs for a week-one and a half before, than in the forest-steppe, - mid-May, and the

maximum feed potential for one-time use is noted at the beginning of summer. The grasslands that can be used here can be used in three seasons: spring – feather grass-fescue grassland, in the summer - cereal steppe pastures and estuarine areas, and in the autumn - wormwood and saline pastures. In this zone, the yield of pasture for seasons (except for winter) is more or less balanced. The highest yield is observed at the end of spring and the beginning of summer, and after drying of dry fodder plants the yield of herbs decreases, however, at this time maximum yield can be obtained from estuarine and floodplain areas. After the occurrence of early osseous sediments, the amount of pasture mass increases, however, both in the beginning and at the end of the pasture period, pasture cannot fully provide cattle in full need of feed, for this period, the reserve feed is created at the expense of field forage production. Under such conditions, in the steppe and dry steppe zones, certain livestock may be kept in pastures up to 170-195 days.

In the semi-desert zone, the productivity of pasture in the warm seasons of the year does not fluctuate, and the layout of the fodder potential is as follows: in spring, the main feed is given by ephemeres (mortuk, wheat grass, bulbous meadow grass, vida, spruce, Syrian herb, fenugreek), in summer saltwater vegetation, (saltgrass, camphorosm, roast salien, lebed and teresken). Some lack of summer pastures is replenished by the dismount of cattle in the mountains (on dzhaylau). Thus, here you can create a similar natural green conveyor, which takes place on the Betpakdalin pasture massif. The normal grazing in this zone begins at the beginning of April and ends at the end of November. The length of the pasture period in the semi-desert zone is 220-240 days, but in fact the grazing continues much longer, which is explained by the difficulty of harvesting stocks of feed for the winter period, aggravated in years with severe winters and prolonged springs.

In the desert zone, the maximum productive yield of pasture is in spring - it is an ephemeral-wheatgrass pasture. The summer pastures are represented mainly by wormwood, leban, marshmallow, teresken and diverse vegetation of floodplain and floodplain areas, autumn pasturelands of the desert have the same feedstock, as well as spring. In favorable years dominate the ephemera and ephemeroids, well developed feather grasses, increases the species composition and height of plants, the vegetative cover is more connected and is in a green state until June. In some semi-desert massifs, pastures acquire the form of a meadow and can be crushed; in these cases, spring cravings are more prolonged. The dominant fodder vegetation is teresken, leban, white saxauls, calligonum, morutok, gray wormwood, wheatgrass, and others.

Seasonality in the use of pasture is unfavorable due to the large disproportion in the feed stocks of different seasons, as large areas of pastures are burned out by the summer and become almost unsuitable for grazing, and the specific gravity of mountain and estuarine pastures is small, and in the territory distributed unevenly, which creates great difficulties in the development of livestock breeding.

The main vital forms of the plants of Kazakhstan's pastures, their eating-nature and the peculiarities of bleeding

Of the many life forms of plants that make up the main cover of the land surface of Kazakhstan, perennial and annual grasses, semi-bricks, shrubs and trees are of a forage value.

Perennial grasses are the most common form of life in Kazakhstan, which make up about 62-65% of all plant species and about 45% of vegetation cover, and have a beneficial effect on nourishment (70-75%) and other nutritional forms. Inside this form there are groups of plants that are eaten differently by different animals. Most of the relatively low and dry plants (ephemeroid, xerophytic grasses, grasses, etc. (up to 84-86%) are better eaten by sheep and goats. Horses, preferring more tall plants, eat 17-20% perennial herbs, cattle – tall meadows (mesophytes and hygrophytes). However, the set of well-eaten cattle is very small, most of them perennial grass – 12-14%

.The second most important form of plant life are*the semi-shubs*, which in the Republic make up 14-16% of all plant species and about 38% of the total vegetation, and the amount of edible all kinds of semi-cultivars reaches 70-75%. These drought-tolerant plants are widespread in semi-desert and desert areas and are the main feed for sheep, horses and camels, camels and horses eagerly eating the largest and most rigorous of them. The most important here are semi-bricks: wormwood, leban, teresken, clumsy saltgrass, camphorosm, biyurgun, saltwood grass, camel thorn, astragalus, etc.

The share of participation of other living forms of plants in the animal feed is more modest, shrubs in the general species composition of higher plants of Kazakhstan make up 5.6% (eaten species of shrubs - 68-72%) and occupy about 12% of the total vegetation cover of the republic. The leaves and young shoots of most shrubs are forage for camels, horses and partly sheep on grazing. Shrub also serves as an effective snow-protecting agent and forms calves for sheep in bad weather.

Annual grasses (excluding weed plants in crops) account for about 5% of the total vegetation cover of the republic. This is basically an ephemeral group of plants that grows in arid conditions. Most of them are eaten by sheeps and goats (pastel, stench, fenugreek, morutok, eagilops,

Bogdan barley, military grass etc.).

Features of blasting of pasture plants in natural zones of Kazakhstan. Scrubbing grassy vegetation should begin no earlier than 13-16 days since the beginning of the rebirth of perennial grasses, when most of the plants reach the shrubber phase – the entrance to the tube or branching – budding, and when the grass usually reaches a height of 12-15 cm during the pasture ripeness. Some lack of pasture mass in comparison with later bleeding is offset by the best aftermath ability, edible and nutritious herbs. Perennial grasses dominated by pastures (feather grass, fescue, quitch-grass, slender wheat grass, and others) are a semi-sustainable type of development, which is why they develop well if they have wintered shoots of the previous year. Winter-skinned sprouts are rapidly growing in spring, while new sprouts of spring development grow slowly. Therefore, if livestock breaks out autumn shoots, then the harvest will drop sharply next year, while a moderate and timely grazing will help maintain a sufficient number of autumn shoots, which will affect the future harvest of herbs. Scrubbing must be completed no later than 20 days before the occurrence of permanent frostbite. During this time, the seasoned plants are able to restore the basal mass of the earth and spare nutrients.

The first aftermath after harvesting perennial grasses is usually suitable for re-bleeding after 20 days, followed by 40-45 days in wet areas, therefore, in the forest-steppe and mountain (mid-mountain belt) zones, 2-3 cycles of bleeding of each type of pasture are usually carried out, thus the period of one grazing must not exceed 7-10 days, and the unsystematic grazing is not rational.

The length of the grazing is mainly due to the condition of the pasturing plant: the grass-fescue grass is best to be peeled for 10-12 days in the middle of May and 12-15 days in the middle of June, semi-artichoke wormwood and swan pastures - from the beginning to the middle of autumn, but within the normal alienation of the crop. The same applies to the reindeer herding-fescue pastures in the autumn. When treating semi-desert and foothill-dry-steppe pastures it is desirable to adhere to the same principle of use of pastures as in steppe and dry-steppe zones, however, the calendar terms of blasting will be different, which is due not only to climatic conditions, but also to the botanical composition of the dominant vegetation of the main types of pasture.

Methods of estimating yield (productivity) natural forage land

The yield of natural forage crops takes into account two methods, namely, slipping and zootechnical.

The slipping method in turn is divided into the method of trial (registration) platforms and the method of transect (model bushes). The

method of trial sites is used to account for the yield in a somewhat uniform (aligned) grassy vegetation. The transect method is most suitable for keeping stock in shrub lands. Both methods are used on mixed rusted desert pastures, since their grasses consist of grassy and shrub vegetation, and none of these methods yields precise results.

The method of trial sites consists in taking typical platforms in the size of 2,5 m2, in 4-fold repeat, cutting high-rise plants at a height of 4-6 cm and low-stems - at a height of 2-3 cm, the cut mass is weighed in green and air-dry condition.

The transect method consists in the separation of transects (strips) in shrub ridge-humus sandy pastures whose yield is taken into account by cutting and weighing the eaten mass from typical specimens - model bushes.

The zootechnical method of taking into account the yield of forage plants in the pasture is reduced to its indirect determination through livestock products (milk, pile, wool, etc.), for which it is necessary to strictly account for the received products from a certain group of livestock grazing on this type or a portion of pastures, systematically weighing cattle (necessarily at the beginning and the end of grazing on this site), as well as taking into account additional feed in the form of fertilizing during grazing.

The quantity of products received is multiplied by the rate of feed in feed units for each type of product and summed up all the products. Excluding from the sum of feed (in feed units) additional feeding, the amount of feed (in feed units) obtained by cattle from the pastures is determined.Since the productivity of pasture is established through the obtained livestock production, the term “pasture activity” is usually replaced by the term “pasture productivity”.

The advantage of the zootechnical method of determining the productivity of the pastures in its relative simplicity, since the accountancy of livestock production is already being carried out, and the disadvantage is that it does not determine the gross productivity and the coefficient of edibility, depending on the type of pasturing. The zootechnical method is acceptable, as a rule, for long and continuous breeding of livestock, although its results are influenced by random factors (cold, cold, water, poor watering, poor quality of grazing, etc.), this method of determining the productivity of pastures should be supplemented and specified the prickly method, which allows, in addition to yield before harvesting, and after calculating the nutrition and digestibility of feeds, as well as feed capacity of pastures.

The capacity of the pastures characterizes the amount of livestock that can be fed on 1 hectare of pasture during the pasture period, which is

considered based on the productivity of the pasture and the need for a green feed of various species of animals.

It is considered that on average 1 animal per day needs the following amount of green food, kg: for cows depending on the lamb – 40-75 kg, young animals of cattle older than 30 - 40 kg, young animals up to a year – 15- 25 kg, sheep – 6-8 kg, lambs – 2-3 kg, horses – 30-40 kg. Assuming that the pasture period for cows is 150 days, then 50 kg of green feed per day for the entire pasture period is required: 50 x 150 = 7500 kg or 75 cc. With a yield of 30 c / ha of green mass per cow, 2,5 hectares will be required, with a yield of 75 cc - 1 hectare, etc.

Features of creation and use of pastures in the natural zones of Kazakhstan

The efficiency of pasture is significantly increased when properly used. For example, the application of a poster (pasteurized) grazing system allows for 20-35% more animals to be stored in the same area than in non-system grazing, and the productivity of pasture lands increases by 2-3 times.

The concept of “cultural pastures”, which implies the creation and rational use of them, is widely used in grassland pasture production.

The most suitable for this purpose are areas where rainfall is at least 500 mm per year, however, cultivated pastures can be established in forest-steppe and steppe zones with the use of lowland, floodplain areas, as well as dry land when sowing the appropriate high yielding herbs in these conditions: medick yellow, fescue, etc.

There are three main ways to create highly productive long-term pastures:

1. Improvement of grasses of natural forage forests, the composition of which includes valuable forage grasses.
2. Seed grasses of the past years are left for pasture use.
3. Creation of new grasses of pasture herbs after radical improvement of natural forage forests.

In the future, the main objectives of rational use will be the organization of the proper system of grazing livestock and measures for the timely care of herbs.

In order to maintain natural pastures in good condition, as well as to increase their productivity, there is a radical and superficial improvement of land pastureland, the creation of irrigated cultural pastures, etc. Natural improvement of nurseries with highly degraded grasslands located in areas, natural the conditions of which allow, without fear of erosion, to obtain a higher yield of fodder crops. This is especially true of pastures located close to large cities or industrial zones. Indigenous improvements require grassland around water facilities, as well as those that, due to the botanical

composition of the grassland, do not meet the physiological requirements of animals.

In desert and semi-desert areas, perennial forage plants from the goosefoot family (leban), as well as saxaul, camphorosm, clumsy saltgrass, teresken due to their biological characteristics, are best at sowing them under the winter or winter in the snow, slightly digging into the soil seeds, the seeds of the rootstock – before the snow falls out or in the shallow snow superficially followed by rolling. Well self-digging into the soil of small pubescent seeds, retracted by the melting of snow.

Creation and use of irrigated cultural pastures. Irrigated cultural pastures are created mainly for dairy cattle, for this purpose constantly irrigated areas are picked up near a dairy farm or a summer camp. For the artificial introduction of these lands, the most suitable grass mixes are medick + cock's-foot grass, medick + meadow fescue or medick + cock's-foot grass + pickle meadow. Herbal mixtures provide a high collection of pasture feed, grow fast after bleeding and are not very sensitive to grazing. In the southeast of Kazakhstan, the most acceptable double blend of medick and cock's-foot grass. The cultivation of soil for sowing and agrotechnics the sowing of these perennial herbs is the same as in the case of the creation of sowing hayfields in the corresponding area.

In the first year of life, slowly developing perennial herbs are usually used on hay, which does not cause a particular oppression of not yet strengthened plants, they are used for grazing from the second or third year of life. In the future, in order to maintain and increase the productivity of the pastes, appropriate measures should be taken to care for them and to apply pastures.

Methods of keeping livestock in summer

There are several ways to keep livestock in summer:

1. *Pasture*, when animals graze on the natural (desert, semi-desert) and perennial seeded pastures (areas of high expansion), which is subdivided into several systems in the course of the pasture period:

a) free or unsystematic grazing, when the livestock feeds throughout the pastures throughout the period, throughout the pasture.

b) a captive or porous system, when all pastures are divided into several plots (plots) and they are blown apart one by one.

c) an attached system when the animal feeds on a rope or chain link, and then translated into a new plot. This method is used when grazing weak, sick animals, as well as in small farms with a small livestock population, limited area of pasture, etc.

2. *Stable keeping*, when livestock is in stalls throughout the summer and receives green feed of various crops in the form of a beveled

mass. This method is used with high expansion of the land and small areas of natural pastures.

3. *Camping of cattle*, in which livestock is contained in specially equipped summer camps, often at a great distance from the places of winter keeping of livestock on natural or sown pastures with the use of fertilizer due to the creation of green conveyors.

4. *Stripping system* is applied mainly in areas of high-mountain pastures, where cattle for fattening disperse during the summer.

When freely or unsystematically grazing of cattle, pastures are quickly eroded, the share of the most valuable and well-eaten grasses is reduced, the herbs are quickly tapped, and therefore in the second half of the summer there are few plants that animals are forced to eat, the productivity of animals in this period drops sharply, Pasture system is one of the most important elements of rational use of pastures.

In the cork (partial) system, the pasture is divided into several plots (squares), which are fed in turn and in succession, with each plot (shed) to be free of grazing for 25-35 days, during which the herbs can grow well.

In this method of grazing livestock requires less pasture plowing, animals receive good feed throughout the summer, and valuable herbs are well preserved in the grasslands.

The size of the pasture areas depends on the size of the herd, the productivity of the pasture, the speed of the growth of the plant mass. It should proceed from the following basic provisions:

1. The period of stay of animals in one plot (slaughter) should be no more than 5-6 days.

2. The livestock's length is related to the height of the blasting – after the grazing, the height of the grass should be about 5 cm, otherwise, with low graining, the grass field will deteriorate.

3. Cyclical use and renewal of spare nutrients in the plant, because the yield of herbs sharply decreases with untimely bleeding. Young shoots develop at the expense of substitute nutrients, and only after the assimilation surface is formed, the resumption of reserves begins.On average, the duration of the cycle of nutrient consumption is 12-16 days, the replenishment of consumed nutrients is also 12-16 days, therefore, all this period is 30-35 days (in some cases up to 40-50 days).

Thus, if we take the average period of flowering of grasses for 35 days, then during the five-day bleeding of a site or a detachment, there will be required 7 plots (squares), except for the area currently used - in total, there will be 8 plots or squares, in addition, it is necessary to have at least 3 -10 reserve plots depending on the soil-climatic conditions of the region.

The necessity of having spare squads (plots), and, consequently,

increasing their number is due to the following reasons:

1. The yield of grasses in subsequent cycles of bleeding decreases, and therefore there is a faster blow up of this area (detachment).

2. With the passage to the south, the pasture period is lengthened, and, consequently, the number of plots (squares) must also increase.

3. Every year, in one or two plots, a system of measures to improve the grassland (root or surface) should be carried out. 4. Some quantity of plots should be allocated annually, depending on the yield of herbs this year, for haymaking.

In this connection, as experience has shown, it is considered expedient to divide the pasture into the following number of plots (pens) for grazing of livestock: in the forest zone not less than 12, in forest-steppe and steppe with improved humidification not less than 16, in the dry steppe and semi-desert zone – no less 24.

When a pasture is located more than 2 km from a livestock farm, a dismantled pasture system is used, the most common form of which is the summer camp's livestock maintenance.

At the camp livestock stock in the or near the pasture there is equipped a shelter with vodkas, where sheds are placed from bad weather and heat for livestock, milking installations, rooms (carts) for storing stockpiles, storage of inventory, concentrated feed, ho-bed room for milk Here cattle are fired for night and day rest, milking and additive. In the vicinity of campgrounds and pastures, green conveyors should be placed for feeding cattle.

In the camping cattle system, the schedule of the pasture day should be set, based on the fact that the best time to graze is morning and evening hours, and on hot days – night. It is established that cattle are eaten for 7-9 hours in 3-4 meals, in addition, cows are placed 2-3 times for rest directly on the pasture for chewing gum. You should drink the cat 2-3 times in a knock, and on hot days 4-5 times. Thus, livestock should be on the pasture, including rest and watering, at least 12-14 hours a day. For sheep, full saturation in the pasture requires 6-7 hours, horses – 10-12 hours.

The priority issue in the organization of pasture territory is the veterinary and zootechnical inspection of pastures and water catchers before grazing. Precisely establish and note the areas of pasture and watering, where there were cases of disease or cattle disease from opioid disorders (Siberian ulcers, emphysematous carbuncles, etc.). These areas should be immediately neutralized. The grazing area adjacent to them can be used only for the grazing of animals that have been vaccinated against these diseases.

10.1 Seasonal pastures in Kazakhstan and their use

According to the research institute of grassland farms, all pastures of Kazakhstan can be divided into the following types: summer, spring-summer, autumn, spring-autumn, winter and year-round.

The summer pastures include high alpine pastures, floodplain meadows and pastures in the northern part of the forest-steppe zone.

Spring and summer pastures– pastures in the small-scale communities of Central Kazakhstan and the swampy steppes of the North and North-West Kazakhstan (forest-steppe and northern steppe zones). They are ready to graze only by the beginning of the summer.

Autumn pastures are represented mainly by salt-and-wormwood vegetation with an admixture of sainfoil, tereskan and other semi-shrubs.

Spring-autumn pastureland is large massifs of pre-stripe bands in the south, south-east and west of the republic, and on the vast desert massif of Betpakdaly. This type of pasture is mainly concentrated in the southern part of the steppe zone, in semi-desert, desert and foothill zones, and accounts for about 15% of all pastures in the republic. In the southern regions, they are represented by ephemeral-wormwood, ephemeral-salt-wormwood and wormwood-ephemeral-sandy-rye-potato associations. In early spring here usually ephemeral vegetation appears, burning out by the beginning of the summer and rejuvenating again in autumn after precipitation. Thus, the combination in the grass of two different vegetation periods and the best eating of the groups of plants causes the two-season use of the specified pasture plants: ephemeres and ephemeroids – in spring, wormwood and saltgrasses– in autumn. At the same time, the salts are usually used by animals in late autumn after autumn sediments – after washing out of plants excess salt. In the southern part of the steppe zone, spring-autumn pasture is represented by grass-wormwood steppes.

Winter pastures are mainly sandy massifs in the desert and less commonly in semi-desert zones of the south, south-east and west of the republic, as well as the southern slopes of mountain massifs and small-meadowlands. The prevalence here of relatively high semi-bricks and shrubs, the absence of snow or a small amount of its cover, sandy soils favor winter livestock grazing. These pastures are poorly watered, but winter snow sheep mostly fill the lack of water.

Typical winter pastures - juvenile-solanaceous. Due to the strong liveliness of soil and vegetation, such pastures are not used in the summer. Late in autumn and winter, after leaching salts with sediments and changing temperatures, the solanaceous vegetation is eaten satisfactorily by horses and sheep. It is promoted by snow and low temperatures. Gray-grazing

pastures are also classified as winter pastures.

Year-round pastureland is adjacent to the winter. This is a pasture in the stormy-ridge desert sands. These include leban-wormwood pastures, the herbs of which can be used in any season of the year, although a certain part of them should receive annual rest. The seasonal resources of the pastures are far from uneven, and the zones increase this imbalance: in the forest-steppe and mountain areas there are no winter pastures, there is practically no spring and autumn pasture, in the desert area, on the contrary, there is a clear lack of summer pastures, etc.

In Kazakhstan, the most widespread rape of sheep from permanent grazing pastures to summer, from the spring plains, mostly sandy pastures, is about 30% of the total sheep population annually dispersed to summer highlands (jailau). The racing is due to the use of rich highland pasture vegetation in the summer, and when grazing in mountain meadows feed is maintained in autumn and winter pastures, in addition, in the hottest and dry weather, animals are in favorable conditions. In high-mountain pastures, it is advantageous for sheep to be kept for as long as possible, and the timing of the race should be selected taking into account the whole complex of factors that determine the rational use of summer mountain pastures. In autumn, from high-mountain pastures, sheep are driven to permanent livestock sites along the same tracks, so they should not be used for grazing in the summer.

In the southern and southeastern regions of Kazakhstan autumn racing usually begins in early September, although the evolving meteorological conditions often make adjustments.

Current pasture management. When considering the system of surface improvement of natural forage forests, attention was drawn to the fact that this system is essentially a complex of measures for the care of herbs that contribute to the conservation of the most valuable forage grasses in the grasslands and the maintenance of their productive longevity.

At the same time, there are a number of specific methods for caring for pastures associated with pasture livestock, of which the following can be called the main ones:

1. Sloping not eaten by the livestock remains of the grass stand.
2. Leveling (spreading) of feces of animals, which remains in pastures in considerable quantity.

In normal conditions, livestock does not eat overgrown trawl in the pasture, as well as grass in places contaminated with feces of animals, non-harmful and harmful plants remain.

The digging of the rest of the grassland is carried out by mowing rams to a height of 5-6 cm immediately after the cattle are discharged to

another site. With a small amount of non-edible residue, the grated grass can be left in place, since after wiping it does not significantly damage grass, and with large quantities, it is expedient to regenerate these residues and remove them with further use. Breeding grass in pasture is one of the main methods of destroying weed and inedible herbs, which helps to create the best conditions for the growth and development of the most valuable fodder herbs in the grass.

Animal feces should also be produced after the cattle have been transplanted to another area (stern), using special loops and harrows for this purpose. Experience shows that the regular cutting of inedible plant remains and the calving of the feces after each harvest helps to increase the productivity of the pasture by 25-30% compared to the areas where such work has not been carried out.

Pasture and haymaking

When considering the above-mentioned material, it was repeatedly emphasized that when one-side use of pastures and hayfields from year to year worsens the composition and yield of herbs, as the normal cycle of renewal and consumption of nutrients is broken down, there is no seed reopening of herbs, the proportion of weeds increases, but only for 4 year of misuse of pastures, the amount of inedible plants in the pasture increases by 20-30%, and the yield of herbs is reduced by 40-50% (N. G. Andreev, 1983). These negative phenomena, typical of unsystematic grazing of cattle, can be avoided by introducing pasture rotation.

The pasture cycle is a system of pastures use and care, in which the terms and methods of pastures are changed in a certain order (in a year, season or several years).In compilation of the scheme of pasture turnover it is necessary to provide the following:

1. Every year, to change the order of using the plots (pens) for grazing: if this year the grazing is started from the first plot (squadron), then in the following – from the second, then from the third, etc.

2. Periodic use of a part (2-4) of the plots (squares) for the sowing-nose, mainly those on which the grazing began in the previous year.

3. Periodic later cutting of 1-2 plots (squares) after insemination or collection of valuable fodder grass seeds.

4. Periodic provision of full rest on heavily demolished areas (units) of pastures with the implementation of systems for their radical or superficial improvement.

Haymaking is based on the same principles as pasture cycle, and the use of hayfields contributes to vegetative and seed reproduction of plants, the renewal and maintenance of the productivity of the most valuable

herbs for a long period of time.

Haymaking rotations should be based on alternation over the years:

1. Squats of cutting, that is, if in the current year began to honeymoon from the first plot, then the next from the second, etc.

2. Sowing and “rest” for the system of radical or superficial improvement on this site.

3. Grazing with grazing.

4. Correctness of cutting.

Pasture and haymaking in different soil-climate zones of Kazakhstan and depending on the type of land, have their own specifics.

There are many other options for simplified pastures, but in all cases the basic principle must be preserved: some pasture lands rest, others are used alternately in different seasons of the year. This allows for the natural insemination of plants - dominant, replenishment of nutrients, prevention of worm diseases and the breaking of sands, and consequently, increasing the yield of pasture.

On low-yielding pastures, it is not appropriate to arrange squatting on areas of pasture-and-mouth, they should be distinguished using terrain or shrub plantations. Pastures in these cases are simple but effective enough, since they increase the productivity of the resting area of the pastures so as to compensate for the removal of it from use, and on average, the rotation helps to increase the productivity of pasture by 18-20%.

CHAPTER 11 ORGANIZING A GREEN CONVEYOR IN ANIMAL HUSBANDRY

Green herbal conveyor in livestock breeding is a system of production of various green juicy feeds and feeding those animals, as needed, without interruption, during the pasture period.

At the beginning of the green animal conveyor it is necessary gradually, during the week, to be accustomed to the green feed. For example, for cows to start with 20-25 kg and bring it to the zootechnical norm.

Do not allow breaks in feeding with green food, since the animal's stomach adapts to it a certain time. Replacing green fodder with hay, haymaking causes gastrointestinal perestroika, animals reduce productivity. To restore it, it will take a long time for a new addiction to the green feed. Therefore, it is necessary to supply him the necessary quantity daily. Feeding animals with green feed should be as long as possible during the spring-summer-autumn period.

Green feed should be balanced by nutrients, mineral salts and vitamins. It should consist of cereal and legume plants It is not desirable to feed cattle with green feed from one corn or some leguminous plants: medick, clover, wicks, etc. In green corn, the digestible protein is less than the zootechnical norm, the amino acid composition of the proteins is defective. Therefore, the feeding of animals with one corn leads to a lack of production.

In the green legumes there is an excess of digestible protein. Therefore, feeding animals with some beans may cause tibia in animals, liver disease, decreased productivity and reproductive functions.

Balanced on all nutrients, juicy green food is eaten easily by animals, easily digested in the body and provides high productivity of animals.

The green conveyor can be arranged in different ways in different conditions. There are three types of organization of a green conveyor in livestock breeding.

The first type of green conveyor is the grazing of animals on the pasture throughout the pasture period. Animals eat the necessary amount of green food on the pasture every day.

If there is no pasture, then a second type of green conveyor is organized – from sown fodder crops to arable land. They slaughter various sowing fodder crops, bring and distribute green feed to feeders on fattening sites. Such forage crops can be perennial grasses, mixed crops of annual fodder crops, root crops, tuberous plants, bell peppers, etc.

For the organization of green conveyor, depending on the specific conditions, different feed crops are selected that give green fodder at different periods in such a way that at the end of the feeding of one crop, the following has grown to the phase of optimal use. When drawing up a green conveyor, it is not necessary to include a large amount of fodder crops, as it complicates the production of seeds and their storage. Depending on the soil-climatic conditions, it is planned to grow more crops that are more productive, full-fledged and well-eaten.For the feeding of animals with green food in the spring, winter crops are planted in spring, cold crops are to be used for late fall: root crops, rape, etc. This is done so that for the most possible period the animals receive a full-fledged green feed.

The peculiarity of the use in the green conveyor of annual cold-resistant early-crops of a long daylight is that they can be sown in a few terms, from early spring until the end of July. Rape can be sown in the beginning of August. After seeding the pea mixture in a few terms, after 15-20 days, you can arrange a green conveyor from the end of June to September. Late sowing thermophilic cultures of short light day (for example, corn) can be used in a green conveyor in the conditions of Siberia in late August – early September.

Perennial grasses in irrigated areas with application of calculated fertilizer rates can be intensively used in several slopes in the phase of tubing of cereals and branching of legumes.

The procedure for calculating the need for animals in the green feed and the exemplary scheme of the green conveyor for the second type are given in Tables 96 and 97. According to these calculations, for existing animals, for the entire period of the green conveyor, taking into account the insurance fund (15%), 1487.2 tons of green fodder will be needed, for whose production requires 178.8 hectares of fodder crops.

It is possible to organize a green conveyor and on a smaller area due to the multi-use use of perennial grasses and the cropping of intermediate crops after the harvest of winter and other early crops to green fodder. In this example, due to the second slope of perennial grass, the area will decrease by 14.3 hectares, and by sowing of intermediate crops after harvesting of winter rye “peas with oats on July 1 – 12.4 hectares, and on July 15 – 6.0 hectares, rape 15 July – 5.7 hectares” –24.1 hectares. Thus, it is possible to organize a green conveyor in this example on an area of 140.4 hectares (178.8 hectares – 38.4 hectares).

The mixed type of green conveyor is organized when the existing pasture is low-yielding and the animals are not saturated with full pasture feed during pasture. When arranging a mixed green conveyor, various options are possible, depending on the specific conditions. If the pasture is

only used in the spring and in the second half of the summer with a break in June and July, then during the break the animals receive green feed on the feeding areas of the seeded fodder crops. If the grazing of animals is carried out throughout the pasture period, but the animals do not saturate completely at low yields of the pasture, they are fed daily after the evening gutting of arable crops on the arable land.

Depending on the specific conditions of the variants of the green conveyor can be many, the essence is to feed the animals with green feed according to the zootechnical standards, without interruptions and for as long a period as possible. High-grade green fodder maintains good health and high animal productivity.

CHAPTER 12 FEED PREPARATION TECHNOLOGY

12.1 Hay harvesting technology

Hay – roughage, prepared from various fodder plants by drying to a moisture content of 15-17%. Drying is the most common way of harvesting and storing feeds for the winter period. Freshened plants contain in tissues 70-80% of water, they need to be dried up to a moisture content of 15-17%, in which the plants cease biochemical processes in plant cells, and the hay is well preserved. The water remaining in it is tied and held with great force, so it is not available for microorganisms.

Hay is an important source of proteins, minerals and vitamins. The nutrition of one kilogram of hay depends on the quality class, according to the Institute of Animal Husbandry (VNIIZiK), fluctuates in the limits: grade 1 – not less than 0, 47 food unit; grade 2 – 0.42 fry unit;grade 3 – 0.36 pounds. Good hay is very important when feeding milk cows during the winter – it is one of the main sources of protein, sugar, vitamins and minerals. In one kilogram of hay from cereal grasses, on average, 40-50 grams of digestible protein, 5-6 grams of calcium, 1-2 grams of phosphorus, 15-25 mg of carotene, of leguminous grasses, respectively – 110-120 grams of digestible protein, 15 grams of calcium, 3 g of phosphorus and 25-35 mg of carotene.

In the structure of diets for cattle, the hay is 10-15%, that is, 4-5 kg per day per animal, for sheep – up to 40%, 1.0-1.5 kg per day for one sheep. The preparation of hay should precede a large preparatory work. First of all, it is preparation of the material and technical base necessary for harvesting and storing the hay. The level of equipment with equipment and its completeness are an important factor in the intensification of forage production, which provides the possibility of introducing progressive technologies and high productivity.

At present, the hay harvest includes more than a dozen technological operations: mowing, rolling, cutting, roll forming, mowing and stinging, pressing, chopping, selection of pressed hay, crushing of pressed hay, compulsory vein-typing, etc. Therefore, it is very important, so that the machines, which are joined by separate operations, correspond to each other in terms of performance.

When calculating the compositions of technological complexes of machines, it is necessary to consider the amount of harvesting of forages, the size of storage for them, the yield of forage crops, the timing of harvesting of feeds, the distance of their transportation to storage sites. Only a carefully designed and well-prepared system of machines helps to increase

the productivity and quality of harvested forages.

In addition to the machine system, all equipment necessary for storing feed and determining their quality should be prepared: sanitary storage, ventilation units, weighing facilities, humidity and hay temperature control devices.

When harvesting and storing hay, the loss of nutrients is often reduced to 30-50%, and carotene is 70%. Particularly large losses occur during field drying. The goal of drying grass on the hay is to get not only a well-preserved product, but also to preserve as much nutrients as possible, approaching their original content in fresh plants, to produce feed with pleasant flavor and high digestibility.

The quality of the harvested hay depends on many reasons: the type of fodder crops, the timing of their cutting, the technology of harvesting and storage. Hay nutrition depends on the chemical composition of plants. Their dry matter contains ash elements, organic substances: proteins, fats, carbohydrates, vitamins and enzymes, which has a huge physiological effect on animals. In the dry matter of plants, the average nitrogenous compounds are 10-28%, carbohydrates – 50-70%, fats – 2,5-5,0%, ash – 2,5-4,0%, vitamins – 0,01-0,02%.

For more effective use of hayfields it is necessary to introduce cutting rotation. It is expedient to carry out selective cleaning of herbs on the hay without waiting for their harvesting ripeness on the whole haymaking process. Finishing the harvesting of herbs on the hay for each cutting period is necessary within 3-5 days.

To preserve the highest amount of nutrients in the hay, it is necessary to mow the herbs in a timely manner. The best timing of cutting cereal grasses – the phylloxera, legumes and herbs – the budding phase – the beginning of flowering. When cleaning grass mixtures are guided by the predominant components of herbs. It is impossible to prepare high-quality hay from herbs, inclined to the late phases of development, coarse, which have already lost a lot of nutrients. Untimely mowing of herbs leads to a lack of crop, a decrease in the digestibility and nutritiousness of hay (Table 19).

Table 19

Influence of the terms of mowing grasses on nutrient content and their digestibility, in % of dry matter,
(according to the data of the Institute of Forage)

Types of herbs and maturation time	Protein	Albumin	Cellulose	NFS
1. Perennial grasses				
Stem elongation	13,0 74,8	11,7 74,3	23,1 80,7	52,5 87,6
Initial blossom,earing	10,3 68,1	8,1 59,7	34,3 70,3	43,6 72,1
Blossom	9,3 60,0	8,1 60,7	37,7 63,1	46,0 69,4
After blossom	6,6 46,9	6,6 46,5	34,4 55,2	50,5 65,2
2. Medick				
Budding	19,3 81,3	16,4 84,9	20,1 42,4	47,5 79,4
Blossom	13,0 73,0	10,0 69,8	27,6 33,6	47,3 73,7

Note: in the numerator, the nutrient content, %; in the denominator – digestibility, %.

The data in Table 98 indicate that the optimal time for mowing herbs are: the phases of going into the tube, earing in grass, budding, and the beginning of flowering in legumes. A decrease in the relative protein content and an increase in fiber, lignification of the cell walls (lignification), a decrease in the ratio of the mass of leaves to the stems in the late phases of plant development reduces the digestibility of nutrients by 10-20%.

Hay harvest, its quantity and quality depend on the height of mowing of grass. It is recommended to mow the grass at the height of 5-7 cm from the soil surface. Such a cutting height of semi-upper and upper grasses provides an output of 85-95% of the mass of the entire above-ground part of the plants. Low-growing grass in the steppe zone is allowed to mow at a height of 3-4 cm.

Mowing is the first operation for all methods of harvesting hay. It is better to mow grass for hay with mowers-conditioners that perform three operations: mowing, flattening and roll laying. Legume grass and cereal-legume mixtures when mowing need to flatten. Flattening contributes to more uniform drying of leaves and stems, reduces drying time.

When mowing grass with mowers that perform only mowing in the swaths, it is necessary to rake the mowed grass into rolls to reduce exposure

to sunlight and reduce photochemical losses during drying.

The main task in the drying of grass is that, without allowing significant loss of nutrients, in the shortest possible time to reduce the moisture content of plants to 17%, i.e. up to such humidity at which the physiological, biochemical and microbiological processes are completely stopped.

In the process of drying, it is necessary to remove a large amount of water from plants - up to four tons per ton of harvested hay. In dry, sunny weather and fast drying, enzymatic and bacterial processes in fading grass cause a small waste of nutrients. In the case of protracted drying, the role of enzymatic processes greatly increases, which leads to large losses of nutrients. Natural drying of herbs in the field, even in sunny dry weather, is inevitably associated with significant loss of nutrients in harvested hay due to mechanical, physiological, biochemical and photochemical processes; digestibility and nutritional value of hay is reduced by 20-25% compared with freshly cut grass.

In the cells of oblique plants, physiological processes continue until the loss of turgor state, to about 50-55 moisture in legumes and 40-45% in cereal grasses. These physiological processes occurring in plants without water and nutrients from the soil, called “hungry metabolism.” During this period, the loss of vitamins reach 50%, readily soluble carbohydrates on the respiration of plants 20-30%. There is a partial decomposition of proteins.

With further drying and decreasing the moisture content of mowed plants below 50% in legumes and 45% in cereal grasses, autolysis begins - a deeper decomposition of organic substances under the influence of enzymes. Carbohydrates, proteins, fats, vitamins are oxidized to the original substances. Proteins under the action of proteolytic enzymes are decomposed into amino acids, which further decompose into ammonia and carboxylic acids. Carboxylic acid decomposition products are carbon dioxide and water.

The end products of fat decomposition are carbon dioxide and water. The final products of starch hydrolysis are glucose, which, upon further oxidation, decomposes into the starting compounds, carbon dioxide and water. The glucose oxidation reaction is expressed by the following equation:

$$C6H12O6 + 6CO2 = 6CO2 + 6H20 + 674\ Kcal$$

Thus, during the biochemical process – autolysis, complex organic substances are oxidized in plants to the initial compounds, and nutrient substances are lost: proteins, fats, carbohydrates, vitamins in the form of carbon dioxide, water and ammonia.

The decomposition of organic matter releases energy. The oxidation of 1 g of carbohydrates releases 4.2 Kcal (17.6 KJ). 1 g of fat – 9.3 Kcal (38.9 KJ).Heat released from dried plants is removed by wind into the atmosphere. The process of autolysis continues until the moisture content of the cut plants decreases to 17-18%. If the hay is snowed at a moisture content of more than 20%, then the heat released during autolysis leads to self-heating of the hay. Autolysis and thermophilic bacteria can raise the temperature of hay to + 90ºC, before charring and even spontaneous combustion is possible.

The technology of harvesting hay should be based on the regularities of water return by mowed plants and physiological and biochemical processes occurring in the plants being dried at each stage of drying, depending on their properties.

First, free water (from capillaries and other conducting vessels) is evaporated very quickly and easily from the surface of mowed plants. Grasses very quickly, in 5-8 hours, wilted to a humidity of 40-45%, and legumes – up to 50-55%. After that, the rate of return of water decreases, because the evaporation of adsorption water from the inner layers of plants occurs much more difficult.

The leaves of the grass, having a large surface area and a small thickness, dry much faster than the stems. By the time of drying, the last leaves dry up to a moisture content of 10-12%, crumble when harvesting hay and are lost as the most valuable part of the plants. These mechanical losses are especially significant when harvesting loose hay during natural field drying, at which the losses of vitamins from exposure to sunlight are also large.

The speed of drying of mowed plants depends on their morphological features, chemical composition and technology of hay harvesting. If the mowed grasses fall under the rain, then the process of autolysis lasts a long time and is accompanied by a huge loss of nutrients in the hay. Along with autolysis, microbiological processes can develop on plants moistened with rain, which leads to hay blackening and molding. That is why when preparing it you should strive to reduce drying to the minimum possible. Tricks that shorten the drying time include flattening of legumes and grass-legume mixtures when mowing, agitating and wrapping the rolls of mowed plants. Mower-conditioners stack mowed grass in a dense swath, in which they slowly dry. To speed up the drying, it is necessary to agitate the rollers with the GVR-6 rake-agitators during midday hours (from 11 to 16 hours), when drying is faster. If necessary, re-agitate the rolls, but to a moisture content of mowed plants not lower than 40% for legumes and 35% for grass grasses. When the moisture content of

the grass is less than 35%, when turning, the leaves and inflorescences are crumbling, the mechanical loss of hay increases.

Turning is necessary on high-yielding hayfields, especially in irrigated areas, where the rolls of mowed plants are stacked in a thick layer. During this process grass becomes more friable, better blown by the wind, drying occurs more evenly and faster.

If field dry hay is harvested, then at grass moisture in rolls of 20-22%, they should be picked up in stacks, loaded onto vehicles and transported to storage sites. In the hay dumps, the hay is unloaded and placed on the ricks. In the process of copying, transportation and stacking, hay dries to a moisture content of 17-18%.

The above-described technology of harvesting non-pressed hay is associated with multiple mechanical impact operations, in which the loss of the most valuable parts of plants – leaves and inflorescences – is inevitable, especially when harvesting hay from legumes. Therefore, due to the growth of the technical equipment of agriculture, this technology should be considered imperfect.

To reduce losses during the harvesting of hay, a more progressive method is used – pressing. Pressed hay has a number of advantages over loose: mechanical losses are reduced by 1.5-2.0 times, since the crumbling of hay stops after pressing. Pressed hay contains more nutrients and vitamins.

It is very important not only to prepare high-quality food, but it is equally important to preserve it before feeding. Therefore, the organization of storage of hay is an integral part in the technology of its harvesting.

Sometimes well harvested hay is poorly stored and loses its nutritional value. For example, during stacking, an uneven compaction or poor termination of the rye is allowed, which leads to significant soaking of hay with rain, which in this case is warmed in separate foci, moldy, and even spontaneous combustion can occur. In some cases, hay is stored in sheds with a bad roof, which also leads to soaking it with precipitation and loss of nutrition.

Storage of hay is advisable not in the field, but closer to livestock farms, on specially equipped sites. Hay must be well cast or folded in covered hay storage. For the purpose of fire safety and reliable hay preservation, it is advisable to place it not in one place, but in two or three spaced apart prepared places.

Before starting the harvesting of hay, platforms are prepared for its storage. The area under the ricks should be profiled, raised above the main surface of the hay deposit. Around the stacks arrange drainage grooves with a bias in one direction.

The hay storage should be separated from the surrounding area by a ditch and fenced in order to prevent animals and unauthorized persons from accessing the hay.

It is very important to comply with fire safety during harvesting and storage of hay. All tractors and cars must be equipped with spark arresters, it is forbidden to repair hay and other equipment on the territory of the hay storage, smoking is prohibited. Lightning arresters should be installed on at least two sides on the territory of the hay storage and proven fire extinguishers should be available. The spatial distance of the skids from each other is not less than 20 m, and between the rows of the skids – not less than 30 m.

To check the quality of harvested hay, samples are taken, guided by the state standard for hay – OST-10243-2000-hay.Selected samples are sent to the laboratory to determine the quality of hay.

The appearance and color of hay is determined visually in natural daylight illumination. The color of hay from seeded legumes and grass-legumes should be green, greenish yellow to light brown, for grass and hay from natural forage lands – from green to yellow-green.

Hay in appearance and smell should be without signs of burning, without musty and moldy smells. The smell of hay is determined organoleptically. If stagnation is suspected, the hay is placed in a glass jar, filled with hot water and closed for 2-3 minutes. Then the water is drained and determine the smell of heated hay.

The remaining indicators of hay quality are determined using instruments and reagents in the laboratory.

12.2 Technology of preparing haylage

Haylage – canned food prepared from 45-55% of plants dried to moisture content and stored in isolation from air. In appearance, haylage is a semi-dried and crushed plant of a yellowish-green color with an acidic odor.

Haylage is a valuable feed for farm animals. In the diets of dairy cows with silage and haylage type of feeding, on average, it makes up 20-25% of the daily ration. Haylage is nutritionally close to green fodder, it retains the most nutritious parts – the leaves and inflorescences of plants. 1 kg of haylage from grass-legume mixtures contains 0.25-0.30 feed. units, 28-32 g of digestible protein, 20-25 g of sugar, 3-5 g of calcium, 1-2 g of phosphorus, 25-30 mg of carotene.

Preparation of haylage is a progressive, cost-effective method of harvesting roughage. With strict compliance with the technology of laying haylage nutrient loss does not exceed 10-15%. Especially great is the

importance of haylage in the conditions of industrial complexes for the production of milk and meat, since it has excellent technological properties and lends itself well to mechanized distribution.

The best crops for this are perennial leguminous grasses and their mixtures with cereals, mixed crops of cereals and leguminous annual forage crops. An important place in the feeding of dairy and fattening livestock is given to haylage from grain crops: pea and vetch oat, pea barley and other legume-cereal mixtures of forage crops. This method of using grain crops for haylage is more effective than separate harvesting of fodder crops for grain and straw.

Preparation of haylage should be preceded by organizational work. First of all, this is the creation of a material and technical base, since obtaining high-quality haylage is possible only under the condition of the complex mechanization of all processes. There must be in the required number of high-performance machines, especially domestic or imported forage harvesters: Don-680, KSK-600, Polesie-280, John Deere, etc., concrete trenches and the necessary number of vehicles.

When planning a haymaking plan, the availability and capacity of the storage facilities and the timeframe for filling each one are taken into account. The capacity of each trench should be such that with the existing technology it can be filled in 3-4 days. The height of the trench should be at least 4 m in order to reduce the ratio of the surface area of the haylage to its mass, which ensures better safety of the feed. With a daily laying of haylage with a layer of at least 1 m, the period of filling the trench should not exceed 3-4 days. The width of the trench depends on the method of loading and extraction of haylage. The length is determined by the technical capabilities that ensure the filling of the trench in 3-4 days. An increase in the period of filling the trench for more than 4 days leads to a strong self-heating of the haylage, an increase in nutrient losses during biochemical enzymatic processes in plant cells, and a decrease in feed digestibility.

When checking the readiness of storage facilities, special attention is paid to the tightness of the walls at the joints of the plates, the embankment of the walls of the trenches with soil and access roads to trenches that should be covered with asphalt or concrete.

Before starting work, it is necessary to instruct workers on the technology of haylage harvesting, assign a technician responsible, who is obliged to keep records of loading times for trenches, monitor the temperature of haylage during laying. It is necessary to have moisture meters for constant control over the humidity of the dried plants of fodder crops in the rolls and when filling the trench.

Technology haymaking includes the following operations:

1. Mowing feed crops in rolls.
2. Drying mowed plants in rolls to a moisture content of 55%.
3. Selection of dried plants with simultaneous grinding and loading into transport.
4. Transportation of shredded plants to trenches.
5. Loading crushed plants into trenches with simultaneous tramming.
6. Sealed shelter of haylage in filled trenches.For harvesting haylage, it is more expedient to use leguminous herbs: clover, medick, sainfoin, etc. The cereal-legume mixed crops of annual forage crops are widely used for harvesting senage.

The quality of harvested haylage, its palatability and nutritiveness largely depend on the timing of the mowing of feed crops.

For harvesting hay, you can mow grass earlier than when preparing hay and silage. Legumes for haylage need to be mowed at the beginning of budding and finish cleaning at the beginning of flowering. Grasses should be mowed in the booting phase and finished at the beginning of the earing. Haylage from grasses skewed in the stage of booting of cereals and budding legumes contains 0.8-0.9 feed per kg of dry matter units (tab. 20).

Table 20

Nutritiousness of haylage from the herbs cleaned in different phases of vegetation

Types of grass	Cleaning phases	Content in 1 kg dry substance of haylage	
		Feed units	digestible protein, g
Clover-timothy grass mixture	Steamingclover	1,0	138
	Budding	0,87	85
	Clover blossom	0,67	62
Medick	Budding	0,85	140
	Clover blossom	0,81	116
Clover	Initial budding	0,93	142
	Budding	0,86	123
	Initial blossom	0,76	104

Herbs skewed in the flowering phase already contain 30 percent or more of the fiber in the dry matter, the relative amount of protein in them decreases, the total nutritional value of 1 kg of dry matter is 0.5-0.6 feed. units

The best term for mowing of legume-cereal mixtures of annual forage crops is the end of dairy - the beginning of the wax ripeness of a

grain of cereal crops. The high dry matter content during this period does not require drying of the plants, and they immediately after mowing are suitable for haylage preparation. Later harvesting is undesirable because it reduces the nutritional value of the feed due to the accumulation of large amounts of fiber, reducing the digestibility of nutrients and the amount of carotene.

Legume grasses and legume-cereal grass mixtures when mowing must necessarily be flattened to speed up and evenly dry the stems and leaves.

In the process of drying the mowed plants, changes in the composition of the mown plants and loss of nutrients occur. The total losses of individual nutrients during wilting during the day, with the exception of carotene, are insignificant and do not exceed 2-3%. These are losses from physiological and biochemical processes. Mechanical losses depend on the characteristics of the plants, the degree of wilting, the complex of the machines used, the method of harvesting, and can reach significant sizes up to 12-20%.

To speed up the drying process, it is necessary to apply turning of the rollers with various turners, as the grass fits into a tight swath, especially after flattening, and dries poorly. The longer the drying of mowed plants, especially in less favorable weather, lasts, the greater the loss of nutrients, especially vitamins and soluble carbohydrates, and the fiber content increases.

As the degree of drying increases, the protein content decreases. The staff of the research institute established the following dependency:

grass moisture, %	76,5	57,7	49,9	41,0	24,0	15,2
protein content, % dry matter	17,0	16,3	14,5	13,4	11,4	8,4

There are various recommendations regarding the degree of grass drying for haylage. Some consider the upper limit of plant moisture at which haylage should be stored – 60%, others – 55%, and others – 50%.

According to many studies, the quality of haylage varies slightly as at plant moisture 50% and 60%. With the observance of technology, haylage is of high quality.

Under production conditions, sometimes haylage is applied when plant moisture is below 50%, justifying this by reducing nutrient loss during fermentation in the canning process and increasing feed intake by animals while increasing the proportion of dry matter in the haylage. Theoretically, this statement is true, but in practice it is not implemented. First, when

plants are dried in the field to a moisture content below 50%, biochemical losses increase during autolysis. Secondly, according to experts on feeding, the palatability of haylage increases only with a decrease in humidity to 60%. Reducing plant moisture below 60% does not increase the palatability of dry matter haylage. Thirdly, the drying of plants below 50% leads to an increase in mechanical losses in the selection, grinding and transportation, complicates the haylage compaction in trenches. Therefore, harvesting hay with plants at a moisture below 50% does not increase its digestibility and nutrition.

The upper limit of the humidity of dried plants over 60% is also considered impractical. Under production conditions over large areas, it is difficult to determine the humidity of all dried plants with an accuracy of up to 5% and with an average humidity of 60-65%, individual parts of plants can contain up to 70% of water. With such plant moisture, physiological dryness of the environment is not created and the intensive development of microorganisms in the haylage, including putrefaction, is possible, which leads to significant nutrient loss by fermentation and to a decrease in the quality of the haylage.

Based on the foregoing, it can be concluded that haylage should be laid at plant moisture not higher than 60% and not lower than 50%.

When selecting dried plants for harvesting haylage they need to be crushed. Crushed plants are better compacted in trenches, the air from haylage is removed more completely. Chopped haylage is easier to unload from storage and mechanize the distribution of animals. Layinghaylage in trenches, the amount of grinding plants depends on their humidity. When the humidity of the plant is 55-60%, it is necessary to grind into segments of 7-10 cm, and if the humidity is below 55%, it should be 2-3 cm so that the haylage is better compacted during tamping.

For transporting crushed plants from the field to trenches, self-unloading heavy-duty vehicles and other dump trucks and semi-trailers are more suitable. The sides of the body of universal vehicles must be fitted and covered with a frequent net, which significantly reduces the blowing and loss of shredded plants. To reduce losses, the opposite side of the vehicle picker-chopper is equipped with a visor to the height of the chopper unloading tube. Vehicles need to be unloaded without driving into a trench in order to less pollute the haylage. In land and semi-buried trenches, it is better to unload the vehicles at their butt, and then move and level the haylage with a bulldozer. In the recessed trenches, the vehicles are unloaded from the sides, then they are leveled with a bulldozer throughout their area.

The crushed plants laid on haylage in trenches must be continuously tamped first and to the end of filling, without ceasing tamping

at night. This is necessary for the displacement of air from haylage, which is one of the main conditions for the successful preservation of haylage with minimal loss of nutrients and vitamins. It is better to carry out tamping with heavy track-type tractors with dozer attachments.

Every day it is necessary to fill the trench with haylage not less than 1 m of its height, so that the trench with a height of 4 m to fill in 3-4 days. Laying haylage with a layer of less than 1 m per day and an increase in the time it takes to fill one trench for more than 4 days leads to self-heating of the haylage. In plants, when humidity is below 60% and with the access of atmospheric oxygen, the respiration of plants is enhanced, biochemical processes take place more intensively, therefore more heat is released when organic substances are decomposed. With the access of air, the self-heating of haylage also occurs as a result of the vital activity of thermophilic bacteria, the development of which dramatically increases when the haylage is heated to +50 °C. With the complete decomposition and oxidation of 1 g of carbohydrates 4.2 kcal is released, 1 g of fat – 9.3 kcal. In a trench with insufficient compaction and access of atmospheric oxygen, haylage is quickly warmed.Due to the heat released by plants when breathing, haylage per day can heat up to +50 °C and higher. When the haylage is heated to +80, +90 °C, charring begins. At the same time, flammable gases are emitted – hydrogen and methane, which can cause a haylage to ignite. Self-heating of haylage up to +50 °C and higher dramatically reduces the digestibility of nutrients, vitamins are almost completely decomposed.

According to the reference book “Feed” (1977), heating the haylage to +50 °C reduces the digestibility of protein from 65-70% to 10-15%, nitrogen-free extractive substances from 80-85% to 50-56%. When self-heating of haylage to +80 °C, haylage becomes unsuitable for feeding.

Heating of the haylage may not stop even with a thorough tamping, if the laying technology is violated. First, it can be in the case of drying the plants to a moisture content below 40%; secondly, when laying a small amount of haylage per day, less than 0.8-1.0 m in height of the trench. In a well-compacted haylage, self-heating is stopped only when a layer of at least 1m is loaded and tamped daily.

When self-heating of haylage to +45, +60 ºC, there is a strong change in proteins and amino acids with the access of atmospheric oxygen. With a non-airtight shelter, mold fungi are developing intensively, which by their enzymes decompose the organic matter of plants with the formation of indigestible, and often harmful, and toxic to animal substances. With the access of oxygen in the air, chemical processes of oxidation, decomposition of organic substances take place with the formation of compounds of

various oxidation states (oxides, peroxides, alcohols, aldehydes and various acids), the activity of enzymes that cause abnormal plant cells, transformation of substances and The food quickly deteriorates within 2-3 days. In case the temperature of the haylage rises above +37 °C, it is necessary to urgently increase the tamping. If the plants are over-dried and not compacted, it is necessary to lay fresh-cut grass with a layer of 25-30 cm to stop the penetration of air into the lower layers and speed up the filling of the trench, mixing the dried-up grass with freshly cut.

An indicator of normal conditions and compliance with the technology of laying hay is the temperature of compacted hay, which should not exceed +37 °C. The temperature must be monitored for maximum thermometers.

In compacted haylage, gaseous products, mainly carbon dioxide, accumulate in the trench more than 1.5 times as heavy as air. Therefore, it prevents the penetration of air into the deep layers of hay. But in the surface layer, as the temperature and wind change, carbon monoxide volatilizes, which is replaced by atmospheric air, which increases the oxidation of nutrients to decomposition products: carbon monoxide, water, ammonia, methane, etc.

Haylage is preserved due to the resulting physiological dryness of dried plants to a moisture content of 50-55%. With such humidity, the sucking power of the cells reaches 52-55 atm., While the majority of putrefactive bacteria cannot develop their livelihoods. Mainly lactic acid bacteria continue to be produced in limited quantities, and mold fungi, which possess great sucking power, develop especially rapidly. Mold fungi are compulsory aerobic microorganisms, therefore haylage must be hermetically covered to prevent their development.

It is recommended to fill trenches above the edges by 1.0-1.5 m, carefully tamping. It is better to lay the top layer of 20–30 cm of freshly mown plants, sprinkle salt of 250–300 g per 1 m2 onto the surface of the haylage, and carefully cover the haylage with a continuous canopy of polyvinyl chloride opaque film. The edges of the film are deepened between the wall of the trench and haylage. If the trench is recessed, then the edges of the film are laid on the ground behind the walls of the trench and sprinkled with earth. The surface of the film on the trench is covered with soil, dry peat or sawdust with a layer up to 10 cm, bales of straw so that it does not sway from the wind and prevent air from penetrating into the haylage.

Sampling to determine the quality of haylage is carried out no earlier than 4 weeks after the end of the bookmark and no later than 10 days before the start of feeding to animals. The rules for sampling are set out in

OST-10201-97. Haylage.

When unloading haylage for feeding animals, it is necessary to follow the established rules to prevent self-heating and deterioration of feed quality. When the storehouse is opened, the gases accumulated in the haylage, mainly carbon dioxide, evaporate, and atmospheric air penetrates into the haylage, which contributes to the development of mold fungi and the renewal of autolysis in plant cells.

To prevent a decrease in the nutritional value of haylage and its molding, it is necessary to remove the shelter gradually and cut off the haylage by narrow vertical layers along the entire width and height of the trench. Every day you need to use a layer of haylage of at least 30 cm.

Before unloading the haylage from the trench, it is necessary to carefully cut the necessary layer for 1 day without breaking the cover and compaction of the rest of the haylage. When you stop using open haylage, it begins to heat up and mold, the temperature can rise to + 50 ° C and higher at a distance of 1.0-1.5 m from the cut along the length of the trench under the film. It is especially dangerous to leave open haylage in the warm season.

Unloaded haylage for feeding animals must be used within one day, because in the air it quickly loses its nourishment, molds and can cause animal poisoning.

12.3 Silage harvesting technology

Silage – succulent feed prepared from various fodder plants by the method of biological preservation and stored in trenches or towers in isolation from air access.

In terms of nutritional value, silage approaches green fodder and is very valuable for animals in winter. Quality silage is a reliable substitute for fresh green fodder in the diet of not only cattle, but also other animals. In comparison with other types of feed, carotene and physiologically active substances are better preserved in it. The more dry matter in silage plants, the higher the nutritional value of the silage. So, in 1 kg of silage from corn harvested in different phases of development, nutritional value ranges from 0.17 to 0.30 feed. units, 12-15 g of digestible protein. The silage in the annual structure of the rations of the silage-haylage type of feeding dairy cows is 20-30% in nutritional value, i.e. 15-20 kg per day per animal. Silage improves digestibility and nutrient absorption of coarse and concentrated feed.

Silaging is one of the methods of preserving and storing succulent feeds: perennial grasses, annual forage crops, root crops, tubers, etc. Silage,

preserved with the observance of technology, is stored for a long time without losing its quality.

Fodder plants containing the necessary amount of sugars for fermentation and increasing the acidity of the silage to pH = 4.2 are better suited for ensiling. At pH = 4.2 and below, most putrefactive microorganisms do not develop. For different groups of microorganisms, the limiting acidity at which they cease their livelihoods is different.

It was important to establish the amount of sugars, which should be in the silage plants, so that when they are fermented by microorganisms, the lactic acid formed increases the acidity of the silage to pH = 4.2. A. A. Zubrilin (1947) divided the fodder crops into three groups according to silability. In the first group, he included those plants that have a sugar content, even when leaving it, 60% lactic acid is sufficient for ensiling. This is a group of lightly sprouting plants: maize, sorghum, sunflower, Sudan grass, melons, perennial grasses, and roots.

The second group includes those plants whose actual sugar content is sufficient for ensiling only under the condition of 100% output of lactic acid from it. This is a group of difficult to ferment plants: legumes in the budding phase, leguminous grass mixtures in the early phases of development.

The third group of non-sylped plants includes plants whose sugar content, even when it is completely converted to lactic acid, is less than the required amount. This group includes soybeans, tops of melons and potatoes, and medick before the flowering phase.

This theory is A. A. Zubrilin called the theory “of the sugar minimum” when ensiling. By “sugar minimum” is meant such a sugar content in green plants, which is necessary for the formation of lactic acid during fermentation in an amount necessary to lower the pH to 4.2, with a specific buffering capacity of the fermented raw materials.

For the normal ensiling of different crops, different acidic acidification is required, different amounts of organic acids being formed, in order to lower the pH to 4.2. This is due to the different buffer properties of plant sap. The role of buffer substances is performed by various salts and organic substances, for example, proteins. In their presence, a significant portion of the hydrogen ions is neutralized. The buffering capacity of plant sap is directly dependent on the amount of proteins in them. Therefore, most leguminous plants are harder to ensil, especially at more than 75% moisture.

With silage plants in the repository gets a huge variety of microorganisms. Depending on the type of plants, their pollution and other conditions for growing, mowing and transporting in one gram of silage plants there can be from several thousand to several millions of different

microorganisms that develop their livelihoods, being competitors for food sources.Among lactic acid bacteria, there are homofermentative, forming from water-soluble sugars, mainly lactic acid with release of carbon dioxide. These bacteria are particularly desirable for the ensiling process, as they ferment sugar into lactic acid with less energy loss. Lactic acid is the main preservative in ensiling. It has dietary properties, is a stronger acid, less sugar is required for its formation than for acetic and other organic acids.

The fermentation of sugar by homofermentative lactic acid bacteria on the final products can be expressed by the equation:

$$C_6H_{12}O_6 = 2CH_3CHOHCOOH + 21\ Kcal$$

Heterofermentative lactic acid bacteria ferment sugars to form not only lactic acid, but also acetic acid and alcohol:

$$C_6H_{12}O_6 + H_2O = CH_3CHOHCOOH + CH_3COOH + CO_2 + 2H_2$$

$$C_6H_{12}O_6 = CH_3CHOHCOOH + CH_3CH_2OH + CO_2$$

Heterofermentative lactic acid bacteria accumulate up to 50% of sugar into lactic acid, up to 16% into acetic acid, 10-20% into alcohol, and up to 30% into carbon dioxide (Zafren S. Ya., 1977). The formation of carbon dioxide, which volatilizes from the silo, means the loss of nutrients from the silage plants. On fresh plants in the first days of silage, bacteria of the group of Escherichia coli develop, which are introduced with the soil, with irrigation water. They ferment carbohydrates partially into lactic, but more into acetic acid with the release of a large amount of gases. They decompose and protein with the release of ammonia, indole, skatole and other toxic products with an unpleasant odor.

When ensiling, oily and sour bacteria are dangerous competitors of lactic acid bacteria, they ferment sugar to oily acid, carbon dioxide and hydrogen:

$$C_6H_{12}O_6 = CH_3\text{-}CH_2\text{-}CH_2\text{-}COOH + 2CO_2 + 2H_2$$

Butyric acid bacteria ferment not only sugars, but also formed lactic acid:

$$2CH_3\text{-}CHOH\text{-}COOH = CH_3\text{-}CH_2\text{-}CH_2\text{-}COOH + 2CO_2 + 2H_2$$

With this fermentation, a large amount of gases is released, which means the loss of nutrients in the silo. Acidity is reduced, because of the two molecules of lactic acid formed one molecule of butyric acid, which is weaker than lactic. Therefore, the acidity of the silage does not increase to pH = 4.2, the loss of nutrients increases, toxic substances accumulate.

Of the type of butyric acid bacteria, proteolites are especially undesirable in ensiling, which ferment not only sugar and lactic acid, but also proteins, the decomposition products of which are toxic substances, including ammonia, which neutralizes the resulting organic acids, reduces

the acidity of silage. The development of oil-acid bacteria stops at pH = 4.5-4.7, they are covered by spores and stored in the silo for a long time.

Silage plants contain a large number of putrefactive bacteria, which, apart from carbohydrates and lactic acid, decompose mainly proteins to carbon monoxide, water, ammonia and amines.

An unpleasant odor that appears when rotting is caused by the formation of intermediate decomposition products of proteins, many of which have a fetid odor and are poisonous: cadaverine, skatole, indole.

In a silo, there are always large quantities of yeast (Saccharomyces), which ferment sugars and lactic acid to ethyl alcohol and carbon dioxide:

$$C_6H_{12}O_6 = 2CH_3CH_2OH + 2CO_2$$

In addition to ethyl alcohol in the process of alcoholic fermentation, other substances are also formed, including toxic ones.

Intensive reproduction of yeast in a silo occurs with an increased moisture content of silage plants (75% and above) and a high content of sugars (Table 21).

Table 21

The development of yeast in corn silage with various water content and sugars (Dzhumanazarov B. N., 1981)

Corn moisture content,%	Sugar content in corn,%	Number of yeast cells in 1 g of silage, thousand pieces			
		after 48 hours	after 6 days	after 15 days	after 30 days
66,1	2,15	unit	no	no	no
67,9	5,68	0,9	no	no	no
87,9	2,27	32,2	2517	85,5	unit

Mold fungiare very dangerous microorganisms during ensiling. Moldy silage is unsuitable for feeding to animals. Mold fungi inhibit the reproduction of lactic acid bacteria, decompose carbohydrates, lactic acid to carbon monoxide and water, promote the decomposition of proteins, which leads to a decrease in acidity and silage quality. Mushrooms produce toxins, which are most often formed during ensiling in land pits and in the upper layers of silo trenches with poor compaction and leaking shelter. Mold fungi are obligate aerobic microorganisms; therefore, their development indicates the absence of an airtight silo shelter.

Thus, in the silo, along with the useful lactic acid bacteria, there are in large quantities undesirable microorganisms for preservation: oil butyric and putrefactive bacteria, yeast and mold fungi. Depending on the

observance of technology, various groups of microorganisms, on which silage quality depends, may prevail during ensiling.

The basis of the biological method of canning is lactic fermentation caused by various groups of lactic acid bacteria. Multiplying, lactic acid bacteria in the course of their life ferment sugars.In the process of this enzymatic fermentation, various substances are formed, among which lactic acid prevails. Being a strong organic acid, it inhibits the development of other microorganisms, first of all, butyric and other putrefactive bacteria, which decompose proteins and release toxic substances into the environment. Therefore, all technological methods should be aimed at creating optimal conditions for the development of lactic acid bacteria and elimination of the vital activity of harmful microflora. For this you need to know well the features and conditions of development of these groups of microorganisms.

The optimal conditions for the life of lactic acid bacteria are the following:

Optimum humidity – 60-70%;

The optimum temperature – +30, + 35 ° C;

The need for oxygen is better fermented under anaerobic conditions;

The optimum acidity is pH = 3.3-5.6.

Lactic acid bacteria better than other microorganisms tolerate a decrease in the moisture content of raw materials up to 50%.Knowing the optimal conditions for the life of lactic acid bacteria, it is necessary when preparing silage to strive to ensure that the moisture content of the raw material is in the range of 60-70%. This moisture of silage plants is optimal for lactic fermentation, and low for yeast fungi, butyric-acid and other putrefactive bacterias.

When the moisture of silage plants is above 80% and with an excess of sugars, the silage is quickly acidified within 2-3 days of ensiling to pH = 3.5-3.3 and the activity of lactic acid bacteria is suppressed, and yeast, which can ferment sugars and lactic acid at pH = 2.5-3.0, develop more actively, which leads to large losses of sugars and starch.

It is believed that the faster and stronger the silage is acidified, the lower the loss and more resistant silage. However, this statement is true only for those cases where the silage plants have a moisture content of 65-70% and a normal amount of sugar, the so-called “sugar minimum” for acidifying silage to pH = 4.0-4.2.

If silage moisture is higher than 75%, which is favorable for yeast, then they ferment the remaining sugars and lactic acid, which leads to a decrease in silage acidity and the development of putrefactive bacteria.

Such silage rots, becomes unsuitable for feeding animals. The development of yeast fungi can be limited by reducing the moisture content of silage plants to the optimal 60-70%. Reducing the humidity of fermented plants below 70% contributes to the inactivation of the vital activity of putrefactive and butyric acid bacteria, which ensure the putrefactive decomposition of proteins with the formation of ammonia and fatty acids. Inactivation of mold fungi is achieved by airtight silo cover.

When silaging silage plants with an optimum moisture content of 60-70%, acidification of silage to pH = 4.0-4.2 occurs quickly, which eliminates further vital activity of putrefactive and butyric acid bacteria.

Silo harvesting technology includes the following operations:

1. Mowing silage crops with simultaneous grinding and loading into vehicles.
2. Transportation of crushed plants to the place of silage.
3. Loading silage plants in storage.
4. Silage tamper.
5. Sealed silo shelter.

The timing of mowing fodder crops have a great influence on the quality of harvested silage. Perennial grasses need to be mowed during flowering, especially legumes, since they used to be poorly ensiled before the flowering phase. Compared with the budding phase, the nutritional value of herbs in the flowering phase decreases, the fiber content increases. Therefore, it is more expedient to use perennial legume herbs for making haylage. Perennial grasses can be used for harvesting silage after pre-drying. Perennial grasses, dried to 50-55% moisture, are silted together with silage crops: maize, root crops having high humidity during harvesting.

To regulate the moisture of silage plants and improve the quality of silage from corn and root crops, you can mix with them during sowing annual feed crops, for example, peas with oats, dried to a moisture content of 50-55%. The optimal time for harvesting multicomponent crops for silage is the beginning of the wax ripeness of the grain of cereal components.

The optimal time for mowing corn for silage is considered to be the beginning of the wax ripeness of the grain, when the humidity of the plants does not exceed 70%. To obtain corn with ears at the beginning of wax ripeness in the conditions of Western Siberia, it is necessary to introduce early-ripening and medium-early hybrids.

The conditions of Western Siberia are characterized by early autumn frosts. Many farms, sowing large areas of corn, begin to harvest it to silage before the onset of optimal technological ripeness, which leads to a shortage of crops and low-quality silage. Corn during this period has a high

humidity (80-85%), juice leaks during mowing, grinding, transportation and tamping.Silage of corn at a moisture content above 80% leads to enhanced development of butyric acid bacteria and yeast fungi; the silage is obtained with poor quality, with the content of butyric acid and other toxic substances formed during the decomposition of proteins.

If, due to weather conditions, corn is forced to be harvested into earlier phases with more than 75% moisture, then to improve the quality of the silage and reduce the moisture it should be silage with dry ingredients: dried forage crops or with chopped straw of cereal and leguminous crops. At high humidity of raw materials, the loss of dry matter during ensiling is greatest. They increase especially when the moisture content of silage materials exceeds 80%, when there is a large amount of sap from plants when mowing, grinding, transporting and tamping in trenches.

It is recommended to harvest rape in silage in the phase of fruit formation. During this period, rapeseed plants have a humidity close to the optimum for ensiling, the protein content is reduced to 10-12%, sugars to 7% by weight of absolutely dry matter.

Sunflower silage must be removed no later than the flowering phase of half of the plants. Joint crops of sunflower with fodder millet, vetch-oat mixture, which are planted in between the rows of sunflower after the first inter-row processing, are more expedient for silage.

The technology of ensiling high moisture feed should include measures to reduce the release of sap from plant cells. The latter can be achieved by reducing the moisture content during drying, which is successfully used on fine-stem herbaceous plants of the usual ordinary method of sowing. Cultivated tilled crops – maize, sunflower, and root crops – cannot be mown for drying in the field, as they are heavily polluted with soil, which leads to the development of undesirable microbiological processes during silage and degrades the quality of the silage. Consequently, the technology of ensiling excessively wet plants should be aimed at preventing or limiting the excretion of cell sap.

The intensity of juicing in a silo is greatly influenced by the degree of grinding of plants, the density of laying and the height of the silo in the trench. Grinding of silage plants with a moisture content of more than 75% into segments of 20-30 mm is impractical, as this leads to an intensive release of juice, which creates favorable conditions for butyric acid bacteria and yeast.

Grinding of silage plants should be different depending on their humidity. Grinding should provide the necessary density of silage laying, but without abundant isolation of cell sap.

Plants with humidity above 75% should be ground into pieces of

70-120 mm. With such large shredding, juices are reduced and nutrient losses are reduced. When ensiling corn, skewed in the early phases at a humidity of 80-85%, fine grinding in segments of 20-30 mm leads to large losses of dry matter and a decrease in the quality of silage.

When harvesting plants with a humidity of 60-70%, fine grinding is necessary for segments of 30-50 mm, so that when tamping, they are better compacted, the air from the silo is more fully displaced.

The degree of compaction of the force is also of great importance in ensiling. The denser the silage in the trench, the less air remains in it. This means that physiological and biochemical processes that occur in the presence of atmospheric oxygen and lead to significant loss of nutrients cease faster in plant cells.

When the humidity of silage plants is not more than 70%, compaction does not greatly change their physicochemical state. When humidity is more than 75-80%, when tamping occurs, enhanced secretion of juice from plants occurs, which contributes to the active development of yeast and putrefactive microorganisms, especially butyric acid bacteria, to the accumulation of butyric acid and toxic substances during the decomposition of proteins. This means that when ensiling plants with a moisture content above 75%, the tamper should be moderate, not resulting in the release of sap from the plants.

When the humidity of silage plants below 70% tamper should be intense. Silage compaction is a positive factor only prior to the start of juice extraction from plants.

Every day, you need to lay the silage in a trench with a layer of at least 80 cm to prevent it from self-heating. To obtain high quality silage, filling one trench needs to be completed in no more than five days.

When laying it is necessary to monitor the temperature of the silo, which should not exceed +36, +37 °C. Increasing the temperature to +40 °C and higher leads to large losses of nutrients and a decrease in their digestibility in the organism of animals. The prevention of self-heating of silos above +38, +40 °C is one of the most important requirements of the silage technology and the production of high-quality silage.

After filling the trench, the silo must be hermetically sealed. The best material for sheltering a silo is a polyethylene film, which is glued together in a continuous canopy and thoroughly pressed down with a layer of up to 10 cm. Air insulation is an indispensable condition for the successful preservation of the silo, eliminating the breathing of plants and self-heating of the silage, preventing the development of mold fungi and aerobic bacteria. Unsealed shelter leads to an increase in silage temperature above +37 °C. The higher the silage temperature, the greater the loss of

nutrients, the lower the digestibility and nutritional value of the silage. In order to prevent the freezing of the silage in case of frost, the trenches are covered with straw.

When complying with the silaging technology of lightly feeding forage plants, there is no reason to fear silage damage. When silos are difficult to silage plants (legumes, soybeans, lupins, melon tops), the silage is not acidified, therefore a reduction in feed quality is possible. With insufficient acidification, butyric acid bacteria develop in the silo, for which the optimal conditions are an anaerobic environment at pH = 4.7–8.5.

To preserve feed, it is necessary to affect plants in two directions: to stop the action of enzymes in cell sap and inactivate the microflora on plants.

Sealing and acidity of silage at pH = 4.2-3.7 are the main factors determining its safety and quality. If, for some reason, the acidity of the silage drops to pH = 4.7, then this will inevitably lead to its deterioration, since favorable conditions are created for the oil-acid bacteria. Silage depressurization contributes to the development of mold fungi and activation of enzymatic activity in plant cells.

One of the ways to reduce losses and improve the quality of the silo during its preparation is chemical preservation. It allows you to prepare high-quality silage from early-harvested forage plants with a high content of digestible protein, for example, from perennial cereal-legume grass mixtures.

When choosing preservatives should be guided by the following points:

1. The preservative should not have a negative effect on the health and productivity of animals.
2. The preservative should be completely destroyed, not giving the feed a non-pleasant smell and taste, not accumulate in food.
3. The preservative should be safe during transportation, suitable for mechanized introduction into the prepared feed.
4. The preservative must retain nutrients in the feed and pay off economically. The most common preservatives are mineral preparations, organic acids, and alkaline reagents.

It is very important to find preservatives for raw materials that are rich in sugar and have a high humidity, for example, when harvesting silage from early harvested corn even before the milky ripeness phase. With excessive plant moisture and excess of the sugar content over the “sugar minimum”, many nutrients are lost during silage and the silage is of poor quality.

Organic acids such as formic, sorbic, benzoic, propionic, as well as

a mixture of these acids, the preparation CNMC, are widely used for preserving feed. It contains acids: formic – 35%, acetic – 30%, propionic – 10%, and oily – 8%.

Organic acids, introduced in a dose of 0.2-0.3% by weight of silage plants, in silage with high-moisture and with a high content of sugars from forage crops (corn, tops of sugar beet) ensure reliable safety and quality of silage. Liquid organic acids are used in the form of a 10% solution, solid – in the form of a powder.

Organic acids have high preservation properties, reduce the loss of dry matter silage, increase the content of lactic acid. They are very effective in ensiling difficult-to-strength high-protein forage crops, such as medick and clover harvested at the beginning of flowering. In this case, the dose of organic acids is increased to 0.4% by weight of the silage plants.

To improve the quality of feed, the introduction of new technologies for their preparation is of great importance. We need high-performance forage harvesters, typical storage for feed, preservatives for chemical preservation, strict compliance with all the requirements of the technology.

In the construction or reconstruction of livestock farms, it is imperative to provide for the construction of modern capital storage facilities for feed on the planned number of animals.

To determine the quality and operational control of the storage of feed you need the appropriate devices to determine the humidity, temperature, acidity and other indicators of feed. Feed production requires reliable rapid methods for assessing the quality of feed and devices for monitoring the physical state of feed during storage.

Of great importance is the development of science-based standards for all types of feed of plant origin. The lack of feed standards has a negative effect on the production of high quality feed.

The implementation of these measures will ensure the rational use of fodder lands and the preparation of the required number of high quality feed.

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Study guide

Serekpaev N.
Stybayev G.
Baitelenova A.
Zasada M.

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info@sciencecentrum.pl, https://sciencecentrum.pl