



Scientific Support of Grain Production in Agriculture

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Abstract: Cultivation technology of grain crops is one of the main areas of research of the Moscow Scientific Research Institute of Agriculture "Nemchinovka". These developments are based on optimization of crop rotations, tillage systems, fertilizers, plant protection, as well as elements agro technical promising varieties of crops for special production conditions.

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I. INTRODUCTION

Increased production of grain crops is actual task of agribusiness. This requires the production of food grains with high baking and technological properties of flour, confectionery, cereals, industrial brewing flax ion, as well as highly nutritious cornmeal, which balanced in energy and protein content, essential amino acids.

Negative factors that inhibit production of grain are insufficient arsenal varieties of cereals for various special uses and low level of technological support of baking grain production. Solving these problems is possible through the introduction of agricultural production of new high yielding, having resistance to biotic and abiotic stressors varieties and hybrids of crops with the specified quality indicators of grain and development of adaptive technology for their cultivation.

Reducing state support for agriculture leads to degradation processes, for basis of sustainable production production of the industry - the only industry in the world, constantly reproduce the generating energy for normal human life.

II. MATERIALS AND METHOD

To stabilize the situation in agriculture and a further rise in the production of high quality grain it's necessary to take measures to ensure recovery restoration and development of farming systems, occupying the production of agricultural products, regardless of the form of ownership, which will return to the reasonable structure of cultivated area, crop rotation and ensure of technological discipline.

This action is a low-cost, but it requires corresponding state organizational beginning, promotion and advertising, and is the basis for the implementation all other measures to improve the production properties of agricultural production and improving its quality.

For example, use of perennial grasses in crop rotations with legumes mandatory component produces grain winter crops with high baking quality without the use of mineral fertilizers. In recent years, the area of perennial grasses

increased from 12-14 million hectares in 80 years to 20 million hectares and more now, but of the whole plane show mercy, only 21% of crops are legumes.

Moscow Scientific Research Institute of Agriculture "Nemchinovka" data indicate that changes in nitrogen fertilizers for winter crops weighting in the form of feed at a dose of 30 kg / ha active substance increases gluten depending on the variety to the grade 3 - 10%, the introduction of 60 - 90 kg / ha active substance (including feed) allows to get producing strong wheat in the conditions of Central Black Earth zone of the district.

Similar actions impact grain quality occur in the application of appropriate doses of organic fertilizer that enhance fertility lands. Currently accordance with the design requirement of Agriculture of the Russian Federation in fertilizer for optimal variant is 26.0 million tons of nutrients. Of them is necessary for nitrogen 10, million tons, phosphoric - 9.1 million tons, potassium - 6.7 million tons. Additional property and justified the need for magnesium and micronutrient fertilizers. In assortment of nitrogen fertilizer dominated ammonium nitrate and urea, which account for 43.1 % of the sheathe needs. Among other forms of importance is given to liquid nitrogen urea-ammonium nitrate (9.8%) and complex solid fertilizers (20.6%).

A considerable part of phosphate fertilizers (25.3%) are single-component form, such as single and double granular superphosphate. Most of the phosphate fertilizers (39.5%) will belong to the complex solid forms (ammonium phosphate, ammonium and their derivatives). As part of this assortment provided fertilizer and liquid forms. Special place is given industrialized phosphorus flour and local production as the most dese-wave and more quickly produced phosphate fertilizers. It accounts for 23.1%, or 2.1 million tons of the total quality.

Among the range of potash greasy form is potassium chloride (65.7 %). Most important followed by complex fertilizers of various types nitro phosphate, ammonium phosphate, etc. The proportion of such of the total demand for potassium is 23.8%. Also provides for the production of chlorine-free forms for their crop, collisional sensitivity to chlorine. Volumes of organic fertilizers should be 400 - 500 million tons. That will allow to prevent degradation processes catastrophic falling soil fertility and reduce the volume of the products obtained with low quantity.

It is necessary to expand the use of phytosanitary products to protect plants. Their correct application provides not only environmental safety, but also getting a quality product. The main reason for getting wheat with low gluten quality, even at high amount its contents in the main grain areas (Northern-Caucasus, the Volga region, Central-Black Earth, Volga-Vyatka and West Siberian



regions) was the pest chinch.

When properly implemented remedies plants can fight this dangerous product quality pest. Besides the main processing sowing insecticide should be call preventive control measures for dealing excludes edge portions of fields.

Mandatory agro technical methods of advanced technologies of crops should be as seed treatment of winter and spring crops, which makes it possible to significantly reduce the susceptibility of the whole complex of plant diseases (snow mold, Fusarium, root rot, rust, smut) turns impact on the quality of the products. Volumes use disinfectants must not be less than 30.0 tons.

Cultivation technology of grain crops is one of the main areas of research of the Moscow Research Institute for Agriculture Nemchinovka. These developments are based on optimization of crop rotations, tillage systems, fertilizers, plant protection, as well as elements agro technical promising varieties of crops for special production conditions.

In developed rotations to ensure the highest productivity of arable land and productivity of cultivated crops, cereals and grass cereals and fallow units comprising precursors of winter crops, winter and next spring cereals. And fruitful crops are winter crops and first of all winter wheat. In connection with the construction of this important crop rotation is the placement of the crops at good predecessors. Such predecessors for winter crops are seeded fallows: clover, vetch and oats, as well as many summer grass (clover and timothy 2 years of use, 1 year of use clover, clover and alfalfa 2-3 years of use etc.), early potatoes, legumes.

The effect on grain yield of winter crops among the best fallow predecessors are: clover and vetch -oat fallows with mustard and with lupine, providing yields of 50 t / ha. A decrease in yields of 10.0 - 29.8% is caused by the worst cereal predecessors - lupine and barley. And at bioenergetic efficiency more preferably rotations, in which there are grain and grass link precursors of winter cultures are seeded fallows. They provide the most productivity of bioenergetic efficiency factor (at 2.91). At the same time sufficiently high level reproduction of soil fertility (humus content in the soil 2.27 %) can be achieved.

Inclusion of green manure predecessors, despite the rise in yields of crops and higher level of soil fertility (the humus content 2.38%), substantially reduce the level of productivity of crop rotation and the energy efficiency ratio of cultivation (up to 1.73).

Research conducted at the Institute in various years allow to estimate the most effective and identify predecessors under promising cultivars of winter crops of own selection. These precursors to an increasing influence rate on the winter crops can be found in the following guide sequence: 1) seeded fallows of one year use summer legume grasses, 2) perennial legume grasses two-year use (increasing the yield are compared with the seeded fallows 1-1.5 t / ha); 3) perennial- legume grass (clover) annual use (yield increase compared with legumes and grasses at

7 t/ha); 4) three-year perennial legumes use (increase yields compared with legume annual grasses use 8 t/ha).

The most preferred in the condition of area is placing various winter crops (wheat, triticale, rye) on the perennial - legume grasses.

One of the methods of increasing grain production is the saturation of crop rotations grain crops. Currently, the farms of southern and southeastern areas with black and gray forest soils grain crops in crop rotations up to 50% in suburban farms to developed production of potatoes and vegetables - 30 - 40%.

Due to the specialization of farm production when it's near economic centers it's necessary to organize crop rotation with potatoes, root crops and other forage crops when it's near to remote lands it's advisable to have crop rotation saturated grain. Generalization of results studies show that the expansion of the area of grain crops in specialized crop rotation should be done primarily by winter wheat and barley. Share of grain in specialized crop rotations can be adjusted to 70 - 75%. Grain yields increase at higher saturation grain, but harvest reduces and conditional net yield of feed units and digestible protein decreases.

Studies have shown that in the solving task of elevated soil fertility and agricultural productivity crops perennial grasses play crucial role in crop rotations. For households with a broad specialization of production grain and grass crop rotation, saturating perennial grasses at least 25%, provide it with the most arable land productivity.

In these rotations the highest level of soil fertility and, most importantly, the sufficient humus balance is achieved even without organic fertilizers. Predecessor fallow or 100% saturation of the grain crop rotation reduces crop rotation productivity (at 8.5 and 3.3%, respectively) reduces winter yield.

Increasing the amount of rotations of perennial legumes herbs and increasing the duration of their use from one year (at cultivation clover to three years, clover with alfalfa) allows mainly to increase the productivity of perennial grasses and crop rotation in general. For area farms specializing in dairy farming, are promising grain and grass crop rotation with saturating perennial legumes and legume grain grass mixtures up to 40 - 50% depending on the structure of agricultural land.

These are the rotations allow to obtain the maximum yield of full-fledged state of high output (50 or more GJ / ha of metabolizable energy) providing yields above 5.5 thousand kg of milk while substantially reducing energy resources to provide expanded reproduction of soil fertility.

To increase production of high-quality feed and more positive impact of perennial grasses on soil fertility, along with perfection the technology it's necessary to expand the species composition of herbs grown in the area.

Currently, predominantly clover and its mixture with timothy and fescue cultivated by farm of the area. The Institute research has shown that alfalfa swards overcome clover swards as superior in productivity and their effect on soil fertility on cultivated sod-podzolic soils. In one of



the experiments with alfalfa grasslands third year of use is given hay yield of 4.48 t / ha against 3.65 t / ha obtained in the variant with clover.

Winter wheat crop on a layer of grass with alfalfa in the first case was 4.88 t / ha, and in the second – 4.48 t / ha. Roots in the 0-30 cm layer of crop residues and their nitrogen values were significantly larger in grass mixtures with alfalfa. Under the impact of the action specified grass mixture more powerful root layer of soil was formed which is important for stable yields.

However, the most effective two-grass mixture on the basis of clover and alfalfa. Clover in the first year of use gives a good harvest, and alfalfa develops better in the second year of use. When growing such grass mixture the highest yield is provided in the first and subsequent years of use, in the case of loss of clover other component alfalfa performs it.

In northern areas is recommended to grow mainly clover and mixtures with grasses; in field crop rotations central and southern areas along with clover and timothy is recommended to cultivate legumes legume-grass mixtures, including clover and alfalfa.

Years of research institute for the development of optimal systems tillage show that on cultivated sod-podzolic soils in the common crop rotation for the area spring barley, spring wheat, peas, buckwheat are the most responsive to the moldboard tillage. Surface subsurface tillage is preferred for winter rye, oats and annual grasses.

Energy and environmental assessment of soil cultivation systems in crop rotations shows that, despite the higher productivity when combined treatment with alternating deep and shallow treatments, energy efficiency ratio on the options using only surface treatment still somewhat higher due to lower processing costs and this results in greater accumulation processing humus. Therefore, preference should be given to crop rotations combined treatments which can provide high productivity, characterized by high energy efficiency, as well as provide a reproduction of soil organic substance at high level.

Found that with increasing saturation rotations perennial legumes up to 40 - 50% and a substantial increasing of the level of soil fertility is achieved highest productivity of crops while minimizing primary tillage. Thus, in these rotations yields of barley and oats particular surface treatment as compared with the plowing increased by 3 - 7 lb / ha.

Studies show the high efficiency of developed at the Institute the system of combined tillage crop rotation with deep sealing of organic fertilizers based on alternating of deep plowing with incorporation of organic fertilizers reversible plows and subsequent smaller treatments with plowing to the lower layer of chopped straw and siderates.

This allows you to create powerful root layer and there increases much of crop productivity of crop rotation , providing accelerated reproduction of soils fertility. The theoretical basis of the development is established regularity of differentiation of the arable layer and detection in experiments advantage of its reverse heterogeneous structure of the presence of fertile layer in

the lower layer of conducive recessed root system and improved water supply plant and nutrients. Ploughing of spreading and perennial grasses is carried of circulating or bunk and plows after premixing them of soil disk tools with the upper (0-8 cm) layer. In next years, conduct surface treatment , deep tillage or shallow plowing depending on climatic conditions and requires of crops . Created by plowing background is favorable for use of minimum tillage with the help of disks and anti- erosion machines.

Regarding the non-black zone in field eight-field crop rotation with perennial grasses (occupied fallow - winter cereals- barley - tilled with overseeding of perennial herbs of the 1st and 2nd year use - - winter rye - oats) bunk plowing plow is carried out in a occupied fallow for sealing organic fertilizers for winter crops and while perennial herbs layer . Under tilled crops (potato, corn for silage) is applied of inversion enucleating and hoeing to the depth of the plow layer (for potatoes tillage in the spring) under barley - plowing after harvesting of potatoes and corn.

If in this rotation organic fertilizers are applied by tilled crops, the bunk plowing is performed at incorporating manure and layer of perennial grasses, and under vetch oat mixture, oats and winter crops are used of surface processing . So in terms of the year-decked combined tillage system using a new sample image of plow use to ensure that increased the productivity of winter triticale by 6-8 lb / ha, spring wheat by 0.6 - 2.2 lb / ha compared with conventional treatment depleted

On sod-podzolic soils with overcrowded subsurface horizons to increase the depth of root layer, regulating water and air regime and cultivation is advisable to periodically processing by tools of chisel type. The most promising conducting of chiseling by 40 - 45 cm in the main processing soil tillage for the crops which are the most required to agrophysical fertility culture conditions.

On soils with abundant moisture for a temporary transfer of the surface water runoff in subsurface, preventing stagnation of water on the surface increasing water stock advisable to carry out a deep chiseling to 50 - 60 cm in the summer-autumn period while preparing soil moisture in winter in moment of not more than 0.8 field moisture capacity, which is used once or twice for a company of crop rotation, soil decomposition and promotes long-term preservation of this effect in the rotation.

Developed technology "zero" soil processing → with using matches for direct seeding in the cultivation of crops in crop rotation of grain fallow link in the system combined tillage. The technology includes the following units : 1) a mixture of vetch and oat - organic fertilizers at a dose of 40 t / ha and phosphorus-potassium fertilizers in " reserve" for 4 years by plowing ; nitrogen - a presowing seed treatment with conventional drill ; 2) winter wheat - soil herbicides (glyphosate 4-6 l / ha) after harvest of annual grasses , nitrogen fertilizers simultaneously with sowing stubble drill and spring fertilizing; 3) barley - processing field glyphosate that after harvesting winter



wheat → boundary , early planting with simultaneous application of nitrogen fertilizers → drill. Seeding rate of crops is increased by 20%.

The study of systems of fertilizers in crop rotations allowed to develop resource saving environmentally secure systems of use organic and fertilizers. Thus, for most speeded in zone crop rotations with saturating perennial legumes and legume- cereal grasses to 25 % organic-mineral fertilizer system is the most effective which includes the application of organic and mineral fertilizers. In crop rotations with high saturation of perennial legumes and legume cereals grasses is the most organo- mineral system with the application of organic and phosphorus-potassium fertilizers effective. Application of nitrogen-mineral fertilizer in these rotations even reduces productivity , causes reduction in soil fertility.

Regard to the importance of the development of systems of fertilizers, providing sufficient-phosphorus balance in the crop rotations for zone on sod-podzolic soil-operation with various mobile phosphorus technology is developed effectively which use of local rock phosphate deposits. The most yield increase of crops (9.4 lb / ha of grain and 8.7 lb / ha of hay) is achieved when there is insufficient soil content mobile phosphorus - 72 - 73 mg / kg. With the increasing of P₂₀₅ in the soil the efficiency decreases.

Application different doses of phosphate fertilizer (300, 600 and 1200 kg / ha) P₂₀₅ compared with natural background (P₂₀₅-72 mg / kg) increased the phosphorus content of the soil up to 130,200 and 400 mg / kg. After 10 years they changed a little - 120, 180 and 300 mg / kg. Adding every 100 kg of P₂₀₅ into the form of phosphorite powder has provided the increase of P₂₀₅ content in the soil at 18 - 20 mg / kg, the mobility of phosphorus - 0.015 - 0.020 mg / l. Phosphorite powder, increasing the level of soil phosphate, provides high residual current → aftereffect on all crops of grain grass rotation.

Three levels of technologies cultivation are developed for different soil-climatic conditions of cultivating and manufacturing capacities for enterprises

Normal (basic) technologies (B) provide the realization of biological capacity by 50% grade , grain yield is about 3.0 t / ha relatively satisfactory quality when labor costs 6.5 pers. / H per 1 ton of grain and cost 1600 rub./ton The basic technology of crop cultivation is provided by mineral fertilizers and pesticides at a minimum , which allow to maintain an average level of cultivated soil , remove the feed element shortage , locating at minimum. Level of fertilizer use 100 - 150 kg / ha active substance Plant protection system including a seed dressing ; application of herbicides - Luvaram and Lagrangian ; fungicides - Impact or Bayleton ; insecticides - decis or karate.

Intensive technologies (B) provide realization of potential varieties are more than 65% , grain harvest - 4.0 - 5.0 t/ha of good quality for under labor charges below 4.5 pers./H at 1ton of grain and the cost 1400 rub./ton Technology is aimed at achieving an optimal level of mineral nutrition of plants, to protect them from pests. Level with fertilizers 200 - 250 kg/ha of active substance ,

including potash and phosphate row materials in the basic tillage of soil nitrogen - fractionally before sowing and spring regrowth. Nitrogen doses are adjusted by results of soil and plant diagnostics. Green manure and straw as organic fertilizer are used . Plant protection system includes a seed dressing ; herbicides – luvaram with lontrel , Lagran with banvel or Lintur ; fungicides - bayleton or altosuper ; insecticides - karatezeon or aktellik .

High-technologies (A) ensure the realization of varieties potential more than 85%, the yield of grain at above 6.0 t/ha of high quality labor at a cost of less than 3.0 yes pers./H per 1 ton of grain and cost 1300 rubles . / ton Made for the highest yield by using high doses of mineral fertilizers (about 300 - 350 kg / ha active substance) , highly effective pesticides , modern technically and highly skilled. Technology most productive on soils with high fertility humus content in the plow layer of 2.5 - 3.0% or more, close to neutral soil environment , the phosphorus content of more than 150 mg / kg , potassium - 120 mg / kg.

III.CONCLUSION

Development of scientific technologies of soil fertility increasing and cultivation of agricultural crops under technical mechanization support environments will allow in the nearest perspective significantly to increase the productivity of agricultural land and ensure high plant production efficiency.

REFERENCES

- [1]. Saranin K.I., Titov G.A. The toxicity of the soil in the cultivation of winter crops. Grain farming, 1984. Number 7.
- [2]. Kirdin V.F. Engineering support of grain cultivation in the Non-Chernozem zone. Moscow, 2004. 71.
- [3]. Sdobnikov S.S., Zenin L.A., Voronkova V.I. Way to improve the efficiency of the root layer of sod-podzolic soils. Reports of Agricultural Sciences, 1981. Number 9.
- [4]. Sdobnikov S.S., Kirdin V.F. Combined tillage with organic fertilizers incorporating in soil layer. Bulletin of Agricultural Science, 1990.

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