THE RHODESIA

Agricultural Journal.

Edited by the Director of Agriculture
(Assisted by the Staff of the Agricultural Department).

PUBLISHED MONTHLY.

Subscription: 5/- per annum; payable to the Accountant, Department of Agriculture, Salisbury.

VOL. XXIX.] AUGUST, 1932. [No. 8

EDITORIAL.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Official Year Book.—The third number of the Official Year Book of Southern Rhodesia has just appeared. The first was published in 1924 and the second in 1930.

It contains about 800 pages, and the Government Statistician is to be congratulated upon the selection and arrangement of the material presented.

It has been found necessary for considerations of economy to omit a number of articles which appeared in the 1930 edition, but a number of new articles, charts and maps have been included, so that it is similar in size to the 1930 number.

Most of the sections are brought up to the end of 1931, with the exception of the tabular statistics, for which the 1931 figures were not complete when the publication went to press.

It is obtainable from the Department of the Controller of Printing and Stationery or the office of the Government Statistician, and the price is 5s.

Price of Crown Land.—During the last session of the Legislative Assembly, Mr. C. S. Jobling, M.L.A., moved:—

> "That this House urges upon the Government that it takes into immediate consideration the necessity for a reduction in the price of Crown land in order to bring about some correlation between such price and the present values of agricultural and pastoral products."

The Government accepted Mr. Jobling's motion, and a committee is now being appointed under the chairmanship of the Director of Agriculture.

The terms of reference are as follows:—

1. (a) The prices charged for all Government land held under Permit of Occupation, Agreement of Purchase or lease as at 1st April, 1932.

(b) Price to be charged for Crown land still available.

2. Consideration of the necessity for a reduction in the prices of such land, based upon:—

(a) size of the farms;

(b) average quality of the land;

(c) estimated value of, say, tobacco land, mealie land, grazing lands, taking into account the proximity to the railway.

3. A consideration of terms of payment.

4. A consideration of interest charges in relation to all land comprising classes 1 (a) and 1 (b) above.

5. Recommendations regarding interest.

Since this subject has been widely discussed by farmers and Farmers' Associations, there is no doubt that a number of farmers would like to present their views personally to the Committee; it is therefore requested that all such persons should write to the chairman indicating what points they wish to bring forward and what date would be suitable for them to appear.

Celery Growing.—An important addition to the literature on celery growing is provided in Bulletin No. 47, of the Ministry of Agriculture and Fisheries, published in April this

year. It outlines the method of culture adopted by the specialist growers in the chief celery-growing areas, and also the results of investigations into celery culture made by the staff of the Midland Agricultural College.

After discussing the extent of the industry, soil and climate, suitable varieties and seed saving, the bulletin goes on to describe the methods of celery growing in the Isle of Axholme. This district is by far the most important, and it is claimed that the specialised technique of celery-growing was evolved and perfected in this area.

The points dealt with include manuring, seedling raising, dressing seed, sowing, bedding-out, spraying, field planting and cultivation, top-dressing, bleaching, lifting and marketing.

The bulletin has 17 pages of text and 10 illustrations, and is obtainable from H.M. Stationery Office, Kingsway, London, W.C. 2, at 7d. post free.

Recipe.—The following recipe for buttermilk cheese has been kindly supplied by Miss Barbara Gibbs, of Bonisa, P.B. Redbank, Bulawayo:—

Bonisa Buttermilk Cheese.—Keep buttermilk for one day, then stand on stove in bowl till it "comes up" like Devonshire cream. Strain through butter cloth and hang up till the whey is all gone. Press between plates with weight on top. Not to be kept long.

Publicity.—The first All-British and Empire National Grocery, Provision and Allied Trades Exhibition ever organised in England was held at Olympia from 21st May to 4th June, 1932.

The last day of the Exhibition was set aside as a Southern Rhodesian and East African day, and the opening was performed by Sir Edward Greig.

The Southern Rhodesian display was in the charge of Mr. A. J. Bouchier and attracted considerable interest.

A special feature was made of maize and maize products manufactured from Rhodesian grain, and the different types of leaf tobacco were exhibited in addition to the numerous brands containing Rhodesian leaf.

Numerous illustrations were shown depicting the cultivation of tobacco, maize and citrus fruits in the Colony, and the various exhibits were favourably remarked upon by a large number of those visiting the stall.

A Green Manuring Experiment.—The following notes regarding a green manuring experiment which was carried out by a farmer in the Enterprise district will be read with interest.—Ed.

"On this farm maize is rotated every fourth year with dolichos beans as a green manuring crop. Last season, 1930-1931, the beans were under-sown thinly among the third crop of maize and were not harvested, with the result that a heavy crop of volunteer dolichos made its appearance with the first rains in October, 1931, on a 40-acre block destined for green manuring. The land had not been ploughed since the previous May, and the only treatment the volunteer beans got was a hand-hoeing twice. By the end of December, 1931, so vigorous a growth of tops had been made, accompanied by prolific nodules on the roots, that the entire crop was ploughed under and the land immediately resown to dolichos beans in January, 1932. This second crop had a slight setback from leaf-curl, which seemed to be prevalent everywhere, but this disappeared as the season advanced, and a very satisfactory second crop of dolichos ensued. So much so that at the beginning of April three courses were open to me: the beans could be left to seed, the crop could be cut for hay, or the whole could be grazed as it stood.

As the veld deteriorates steadily from April onwards, it was decided to utilise 20 acres for grazing for a small dairy herd (30 head including calves), and to reserve the remaining 20 acres for seed. The herd was allowed to graze for a few hours only each day, but the improvement in condition and milk yield was quite marked. The seed is ripe at the time of writing and promises a good return, and after this

is harvested these vines will be utilised for grazing and will probably last until the maize stalks are available.

Now this procedure opens up an alternative method of green manuring which has obvious advantages, particularly on those farms where feeding for cattle is a consideration:—

(i.) Two lots of roots with their nodules are ploughed under in addition to the available tops.

(ii.) Ploughing in October is obviated, being replaced by a ploughing in December when the oxen are less busy.

(iii.) A crop of leguminous hay can be cut in April or May, or the beans may be harvested, or the crop may be utilised as grazing at a time when the veld deteriorates in value and the maize stalks are not yet available.

(iv.) Some return is being obtained from a plot when it is being green manured, in the form of grain or fodder.

This plan would, of course, not be feasible where sunnhemp was used, but it could be practised in the case of velvet beans, dolichos or cowpeas. In any case the results have been so satisfactory this year that I propose continuing it in future years, with possibly some variations such as using the earlier maturing cowpea as a second crop, and by planting the first crop of dolichos dry in September or October."

PIGGERIES.

By B. G. Gundry, A.I., Mech., E.

In the following pages it is proposed to describe the construction of a simple type of permanent central piggery, and also temporary and portable houses for use in paddocks where pigs are run on the colony system.

The general type and design of the buildings and accessories described are based on the recommendations of the Division of Animal Husbandry.

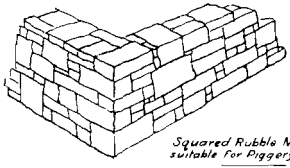
Site.—In selecting a site for a permanent piggery such as is shown in Plate 1, preference should be given to a piece of well-drained ground having an even fall of about 1 in 80 to facilitate drainage.

If possible, the site should be to the leeward of the main homestead, within easy reach of the dairy and feed grinding floor, if such are in existence.

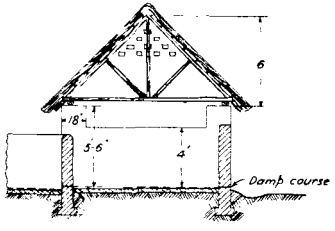
Coolness is an essential factor to be considered, and the piggery should not therefore be shut in by other buildings or dense trees. While a certain amount of shade is desirable, *sunlight should not be entirely excluded, particularly in the* early morning hours. It is an advantage to have the piggery in close proximity to some permanent pasture with a few shady trees, in which the pigs can be turned out to graze. A suitable spruit of running water, in which they can wallow in hot weather, is also an asset, but, of course, the pigs must not be allowed to pollute a neighbour's water supply.

Foundations.—Having selected the site and decided on the number and arrangement of the pens to be built, the foundation trenches may be pegged out. In order to get the angles square, it is advisable to set them off with a wooden triangle made from floor or ceiling boards, with sides

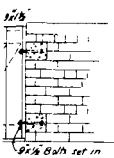
PLATE I.

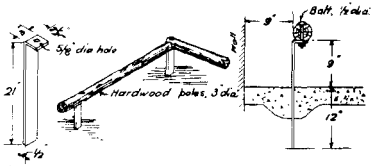


Squared Rubble Masonry suitable for Piggery buildings



Section thro' Pen with thatched roof





g gate

Farrow Guard & method of setting iron supports in concrete floor.

of 6 ft., 8 ft. and 10 ft. respectively. If accurately made, the angle opposite the longest side will be a right angle.

On a good compact formation, the trenches should be dug 12 ins. deep, but as the ground surface is, or should be, sloping, and the bottom of the trench must be kept level, it will be necessary to step them down by the thickness of one brick at the necessary intervals to keep the trenches at the proper depth throughout. It will be convenient to make these steps to correspond with a division wall in the pens, as will be seen in the side elevation of the piggery illustrated in Plate 1.

The width of the trenches should be 6 to 9 ins. wider than the maximum width of the foundation. The bottom of the trenches should be quite level, and when finished should be tamped evenly all over to thoroughly consolidate the sub-soil.

The foundations themselves may be built of hard, well-burnt bricks, stone or concrete.

The lower courses should be at least 50 per cent. wider than the thickness of the walls they are to support, except for the feed room or other building, the walls of which are to be more than 6 or 7 ft. in height, where they should be twice as wide as the thickness of the walls.

The foundations, which comprise all the work below the damp course, whether of brick or stone, should preferably be laid in 1 to 5 cement mortar. A cheaper alternative is to use a lime mortar mixed in the proportion of about 1 part lime to 6 parts of sand. The durability of this mortar can be considerably increased by the addition of 10 per cent. of cement, which should be added to small batches of the mortar immediately before it is used. Under no circumstances is the use of dagga recommended for laying foundations.

If, in exceptional circumstances, it is decided to use concrete for the foundations, the trenches should be neatly excavated to the exact width the foundations are to be. The concrete, mixed in the proportion of 1 part cement 3 parts sand and 6 parts stone, is then placed in a layer about 4 ins. thick and tamped down. The foundations can then be completed to the damp course level in brick or masonry as described above, or, if they are to be completed in concrete,

shuttering must be arranged in which to mould the concrete to the height and thickness desired.

Damp Course.—A layer of material impervious to moisture and "white ants" must be placed on the completed foundations. A bitumastic fabric known as damp course felt, or 26-gauge galvanised iron, are the materials most commonly used for this purpose. A layer of cement mortar only is not considered satisfactory, as it is liable to crack and is not entirely damp-proof. There is little difference in the cost of iron and felt—the latter is more easily cut and handled, but the former is probably the more durable. If iron is used, it must be cut into strips the same width or a little wider than the top of the foundation. The strips are joined end to end either by overlapping them by about 3 ins. and soldering them together over the full width, or by hooking the ends together and hammering them flat, care being taken not to damage the galvanising.

If lime mortar has been used in the foundations, the top course of brick or stone should be covered with a thin layer of 1-5 cement mortar before an iron damp course is placed in position, as lime reacts on the galvanising and eventually destroys it. For the same reason cement mortar should be used for laying the course immediately above the iron. No such precaution need be taken if felt is used. This material is cut into strips of the necessary width and any convenient length, and where these join they should overlap by at least 6 ins. It will be seen from the drawings that the level of the damp course is approximately 6 ins. above the adjacent ground level at the back of the pens, and is stepped down one course at the walls dividing the pens from the yards.

The surface of the floors should be level with, or rather below, the damp course.

Walls.—The walls may be of brick or masonry. The former should be all 9 ins. thick, but the latter will require to be somewhat thicker, those on the outside being from 15 to 18 ins. thick and the division walls from 12 to 15 ins., according to the size and shape of the stones available.

The type of bond known as "squared rubble" is recommended in preference to "random rubble," which, when

attempted by the ordinary native builder, is apt to degenerate into a mere untidy pile of stones possessing neither strength nor durability.

It will be noted that a fair proportion of the stones should occupy the full width of the wall, like the "headers" in a brick wall. Only hard, sound stones should be used, and they should be laid on their natural beds, i.e., with the grain or laminations, if such are visible, lying horizontal.

Lime mortar mixed in the proportions of 1 part lime to about 6 parts of sand is recommended for laying either bricks or stones, but on account of its cheapness, dagga is likely to be more popular. It must be remembered, however, that while dagga is quite satisfactory if kept dry, it becomes useless if moisture is permitted to penetrate into the wall. A large proportion of the walls in a piggery have no roof to protect them, and it is therefore necessary to take particular care to render them perfectly weather proof. The surest method of doing this, particularly with brick walls, is to plaster them with 1 to 4 cement plaster, to which a half part of well slaked lime may he added to make it work more easily and to render it somewhat more waterproof.

The top of the exposed walls should be rounded as shown in the cross-section of a wall on Plate 1.

The brickwork should be kept slightly damp as the plastering proceeds, so that the plaster is not dried out too quickly and spoilt.

Masonry walls huilt of comparatively small stones should also be plastered, the dagga joints being first raked out to a depth of ahout an inch in order to give a key for tbe plaster.

Walls built of large, well-shaped stones are better left unplastered, but the joints must be raked out to a depth of 1 in. and pointed with a 1 to 3 cement mortar, great care heing taken that no small holes are left into which rain can penetrate. The tops of such walls should be plastered and rounded off with the same mixture.

Floors.—The floors should be of either stone or concrete. Cement-plastered brick floors are not recommended owing to their liability to crack and their inability to withstand the wear and tear to which they are subjected.

If flat slabs of hard stone are available, they make an excellent and cheap floor, but they must be very evenly laid so that rain water and urine cannot collect in puddles. Before any stones are laid, the original ground surface must be brought to the proper height and slope and tamped solid.

Each stone must be carefully bedded down on a layer of sand about 1 in. thick by a few blows with a heavy piece of timber. A row of stones should first be laid down each side of the pen or run, particular care being taken, with the aid of a straight edge, to see that they are evenly laid to the correct slope. These two rows can then be used as a guide for the straight edge, which, when resting with one end on each row, can be used to test the intermediate stones as they are laid. Particular care must be taken to avoid any depressions in the corners or sides of the pens or yards, and to avoid this it is as well to allow the floor to slope very slightly from the sides towards a small depression about half an inch deep running from the entrance to the pen to the hinge side of the gate in the yard, but the formation of an actual gutter should be avoided.

A space of about half an inch should be left between adjacent stones, which, when the floor is otherwise finished, is filled in with a grouting mixture of 1 part cement to 3 parts sand. This should be fairly liquid, so that it can be thoroughly worked in to all the joints with the point of a trowel, the object being to prevent water soaking through the floor.

There should be a step about 1 in. deep between the pen and the yard to ensure that during a heavy downpour of rain, water cannot flow back from the yard into the pen.

Before a concrete floor is laid, the ground surface should be prepared as previously described, but if possible a layer of gravel or hard broken bricks a few inches thick should be laid down first and tamped solid.

As no delay must take place when the concrete is being placed, use must be made of level pegs. These pegs, which should be about 1 in. diameter, are driven into the ground in straight lines about 3 feet apart each way, so that the top of each peg is exactly at the height which the surface of the floor is to be at that particular spot. Their height should be carefully checked and adjusted with a straight edge so

that the floor will be at the correct grade. The same care should be taken to make a slight depression to localise the drainage, as explained in the case of stone floors.

The concrete should be of the proportions of 1 part cement, 3 parts sand and 5 parts aggregate, i.e., broken stone. In order to obtain a hard wearing surface, it is best to finish the concrete with a sufficiently even surface so that plastering or "topping" is unnecessary. In order to do this, particular care must be taken to obtain a well-graded aggregate. This should consist of sound, hard stone such as granite or quartz broken into various sizes, from those which will just pass through a three-quarter inch diameter ring down to a coarse sand, the proportionate number of the different sizes being such that they pack together to form a dense mass. All oxidised or friable stone should be discarded.

The ingredients of the concrete must be mixed thoroughly before and after the water is added. It must be remembered that the setting of cement is a chemical reaction which commences about 30 minutes after the water is added, and each batch should be mixed, placed and finished off within that time, if the full strength of the concrete is to be obtained. The concrete must be placed as evenly as possible and rammed down level with the tops of the pegs with a rammer having a face about 6 to 8 ins. square, covered with metal. If it is found that in places the sand and cement do not work up sufficiently round the aggregate to form a fairly smooth surface, a small quantity of mortar consisting of 1 part cement to 3 parts of coarse sand may be placed on the bad patches and tamped in.

This same mixture may be used for filling in the holes left by the level pegs, which are removed as soon as the concrete immediately surrounding them is completed. To facilitate their removal they should be slightly tapered.

The concrete trough may, if the builder is sufficiently skilful, be roughly moulded integral with the floor and finished off with a 1-3 cement plaster as soon as possible afterwards; otherwise, the space occupied by the trough should be left bare and the trough moulded as a separate operation.

Immediately the concrete is finished, it must be covered with clean grass or old sacks and kept damp as described later in some general remarks on the use of cement.

The feed passage and drains may be constructed either of stone or concrete in the same method as described for the floors.

Roofing.—Corrugated iron or thatch, or a combination of these two materials, may be used for roofing the pens.

Corrugated iron alone has the disadvantage of making the pens rather hot during sunny weather, but in order to overcome this objection, it may be covered with a layer of thatching grass about 3 ins. thick. The iron is supported on three purlines, resting on pillars projecting from the walls dividing the pens, and to which they are anchored by strips of hoop-iron built into the top six courses of brick-work. The purlines may be of 6 in. x 2 in. imported timber, as shown in the drawing, or straight gum-poles having an average diameter of about 4 ins. may be used. In order to give the roof a neat and workmanlike appearance, the upper surface of the poles should be dressed off perfectly level with an adze.

If the iron is to be covered with grass, short lengths of 14-gauge galvanised iron wire should be twisted round the roofing screws before they are driven right home, so that the two ends of the wire, about 6 ins. long, are left with which to tie down the laths or wires which will have to be laid over the grass to keep it in position.

If a thatched roof is to he erected, it should be carried on triangular principles as shown in the drawing; these rest at intervals of three to four feet on bearers running along the front and back of the pens. The purlines may consist of thin straight sticks of native timber or 10-gauge fencing wire spaced 12 ins. apart.

The roof of the feed room, if of iron, is carried by 4½ in. x 1½ in. rafters placed 5 ft. apart, crossed by three lines of 3 in. x 2 in. purlines. A thatched roof would be built similarly to that shown for the pens.

Gates.—The gates for the runs may be made from 6 in. x ⅞ in. flooring, or boards from a heavy packing case. They

should be not less than 2 ft. wide by 3 ft. 6 ins. high. The battens and diagonal brace should be screwed and not nailed to the uprights. They are hinged by two 18 in. Tee hinges to gate posts of 1½ in. x 3 in. timber bolted to the walls. The posts on either side of the division walls, on which the gates are hung, may be conveniently fixed by means of half-inch bolts screwed at both ends, set in the intervening brickwork as shown in the drawing. The opposite posts are best secured by bolts set in small concrete blocks built into the walls. These blocks can be cast in a wooden box, the inside dimensions of which are 9 ins. x 9 ins., and equal in thickness to two bricks, plus the thickness of one mortar joint, which will amount to about 6½ ins. in all. As the concrete is filled in, an ordinary hexagon-headed bolt 9 ins. x ½ in. is set in position so that it projects 2½ ins. from the end. The concrete for this purpose should be of 1 part cement, 2 parts sand and 3 parts small stones. When quite set, the blocks are removed from the moulds and built into the wall. As a number of such blocks will be required, a multiple mould should be made with two 9 in. planks standing on edge on a level piece of ground, with division pieces set crossways, making a number of compartments of the required width.

An alternate type of gate may be made with the battens projecting about 1 in. on either side so that they slide up and down either in a groove cut in the gate posts, or between two strips of wood about 1 in. square nailed to each side of the post so that a slot 1 in. wide is left between them.

A piece is cut out of these strips about 6 ins. from their lower end, so that when the gate is raised about 6 ins. and the top batten is clear of the posts the lower batten is opposite this gap and the gate can be entirely freed without lifting it any further. It is secured when shut by an ordinary bolt or a pin, such as a stout nail passed through the end of one of the battens and the post.

This type of gate is not so convenient as the hinged variety, but the cost of the hinges is saved, and they are very secure.

Farrow Guards.—Farrow guards are necessary in the breeding pens to prevent the sow from crushing the young pigs against the walls. The guards may consist of straight

hardwood poles about 3 ins. diameter, bolted to iron supports set in the floor. These supports may be made from old wagon tyres drilled and bent over at the top as shown in the drawing.

If the floors are of stone, it is advisable to leave spaces about 16 ins. square where the supports are to be placed, and when the floor is finished the supports are put in position and secured by filling in the space around them with concrete. If the floors are to be of concrete, the supports are placed in position first by driving them into the ground so that their tops will be at the correct height above the floor. It is advisable to excavate a depression two or three inches deep immediately round the iron so that the concrete is thicker there and holds the supports more securely.

Feed Room.—A suitable building in close proximity to the piggery in which to store and mix the foodstuff is a great convenience.

The floor may be of concrete, or, for cheapness, may consist of bricks laid flat and plastered with 1-4 cement plaster three-quarters of an inch thick. The walls also should be plastered with the same mixture to make the building as vermin proof as possible. A few bins about 4 ft. long by 2 ft. 6 ins. wide and 2 ft. high for the storage of foodstuff are also a convenience. They can be built of brickwork 4½ ins. thick laid and plastered with 1-4 cement mortar. They should have well-fitting lids of wood or galvanised iron to exclude rats, etc.

(To be concluded.)

REPORT OF THE BRANCH OF CHEMISTRY

FOR THE YEAR ENDED 31st DECEMBER, 1931.

General.—The indoor analytical work of this Branch for the past year has been almost exclusively confined to performing the routine work entrusted to its charge. Owing to the reduction of staff experienced throughout the year, occasioned by one member resigning to fill another post, and another leaving for an extended course of further study in the United Kingdom, and the fact that on grounds of economy they were not replaced, it was impossible to carry out any purely chemical laboratory research work.

The routine duties fall under the following heads:—

(1) Analyses of soil samples, waters for agricultural purposes, agricultural limes, manures, agricultural products generally, for farmers and for allied Branches.

(2) Analyses of samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914."

(3) Cattle dips and toxicological analyses for the Veterinary Department.

(4) Analyses of samples and standardisation of glassware, under the "Dairy Produce Act, 1925," and the "Dairy Industry Control Act, 1931."

Summary of Routine Analyses.—The following table comprises the samples analysed during the year:—

Soils	410
Sub-soils	24
Manures and Fertilisers	45
Farm Foods	43
Cattle Dipping Fluids	30
Toxicological	79
Waters	20
Limestones and Rocks	17
Glassware (standardised)	78
Dairy Products	9
Forensic	5
Vegetable Products	246
Miscellaneous	28
	1,034

It is worthy of note that the grand total of 1,034 represents the greatest number of samples for one year that has so far been dealt with by this Branch, the previous maximum being 937 for the year 1929.

In addition to these actual analyses, much advisory work by correspondence and interview was performed by the senior officers of the staff. Most of this was done for farmers seeking guidance as to correct soil and fertiliser treatment, but very frequently information was requested and given upon problems which are rather outside the normal sphere of an agricultural chemist. Advice, too, was supplied to commercial firms on chemical problems of their own, and there is hearty co-operation between the Branch and other divisions and branches of the Agricultural Department.

Although requests from individual farmers and Farmers' Associations for an officer of the Branch to visit them were quite as numerous as in previous years, very few could be complied with, owing partly to pressure of work with reduced staff, and partly to the necessity at present for cutting down expenses.

Soils.—The 410 soil samples enumerated above include 138 taken in the soil reconnaissance of part of the Inyanda Block, Fort Victoria district, for purposes of reporting on

the suitability of this area as an irrigation project, commonly known as the Umshandige Gorge Project. The samples were taken in October, 1930, and were included in the list for 1930, but their analyses occupied the whole time of two members of the staff for five months of the year under review, the final report being completed in June, 1931. Further reference will be made to this under Investigational Work.

Of the remaining 272 samples, 123 were submitted either in order that we might ascertain by examination and analysis their suitability for tobacco production, or that advice on fertiliser treatment for tobacco might be given; 60 were submitted for report on treatment for maize, and 84 for advice as regards composition and general cropping, or that deficiencies or harmful ingredients might be detected. The fact that nearly 50 per cent. of these samples came from farmers contemplating tobacco-growing, is significant in that it indicates a reviving interest in that crop, due doubtless to the depressed condition of the maize market. There were no enquiries as regards light tobacco—all requests emanated from growers intending to produce the heavier grades.

The remaining five samples received a complete chemical and mechanical analysis in connection with the pasture research experiments.

Manures and Fertilisers.—Forty-five samples of these were analysed during the year under review; of this total, 19 were taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, 1914." It is gratifying to be able to report that one only of these was found to be below guarantee, and that but very slightly in an unimportant constituent. The vendor concerned was communicated with, and a satisfactory explanation received.

In the year 1928, in order to have more perfect control of the quality of fertilisers and farm foods being sold throughout the Colony, and to ensure that the terms of the Ordinance were being universally complied with, arrangements were made to appoint official samplers at Bulawayo, Gwelo, Gatooma and Umtali. The duties of those appointed are to sample under the Act fertilisers and farm foods being offered for sale in the respective towns, or passing through the railway stations, and to send the samples to

this Laboratory for analysis. A reminder is sent each year, but little notice is taken. For the year under review, four samples only of fertilisers were received from these outlying stations, one from Gwelo, one from Gatooma, and two from Umtali; there were no farm foods. The remaining 15 fertilisers, and all the farm foods, were sampled by officers of the Branch at Salisbury. The position is not a satisfactory one.

Of the remaining 26 samples, 6 were fertilisers analysed for commercial firms and the usual charge was made; 15 were done at the request of farmers wishing usually to know if their stocks had lost strength from a previous year, and how to bring them up to a required strength, if necessary; 5 were miscellaneous manures, including two samples of wood-ashes, also done for farmers.

Farm Foods.—Ten of these were taken under the Act, 33 were from other sources.

Of the 10, two did not conform with their guarantee. To the vendors of one, a strict warning was issued, and a recommendation was made that a prosecution should be instituted against the other firm concerned. This was done, but owing to legal sophistries the case broke down in its preliminary stages. Notwithstanding the advertisement inserted in the newspapers at the end of 1930 calling the attention of vendors of farm foods and fertilisers to their obligation to effect registration each year before 31st March, three firms of six entered for sampling purposes by the officers of the Branch were found to have neglected to do so. This was reported, severe warnings were sent to the firms in question, and registration was effected by them without delay. It is to be hoped that in future steps will be taken to ensure that the regulations as regards registration are strictly complied with, as it is a waste of time and material for this Branch to analyse first, and then have registration effected afterwards; further, it confuses the legal position when a sample is found to be below the guarantee of a registration recorded after analysis.

Twenty-one of the remaining samples were either partially or completely analysed at the request of other Divisions of the Department, 5 were for commercial firms and 7 for private farmers. None calls for special comment.

Cattle Dipping Fluids.—Thirty of these have been analysed and reported upon. The increase in number from last year, when only 17 were done, is due to an arrangement between the Chief Veterinary Surgeon and the Chief Chemist that Cattle Inspectors should forward samples of dip from selected tanks tested by them, together with the result of their tests, in order to standardise their iodine solutions. These samples are analysed at this Laboratory; if the result differs from that given by the Cattle Inspector, he is informed accordingly, and the factor necessary to correct his iodine solution is given him, together with an explanation. In only very rare instances have the Cattle Inspectors been found to be far out with their results.

Nearly all the remaining 13 samples were submitted by officers of the Veterinary Department for analysis, under the "Cattle Cleansing Act, 1927."

Toxicological Analyses.—Deaths of animals due to careless handling of arsenical dips still continue year after year. Last year 67 samples of viscera of animals suspected of dying of arsenical poisoning, or of soils thought to be impregnated with spilt dip were examined, and this year the number is two more. Of the 69 samples examined for arsenic, 27 were found to contain sufficient quantity to cause death, in 9 traces of arsenic were found, and in 33 the presence of arsenic, though suspected, could not be verified on analysis. The poison suspected in the other 10 samples, waters and soils, was cyanide; negative results were obtained except in one instance, the water from the slimes dam of a mine, tested as a precautionary measure.

Waters.—Twenty samples of waters were reported upon, 4 of these being included in the Umshandige Gorge Irrigation Project report. Eight others were subjected to special analysis for the Irrigation Department in connection with soil erosion work, and the others were examined mainly to test suitability for private irrigation work or for suitability for use in boilers.

Limestone and Rocks.—Of the 17 samples sent in under this head, 11 were received from natural deposits found by farmers on their lands. Four of these had a calcium carbonate content of over 70 per cent., and were reported upon

as suitable for agricultural purposes, but the others were poor specimens of low-grade limestones. The remaining 6 were also analysed for farmers wishing to know the exact lime content, as carbonate or quicklime, of samples they had bought from commercial firms.

Glassware.—Seventy-eight cream test bottles were submitted for standardisation as required under Government Notice No. 279. Eight of these did not conform to the standards laid down in this Notice, so were destroyed as per regulation.

Dairy Products.—Nine samples of butter and milk were dealt with, 8 being done at the request of the Dairy Expert, with a view to discovering the presence or absence of preservative. The other sample was one of milk delivered by a local farmer for examination as to normality or otherwise.

Forensic.—For the first month of the year, owing to the absence on leave of the Government Analyst, analyses of five forensic samples were undertaken and completed. Three of these consisted of viscera of dogs taken by the Criminal Investigation Department, and the others were different parts of the viscera of a native suspected of having been killed by poisoning. Positive results were obtained in the former investigation, negative in the latter.

Vegetable Products.—The 246 samples enumerated under this head include 125 analyses of grasses completed by the Chemist seconded for pasture research, each of these analyses involving 13 different estimations. Equally as complete analyses were made of 24 grass samples for the Pasture Research Station at Naivasha, Kenya Colony. Partial analysis was performed on 21 other samples of grass, including five submitted from the Walvis Bay Railway Survey party from N. Bechuanaland, 2 from Rhodes Estate, Inyanga, 7 pure species from the Salisbury Experiment Station, 2 from the Director of Agriculture, and 5 from private farmers.

The majority of these were analysed to determine their feeding value for stock, but no result is worthy of special mention.

Forty-eight samples of maize grain and core were subjected to moisture tests in connection with an investigation

into the effects of potash on the drying-out of maize. Further reference is made to this under Investigational Work.

The juice content of 8 samples of oranges from Mazoe Citrus Estate was estimated at the request of the General Manager, B.S.A. Co.

Other specimens classified under the heading Vegetable Products include tobacco leaves, cotton seed, varieties of oats, silage, m'futi leaves, majorda peels and sunflowers.

Miscellaneous.—The samples included here are 28 in number, and were composed of salt licks from the Game Warden, Wankie Game Reserve, telephone cable from Chief Postal Engineer, eggs from the Poultry Department to be tested for water-glass treatment, oils, barbed wire, clinker, brine, etc.

A sample of soap was analysed under the "Standardisation of Soap Act, 1930"; the miscibility of varying proportions of absolute alcohol and petrol was investigated and reported upon in connection with the power alcohol scheme; an investigation into the bleaching of pea-nuts was carried out at the request of the Chief, Division of Plant Industry, and several samples of bones from diseased and healthy oxen were analysed for the Director of Veterinary Research, in an endeavour to ascertain whether the former had suffered from osteomalacia.

Investigational Work.—As already indicated, the task of coping with the abnormal number of routine samples submitted throughout the year, and the gradual diminution of staff, have rendered the undertaking of much investigational work almost an impossibility. Further, as pointed out in the annual report for last year, we are seriously restricted in our facilities for indoor research work by bad laboratory accommodation and antiquated plant.

1. *Umshandige Gorge Irrigation Project.*—The chemical report on this scheme was issued from this office at the end of June. It embodied the results of seven months' continuous analytical work by one of the staff, and for four of these seven months, two were exclusively engaged on it. Complete analyses were made of 138 samples of soils and subsoils; each one of these involved nine different estimations, as did the analyses of the water extracts of 30 of them which

showed a high percentage of water-soluble salts. Four samples of water taken from the Umshandige River at different times of the year were also completely analysed and reported upon.

The final conclusions were that, of the 4,260 arable acres inspected and sampled, 3,109 acres, not including one farm uninspected nor small isolated areas under 20 acres, were considered, from a chemical and physical point of view, entirely suitable for the purposes of this scheme. These were classified as under:—Irrigability: Class I., 1,221 acres; Class II., 647 acres; Class III., 1,104 acres; Class IV., 705 acres; 568 acres of these were classed as "doubtful" with a warning that care would be necessary in their irrigation.

The final report consisted of 26 pages of type, 22 separate tables of analytical results, and 27 photographs.

It has been decided by the Government to take no steps at present in connection with this project, but the Lands Department has been instructed not to alienate any of the farms affected.

2. *Influence of Potash on the Drying-out of Maize.*—An experiment to determine whether or not potassic fertilisation exercised any influence on the drying-out process of maize in the field was carried out, with the assistance of the Salisbury Experiment Station staff, during the year under review. The description and results of this experiment were published in the December issue of the *Rhodesia Agricultural Journal*. The final conclusions quoted from this article were: "There is no uniformity in the results, and no indication that the application of the potash to the soil has accelerated in any way the drying-out of the grain."

3. *Manuring for Maize Production.*—These trials, which were originated in 1926, to compare the relative merits of raw rock phosphate and bone-and-superphosphate as fertilisers for maize, and which were intended to run for five years, have now been completed. The results obtained from 1926-27—1928-29 inclusive were published in the *Rhodesia Agricultural Journal*, December, 1929. The totals for the three years were, over four 1/10 acre plots, for raw rock 7,292 lbs. per acre, and for bone-and superphosphate 6,795 lbs. The yields for 1929-30 were 1,931 lbs. per acre and 1,389 lbs. per acre respectively, and for last year, 1930-31,

958 and 820 lbs. respectively, The grand totals for five years are, therefore, 10,181 lbs. per care for raw rock, and 9,004 lbs. per acre for bone-and-superphosphate, a difference in favour of the former of 1,177 lbs., or nearly six bags per acre in the five years.

The results throughout have therefore been consistently in favour of raw rock phosphate.

4. *Citrus Fertiliser Trials.*—Owing to the decision of the management of the British South Africa Company's Citrus Estates at Mazoe and Umtali to uproot their Washington Navel trees in the groves in which these trials were being conducted, the latter have perforce come to an end. Over the eight years during which the experiment has been conducted, the complete fertiliser with nitrogen, phosphate and potash have given the best average yield. The results for 1931 show phosphate and potash without nitrogen as giving the highest yield in lbs. of fruit per tree—an average of 400 lbs. per tree, but taken over the eight years this treatment has given an average of 212 lbs. per tree against 224 lbs. per tree from the complete fertiliser.

RESEARCH INTO THE IMPROVEMENT OF NATURAL PASTURES.

Pasture Research Station, Matopos.—Details of the plan of research in operation at this station were published in the annual report of this Branch for the year 1930.

In addition to the plan as originally outlined, an experiment is now in operation to determine whether the addition of minerals in the form of a lick will exercise any material influence on the rate of growth and productivity of animals when the grass is not controlled by cutting and the animals are left under ranging conditions. The behaviour of these animals will be correlated with that of the other groups of cattle where the pasture is either controlled by cutting and grazing or by a combination of these two factors with fertilisation of the grass with phosphatic, potassic and nitrogenous fertilisers.

Results so far obtained at Matopos in regard to the grazing animals have been very striking and it has been possible on the small acreage available to carry successfully through the year the whole of the 55 experimental animals

without any supplementary feeding. All of these beasts were in splendid condition at the end of the dry season, and the results show that where hay is cut at the proper season of the year and fed to the grazing animals during the winter months, there is very little loss of weight, and the animals can be maintained in excellent condition throughout the complete year.

The main influence of fertilisation so far has been on the quantity factor of the grazing rather than on the quality factor.

The results of the experiments here have indicated that the major point of importance to farmers in Matabeleland is that if they hope to keep their cattle in good condition without supplementary feeding during the winter months, they would be well advised to make every effort to carry out their hay-making during the latter part of January and the month of February. By this process the value of the veld for stock rearing purposes is greatly enhanced.

The results from the grazing animals show a close correlation with those obtained by chemical analysis, and it would appear that this latter method is a valuable guide to the methods of control which should be adopted in pasture management in this country.

A further interesting point is that chemical analyses show that veld which has not been cut or burned undergoes a great deterioration in its feeding value during the following season.

Pasture Research Station, Marandellas.—The experiments at this station have now been in progress for one year, and although it is too early to make any very definite statements regarding the results which may ultimately be obtained, the evidence indicates that control with the mowing machine is of great importance on veld of this nature, and by this means alone an enormous improvement can be made to the carrying capacity of the veld.

As at Matopos, the main influence of fertilisation appears to be on the quantity factor rather than on the quality factor, but it could, of course, scarcely be expected that fertilisation would make any very great difference in one year. Although the carrying capacity of this station was estimated at one

beast to 20 acres, it has been shown that by means of stumping and controlling the grass by cutting and grazing, one beast to 9 acres can very easily be carried without any fertiliser being applied to the veld. Where the grass was not controlled by cutting and stumping, it was found to be impossible to maintain a beast to 9 acres, and the animals subjected to grazing under these latter conditions lost weight materially before the dry season had advanced very far, and their condition at the end of August was so bad that supplementary feeding became necessary in order to keep them alive.

As the results obtained by cutting and grazing had been so successful on this station with cattle, the experiment is now being conducted with pure-bred Merino sheep.

Considerable interest by the general farming community has been manifested in this station. Three Farmers' Days were held throughout the year, in June, August and September. These were very well attended, some farmers coming from long distances. Explanatory addresses were given by the Chief Chemist, the Director of Veterinary Research and the Senior Botanist, the party subsequently proceeding to the various paddocks where the progress and practical results of the experiment were demonstrated by the officers in charge to extremely appreciative assemblies.

CHEMIST'S REPORT.

Matopos Pasture Station.—During the year 72 grass samples from this station have been analysed, 51 of these being from the sandveld area and 21 from the black land. It was noticed that the feeding value of the grass on the sandveld diminished earlier in the growing season than that of the grass on the black land. Regular two-monthly cutting maintained the feeding value in both areas throughout the growing period. The hay from the sandveld area, although good, was of less value than that from the black land. Two cuttings of hay were made on the black land area, the first at the end of January and the second three months later. The analyses of these samples showed the first cutting to have a high feeding value both in protein and minerals. In the second cutting the protein content was maintained, but there was a large drop in the mineral content. Analyses

have not revealed any significant differences in the quality of the pastures from fertilised and unfertilised paddocks.

Marandellas Pasture Station.—Fifty-three grass samples have been analysed from this station, and the results of analysis have in a large measure confirmed the findings on the sandveld area of the Matopos station. The hay, cut a month later, appeared to have a higher feeding value than that from the Matopos sandveld. Samples taken monthly from unstumped and unfertilised land showed a marked deterioration from March onwards, readily accounting for the loss in condition of cattle even when the quantity of pasture is more than sufficient.

In addition to the grass samples, the complete chemical and mechanical analyses of five samples representative of the soil on the station were carried out. These analyses showed that the soils were markedly deficient in the essential plant foods, and consisted of almost 90 per cent. coarse and fine sand.

BOTANICAL REPORT.

Matopos Black Land.—In February the quadrats in each paddock, which had been fertilised but not grazed or cut, were analysed for the second time and the results accurately charted.

The grasses of this black land area are practically all of the better type where food values are concerned. The analyses show, during the year, an increase of 258 per cent. of the "Turf grass" *Ischæmum glaucostachyum*, and 71 per cent. of "Milanji grass" *Digitaria milanjiana*. These are the dominant grasses of the pastures, and both spread by underground stolons and both are valuable fodder grasses.

After the analyses, these quadrats were thrown open to receive the same treatment as the rest of the paddocks, and two other quadrats in each paddock that had been grazed or cut with the rest of the area were enclosed and an analyses of these will be taken next February.

In this way we shall note the effect on the botanical composition of fertilising alone, and of fertilising plus grazing or cutting.

Detailed observations were made in February, September and November. This year it is intended to make these observations more frequently.

Up to the present (this is only the second year of the experiment) the most important result, from the botanical point of view, seems to be that the grasses in the fertilised areas commence their growth earlier than those in the unfertilised areas.

Marandellas.—In January four quadrats were laid down in seven paddocks; two in each were charted accurately, two roughly.

The pastures were visited again and observations made in August and November.

This is the first year of the experiment, and the only result that can be noted is the extraordinarily marked difference between the unstumped and the stumped controls. In the former the grass was so sparse that the stock could not exist on it without additional food, while the latter showed a luxurious pasture on which the stock thrived.

TRAVELLING.

Owing to the extreme necessity for economy, very few journeys to meetings of Farmers' Associations for lecturing purposes could be made this year. In all, four lectures were delivered, at Shamva, Glendale, Umvukwes and Umboe, and opportunity was taken of visiting farms in the respective districts and rendering advice where requested.

Four lectures on soils, manures and dip-testing were given to the pupils at the Salisbury Tobacco Experiment Station.

The Chief Chemist accompanied the Director of Agriculture in November on a visit to the Rhodes Inyanga Estate, and a joint report was submitted as to the possibility of applying to this estate the results obtained on the Pasture Research Stations.

Members of the staff were in attendance at the Salisbury Agricultural Show on 26th and 27th August, in order to explain the exhibit of the Branch and give general advice.

TWENTY-ONE YEARS OF PLANT INTRODUCTION AND TRIAL IN SOUTHERN RHODESIA.

PART II.

(*Concluded.*)

By H. G. MUNDY, Dip.Agric. (Wye), F.L.S.,
Chief, Division of Plant Industry.

ROOT AND OTHER SUCCULENT CROPS.

BEET, SUGAR (*Beta vulgaris*, var. *saccharatum*).—Succeeds as an autumn-sown crop under irrigation or on moist vlei land, but is not dependable as a summer crop unless aided by irrigation. Requires an exceptionally fertile soil, or one very heavily manured, in order to yield well.

CATTLE CABBAGE (*Brassica oleracea*, var.).—Grows well as an autumn-planted crop on wet vlei land or under irrigation, but is unreliable in summer owing to the inevitable attack of several insect pests, reference to which will be found under the paragraph dealing with kale. Requires generously manured land and is a costly crop to produce.

CATTLE RADISH (*Raphanus sativus*, var.).—Given adequate moisture and freedom from pests, this crop grows well at all seasons of the year and seeds freely, but during the summer months it is very prone to attack by one or more of the insect pests of the *Cruciferæ*. Like the garden radish, if overgrown or under adverse conditions the root quickly becomes hollow and fibrous, and in summer this usually happens immediately a drought occurs or when the rains cease. It is of little value, therefore, for late autumn or winter feed, except where irrigation can be provided, but may possibly find a place as a root crop for sheep in areas where some rain accompanied by heavy winter mists at that season of the year can be expected.

CASSAVA (*Manihot aipi* and *M. utilissima*).—Climatic conditions over the high veld of Southern Rhodesia are insufficiently tropical for these plants to yield well. At altitudes of 4,000 feet and over the crop is slow to mature, and the yield of roots from a two-year crop is no greater than would usually be obtained from sweet potatoes in six to eight months' growth. Well suited to altitudes of less than 4,000 feet and, owing to drought hardiness, particularly so where the rainfall is somewhat unreliable.

CHARD, SWISS. Silver or Seakale Beet. (*Beta vulgaris*, var.).—Not usually a successful summer crop in Rhodesia. Sometimes grown under irrigation by poultry-keepers to provide winter green feed. But for general stock feed purposes there are many more valuable crops which can be grown when irrigation is available.

CHOU MOELLIER (*Brassica oleracea*, var.).—A plant of the kale family. The same remarks apply as to thousand-head kale.

CHICKORY (*Chicorium intybus*).—Has not proved successful as a dry land pasture plant and is intolerant of wet, swampy soils. If the demand warranted it, chickory could be grown with ease and certainty on deep loamy soils as a rainy season crop for the production of the root.

CHINESE CABBAGE (*Brassica oleracea*, var. *chinensis*).—This plant possesses very similar growth characteristics to other types of cabbage, and is liable to attack by the same insect pests. Hindrances to cultivation as a field crop are similar to those in respect to cattle cabbage. Can be grown as a garden vegetable.

JERUSALEM ARTICHOKE (*Helianthus tuberosus*).—Grows exceedingly well during the warm months of the year and yields heavily. No means have yet been found of keeping the tubers, either in the ground or out of it, from one rainy season to another, though perhaps the planting of an intermediate spring crop under irrigation might overcome the difficulty. The need to import seed tubers each year has caused the cultivation of this crop to be restricted to that of a garden vegetable, for which purpose, however, it is deservedly popular.

KALE, THOUSAND-HEAD, ETC. (*Brassica oleracea*).—Also turnip, rape, swedes, kohl-rabi and mustard. None of these can be grown on a field scale in summer owing to attacks of turnip saw-fly, diamond-backed moth, webb worm, the larger cabbage moth and cabbage aphis. During the summer they are sooner or later invariably defoliated and partially or completely destroyed by one or more of these insects. All are successful in winter under irrigation or on moisture-retaining soils, but are not yet extensively grown. They will no doubt in time become more popular winter crops, especially as sheep farming develops, but other succulents such as pumpkins, cattle melons, edible canna and sweet potatoes in summer, and oats and barley for grazing or green fodder in winter, can be produced more cheaply.

MANGEL, MANGOLD WURZEL (*Beta vulgaris*).—There is no known part of the Colony in which the rainfall is of sufficient amplitude and certainty to justify the growing of this crop without the aid of irrigation. The same remarks apply in general to its cultivation as to that of sugar beet. Other succulents grown in summer for use in winter, such as silage, sweet potatoes, edible canna, melons and so forth, can be produced more cheaply and with greater certaintly.

Given irrigation and a highly fertile soil, heavy yields can be obtained from seed sown *in situ* or transplants put out in March.

POTATOES, IRISH (*Solanum tuberosum*).—A large range of late, mid-season and early varieties have received trial. "Up-to-date" has consistently proved the most reliable yielder and the potato best suited to the Colony in general. Mid-season and early varieties—particularly the latter—are usually disappointing in yield and "run out" very rapidly, due, it appears, to greater susceptability to virus diseases. Locally conducted experiments have shown that this tendency can be much reduced by rigid selection in the field, but the expense and labour involved thereby is considerable.

YAM (*Dioscorea*, sp.).—The rainfall of Southern Rhodesia is too light and irregular and the climate is insufficiently tropical to meet the requirements of this crop.

CROPS OF THE GRASS FAMILY.

ADLAY (*Coix Lachryma-Jobi*).—A coarse, strong-stooling annual grass crop cultivated in India, China, Japan and the Asiatic tropics. The type of adlay introduced here was drawn from the Philippine Islands, where it was reported to produce a grain of high feeding value which could satisfactorily be employed as a substitute for wheat or for blending with wheaten flour. The plant proved highly sensitive to low temperatures and even at the lower altitudes was unable to mature a satisfactory yield of grain. Under more tropical conditions adlay might well possess special merit as a silage crop.

BROOM CORN (*Sorghum bicolor*, var. *technicus*).—Has repeatedly been tried as a commercial crop in Rhodesia, but has not become popular, probably due to its extreme susceptability to attack by stalk-borer and aphis. If the price offered for the broom fibre warranted it, the former insect attack, which is the more serious, could be controlled by treatment. Like kaffir corn, the plant appears to thrive best under a somewhat limited rainfall.

BROOM CORN MILLET. Hog millet: Proso. (*Panicum miliaceum*).—The flowering panicle and seed-heads of these millets resemble those of broom corn in general appearance, but the plant does not exceed 1½-3 feet in height. A quick maturing crop, but of little economic importance where more heavily yielding grain and fodder crops can be grown.

COWCANE (*Saccharum* sp.).—Also Indian cane. These two coarse fodders, which were introduced from India, are intermediate between sugar cane and Napier grass (elephant grass) in appearance and growth. As dry land crops, they are less hardy and vigorous than Napier grass, though more tolerant of drought and cold than sugar cane. Under irrigation they are less valuable fodder crops than Uba cane, but are more suitable for silage than Napier grass owing to their more succulent and less fibrous stalks. Their saccharine content compares unfavourably with that of Uba sugar cane.

JAPANESE MILLET. Japanese barnyard millet. (*Echinochloa frumentacea*).—Another of the many types of millet grown primarily as fodder or hay crops. Sensitive to

frost. Revels in a cool, damp soil and grows well on the sand vleis of Rhodesia, which do not become excessively swampy. A useful summer crop which is not cultivated extensively at present, but which will eventually become more popular on the type of soil indicated.

KAFFIR CORN. Milo maize, Sorghum Jerusalem corn etc. (*Sorghum* spp.).—Cultivated to a considerable extent by the natives of Rhodesia, particularly in the dryer areas, but has never become popularised as a European crop on account of the superior attractions of maize. Is much attacked by stalk-borer and aphis, and the grain yield, which is usually less than that of maize, is still further reduced by the depredations of small birds. Saccharine varieties of sorghum suffer from similar disadvantages. Some varieties have proved excellent trap crops for the suppression of witch weed (*Striga lutea*).

KIKUYU GRASS (*Pennisetum clandestinum*).—This well known grass, which originated from Kenya Colony, proves to be rather exacting in its requirements in Rhodesia. It is not satisfactory as a dry land pasture except in areas of high rainfall and winter mists or on pockets of land where exceptional fertility is combined with a cool, moist but well-drained land. It thrives best on deep peaty soils, and is not generally successful on the wet granite vleis of the Colony unless liberally assisted by heavy applications of complete fertiliser. It invariably demands a soil of high fertility, and under irrigation combines well with white clover.

PEARL MILLET. Bulrush millet or babala grass. (*Pennisetum spicatum*).—The plant sometimes known by the name of babala grass in the Union of South Africa is in no way distinct from the widely distributed native grain crop *Munga* or *N'youte*. It is not usually grown by European farmers, but may be worth the attention of poultry keepers who wish to produce their own supplies of this grain. Appears to thrive best on light sandy or alluvial soils and under such conditions possesses some merit as a silage or roughage crop.

SUGAR CANE (*Saccharum officinarum*).—The climate of the high and middle veld of the Colony is too cold and dry for this crop. An exception is to be found in the black,

basaltic vlei soils of the Wankie district where, unaided by irrigation, Uba cane grows extremely well. As an irrigated crop, good development is made at altitudes below 4,000 feet. Is intolerant of cold, ill-drained soils and cannot generally be recommended even as a fodder crop under dryland conditions.

TEFF GRASS (*Eragrostis tef.*).—This annual hay grass so popular in South Africa appears less at home in Rhodesia. It thrives best on sandy and loamy soils, but its yield is uncertain. If sown early it often matures when weather conditions render hay-making almost impossible, while if sown late it frequently suffers from insufficient rain. Yields seldom exceed one-half to three-quarters of a ton per acre. The crop does not appear likely to become one of importance, and is usually only grown on a small scale when a little very choice hay is required for some particular purpose.

TEOSINTE (*Euchlæna mexicana*).—A much-stooling, coarse annual grass, native of Central America. The Rhodesian climate is generally insufficiently tropical for its requirements, and growth is slow. It seldom flowers or seeds, and produces a smaller tonnage of fodder than maize, Guinea grass, Napier grass and several other similar fodders. There is no record of teosinte ever having been grown in Southern Rhodesia with any appreciable success.

MISCELLANEOUS HERBAGE PLANTS.

BASSIA HYSSOPIFOLIA.—A recently introduced herbage plant, native of alkaline soils in California. In preliminary experiments it has grown well and seeded freely, and will be afforded further extended trial.

CHILIAN GOOSEFOOT (*Chenopodium quinoa*).—An annual herb of Chile, Peru and New Granada reputed to possess merit as a herbage plant. Two separate introductions of this species have been made, but in neither case did soil and climatic conditions appear congenial.

KARROO BUSH (*Pentzia virgata*).—This arid country browse plant does not find conditions in Rhodesia to its liking, and its growth is insufficient to render it of economic importance here. Flowers freely and attains a height of six

to nine inches, but does not maintain its place by seeding, and gradually dies out.

LIPPIA REPENS.—A reputed lawn plant from California said to thrive under the shade of trees and recommended for checking sheet erosion. Grows moderately well, attaining a height of four to six inches, but is unable to survive the long rainless winter unless aided by frequent irrigation. Not regarded as of any local value.

SALT BUSH (*Atriplex, spp.*).—All the well recognised varieties of this plant have been tested, included Old Man (*A. nummularia*) and Creeping Salt Bush (*A. semibaccata*). These desert and alkaline-loving plants are not at home under the more humid conditions and on the acid soils of Rhodesia, and generally speaking do not appear to justify cultivation. The two varieties specifically named above show more promise than any others, but a large acreage under either would be required to yield any considerable amount of fodder.

SHEEP'S BURNET (*Sanguisorba minor*).—A low-growing herbage plant of Europe, sometimes recommended as a pasture plant for poor, dry soils. Is unable to withstand the long, dry winters of Rhodesia, and is intolerant of swampy soils. Is of insufficient merit as a grazing plant to warrant its being grown on irrigated land.

SHEEP'S PARSLEY (*Carum petroselinum*).—The same remarks apply as to sheep's burnet.

SHEEP'S TANSY (*Phacelia tanacetifolia*).—An annual herbage plant from California. Grew well in spring under irrigation, but has failed in summer and makes little growth in winter. Cannot apparently subsist unless aided by irrigation.

MANA-TO-KO (*Myoporum insulare*).—A succulent plant introduced from the Eastern Province of Cape Colony. Reputed to possess value as a fodder plant and to be suitable as a hedge. Has failed to survive the winter, except when assisted by irrigation, and does not apparently justify cultivation under such conditions.

FIBRE CROPS.

AHGAN (*Ananas macrodontis*).—A number of plants were received for trial through the assistance of the Royal Botanical Gardens, Kew. These were propagated for several years, some in pots filled with specially prepared compost, and some in the open ground. They made no growth, and in spite of being watered when it appeared necessary, and being afforded protection from cold winds and frost in winter, they all finally died. Climatic conditions were apparently unsuitable, temperatures probably being too low.

BROTEX (*Lavertera arborea*).—A plant much advertised a few years ago as producing an admirable fibre, a seed crop suitable for conversion into cattle-feeding cake and a suitable pulp for paper manufacture. Plants only grew to a height of two to three feet and failed to survive the winter, although watered when it seemed necessary.

FLAX: LINSEED (*Linum usitatissimum*).—Many strains of this crop, including "J.W.S.," bred by the Irish Linen Research Institution, have been experimented with, and a certain amount of selective breeding has been undertaken. The periodical spells of extremely hot and dry weather, which are always liable to occur during the Rhodesian summer, appear to render conditions unsuitable for the growing of flax as a rainy season crop.

It thrives better in winter under irrigation in the warmer areas not liable to severe frosts. Even under the most favourable conditions the grain yield is light and seldom exceeds eight to ten bushels per acre. Production is limited to the Colony's requirements of linseed.

FLAX: NEW ZEALAND (*Phormium tenax*).—This well known perennial fibre plant grows well when irrigation can be provided or given an adequate supply of moisture during the dry season. It shows considerable promise on partially drained wet vleis in the granite, sand-veld areas of the Colony, and may well have commercial possibilities.

HEMP, BIMLAPATAM (*Hibiscus cannabinus*).—A common and troublesome weed plant, particularly on sandy, granite soils. Introductions have grown extremely well, and the crop has undoubted commercial possibilities if a satisfactory system of mechanical extraction of the fibre could be

perfected. *H. sabdariffa* also grows freely with less tendency to branch, but does not seed so heavily. Local selection of desirable plants has proved the feasibility of developing strains of both species markedly free of the branching habit.

HEMP, BOWSTRING (*Sansevieria sulcata*).—This, together with *S. cylindrica* and other allied species, occurs naturally in scattered clumps under the shade of trees and bushes in the hotter and dryer districts of the Colony. The wild plants do not occur in sufficient quantity in any one locality to warrant their presence being regarded as an economic asset, and from trials which have been made it is not considered that any of the species would justify treatment as a cultivated crop.

HEMP, COMMON (*Cannabis sativa*).—Has been introduced and re-tested several times, but in no instance have the plants made satisfactory growth. The same remarks apply to Kentucky hemp seed introduced from the United States of America.

HEMP, MAURITIUS (*Furcroya gigantea*).—Grows extremely freely and attains great length and width of leaf. Could be cultivated very extensively if the commercial aspect justified it.

HEMP, SISAL (*Agavi sisalana*).—Does not grow as freely or luxuriantly as Mauritius hemp, and in most parts of the Colony the leaf development appears inadequate to warrant commercial production. Shows better promise in the warmer parts of the Mazoe and Gwelo districts, and if prices for the fibre improve, may ultimately find a place among the commercial crops of some of the warmer areas.

JUTE (*Corchorus olitorius*).—No success has attended any introductions of this crop.

RAMIE, SILVERY. China grass. (*Bœhmeria nivea*).—This admirable fibre plant grows freely as a perennial, dry-land crop, and even better under irrigation. Difficulties in connection with the extraction of the fibre render its cultivation at present uneconomical. Similar remarks apply in the case of *Urena lobata*.

SIDA, spp. (*Sida rhombifolia*).—This species, together with *S. longipes*, *S. cordifolia* and *S. acuta*, are not uncommon

under-shrubs in many parts of the Colony. The first-named in particular is said to yield a fibre of very high quality, but difficulty and cost of extraction appear an almost insuperable obstacle to development of an industry from this crop. Grown readily from seed.

The young shoots are browsed by cattle and sheep in early spring, but value in this direction does not warrant cultivation.

TREE COTTON (*Gossypium arboreum*).—A perennial bush or small tree. Much attacked by all the insect pests of cotton present in Rhodesia and therefore a dangerous host plant for carrying over these pests from one year to another. Produces its fruit during the period of heaviest rains, which leads to much injury to the lint. Apparently without merit as a commercial crop.

OIL SEEDS AND ESSENTIAL OIL PLANTS.

CASTOR OIL (*Ricinus communis*).—Numerous strains of this crop have been introduced, and it has been grown experimentally by a number of farmers. Individual plants, especially "escapes" growing on waste land, bear profusely, but when brought under cultivation as a field crop the yield of beans has always proved too light to afford a profitable return to the European farmer.

NIGER SEED (*Guizotea abyssinica*).—The seed yield of this annual crop is too low in Rhodesia to warrant its cultivation for purposes of oil production. Some years ago it gained considerable popularity as a green manure crop, but of late has almost entirely been superseded for this purpose by sunflower, sunn hemp and various other legumes. It none the less possesses distinct merit as a green manure plant and can also be converted into an excellent and palatable silage of high feeding value.

PERILLA (*Perilla ocymoides*).—This plant was introduced through the agency of the Imperial Institute. It grows moderately well in Rhodesia, but the seed yield is too low to render the crop profitable for cultivation by European farmers.

PEPPERMINT (*Mentha piperita*), also *M. piperita vulgaris* and *officinalis*.—Grows freely on heavy, dark soils

under irrigation, but if not irrigated fails to survive the dry season. May have commercial possibilities.

SPEARMINT (*Mentha viridis*).—The same remarks apply to this species. Is not used for the production of commercial "peppermint oil," but the leaves are employed for flavouring foods and drinks.

SESAMUM (*Sesamum orientale*).—This crop was at one time grown quite extensively by the natives of Mashonaland, but is now more rarely seen. Both native and introduced strains have been tested exhaustively, but the seed yield is very light, and without considerable improvement in this direction the crop cannot be recommended for cultivation by Europeans. As maturity approaches, the capsules open and seed is shed very readily, a factor which adds to the difficulty and expense of harvesting.

TARWEED (*Madia sativa*).—No success has attended the several introductions of this plant.

DYE PLANTS, SPICES AND CONDIMENTS.

ANISEED (*Pimpinella anisum*).—Grows well and seeds freely as a summer crop under normal rainfall. Might be cultivated extensively if markets justified.

ANNATTO (*Bixia orellana*).—A large perennial bush with attractive flowers and foliage. Grows well and seeds fairly freely; could be cultivated commercially if the demand warranted. Is leafless in mid-winter but makes an ornamental garden shrub.

CORIANDER (*Coriandrum sativum*).—The remarks made in connection with aniseed apply to this crop also.

LIQUORICE (*Glycyrhiza glabra*).—Will not survive the winter if grown as a dryland crop, but provided a market can be found for the product, is deserving of further trial under irrigation, particularly at lower altitudes.

SAFFLOWER (*Carthamus tinctorius*).—This rather handsome annual grows quite freely as a summer rainfall crop, but has not yielded seed as heavily as sunflower. Is very hardy and might be grown extensively as a dye or oil seed plant if prices were sufficiently attractive.

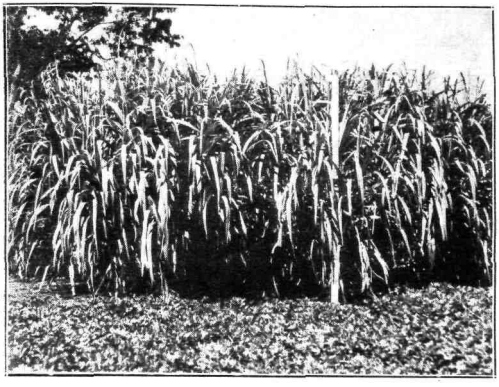


Fig. 1. Cow-cane, mature growth.

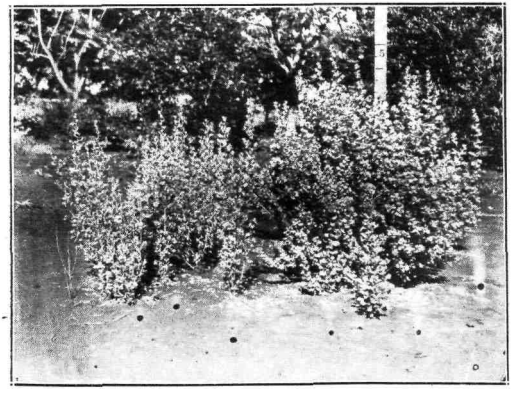


Fig. 2. Old-man Saltbush. The oldest plant is three years old.

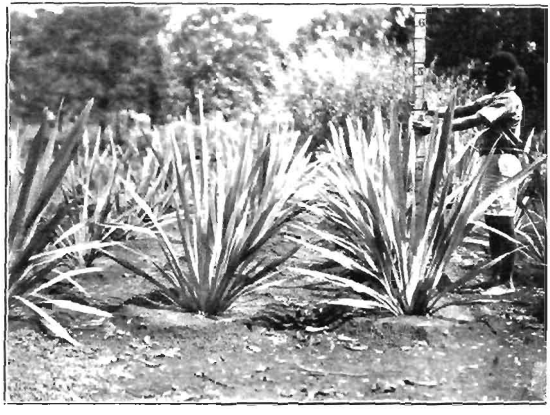


Fig 3 New Zealand Flax, three years' growth on red soil watered periodically during the dry season

Fig 4. Arrowroot growing on the Salisbury Experiment Station.

SAFFRON (*Crocus sativus*).—No success has attended introductions of this crop.

TURMERIC (*Curcuma longa*).—This plant subsists from year to year and does not die out. It appears above ground with the advent of each rainy season, but produces practically no growth or development. Climatic conditions appear altogether unsuitable.

SUNDRY OTHER PLANTS.

ALGAROBILLA (*Cæsalpinia brevifolia*).—A small shrub native to Chile, the pods of which are an important source of tanning material. Makes moderate growth in winter, but succumbed in summer. Climatic conditions are apparently unsuitable.

ARROWROOT (*Maranta arundinacea*).—Grows moderately well as an irrigated crop at the lower altitudes, and given such conditions, is deserving of further trial. It appears entirely unsuited as a dryland crop, except, possibly, for areas of high temperature and precipitation above the normal.

ACTINIDIA CHINENSIS.—A scandent vine-like plant introduced from California and said to produce a fruit of very attractive flavour. Grows moderately well in summer but does not fruit in Salisbury at an altitude of 4,800 feet. May be worth further trial under irrigation at lower altitudes.

CANAIGRE (*Rumex hymenosepalus*).—This plant of the "Dock" family, which provides a source of tannin, has not succeeded as a dryland crop, but grows moderately well under irrigation. Much difficulty, however, has been experienced in obtaining a satisfactory germination of seed and a good stand of plants. Might be worth attention if prices and demand were sufficiently dependable.

CHERRY, PITANGA (*Eugenia uniflora*), also *Eugenia hookerii*.—Grow into small, shapely trees of fifteen to thirty feet in height but do not fruit sufficiently to be of value on this account.

CHIVES, GIANT (*Allium schoenosprasum*).— Can be grown as a winter crop under irrigation but not as a dryland summer crop.

GOOSEBERRY (*Grossularia echinella*).—This is the species of gooseberry which in its wild state is reported to occur furthest south on the American continent. For this reason it was introduced into Rhodesia, where the ordinary types of gooseberry grown in Europe have not yet been found to thrive. The entire plant, including the berries, is densely covered with spines, which exude an unpleasantly flavoured juice. Several plants have grown and fruited freely on the Salisbury Experiment Station, and it may be that this species can be utilised with advantage as a stock on which to bud improved types of commercial gooseberry.

HOP (*Humulus lupulus*).—Several introductions of this crop have been made, and it has been tested both with and without irrigation on the high veld at an altitude of 4,800 feet and at lower elevations down to 3,200 feet. In no case has anything approaching satisfactory growth been made.

HYDNOCARPUS ANTHELMINTICUM.—Medicinal preparations utilised in the treatment of leprosy are obtained from this evergreen tree. It appears to require a certain amount of shade, since it is reported as almost invariably occurring in its native habitat in association with other evergreens. On the Salisbury Station the seeds germinated and the young plants grew for about six months, but then died off. May possibly meet more congenial conditions in the cooler and moister climate of the Eastern Border.

PHYSIC NUT (*Curcas purgans*).—A small tree which grows well and bears heavily in all parts of Mashonaland. Young plants volunteer freely from self-sown seed. There appears, however, to be no market for the seeds, which may be utilised for medicinal purposes and which also contain a high percentage of oil.

POPPY, OPIUM (*Papaver sativum*).—Could be grown as a winter crop aided by irrigation. Poppies do not thrive in Rhodesia during the rainy season.

SUNBERRY (*Physalis minima*).—A solanaceous plant of the Cape gooseberry family which produces a small purple-coloured berry. Is now a naturalised weed throughout the Union and Rhodesia. May be utilised for jam-making, but is not equal in yield or economic importance to the Cape gooseberry (*P. peruviana*) or giant austral berry (*P. ixocarpa*).

TRIGONELLA FOENUM GRAECUM.—An annual herb, the seeds of which are used in veterinary medicine. Has made no satisfactory growth or development in any trial so far conducted.

WORMWOOD (*Artemisia*, spp.).—Utilised in the preparation of vermifuges and for other medicinal purposes. Subsists unthriftily as a summer crop unaided by irrigation. Might perhaps be produced commercially in some districts with the aid of irrigation if an adequate market were available for the product.

Acknowledgment is made of assistance rendered in the compilation of this list by Mr. H. C. Arnold, manager of the Salisbury Agricultural Experiment Station, under whose supervision all recent introduction trials have been made; to Miss S. M. Stent, Senior Botanist; and to Mr. J. A. T. Walters, late Assistant Agriculturist in this Department, who was in charge of the work during the years 1914-1918, *and who in June,* 1916, *published an article in this Journal entitled "Crops Unsuitable to Southern Rhodesian Conditions," and who has kindly checked the present record.*

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

REPORT OF THE COTTON SPECIALIST, EMPIRE COTTON GROWING CORPORATION,

FOR THE YEAR 1931.

Season.—Taking into consideration the main cotton growing areas, the season varied from very severe drought conditions in the Hartley district to moderate drought conditions in parts of Mazoe and Lomagundi. The actual rainfall would have been sufficient for the cotton crop, but the distribution generally was bad. Long drought periods occurred in February and March, which caused much shedding of young buds and flowers. In certain parts of Matabeleland the drought was even more severe, yet the cotton crops there weathered the conditions moderately well, due, probably, to the better moisture retaining capabilities of the sandstone formation, particularly in the Umgusu Valley.

Towards the end of the season minimum temperatures were slightly higher than usual, and it is presumed that this enhanced the quality of the lint, a feature of the season to which further reference will be made.

Acreage, Yield per Acre, and Total Production.—It was reckoned that there would be about a 50 per cent. increase in acreage over that of the previous season, but actual figures obtained through the courtesy of the Government Statistician show the acreage to be slightly less than was anticipated. The provisional figures given for the cotton crop, 1930-31 (received 31st December, 1931), are as follows:—

Cotton Crop, 1930-31 (Provisional Figures).

	Cotton		Cotton Ratooned		Total	Cotton
	Acres	Yield (lbs.)	Acres	Yield (lbs.)	Acres	Yield (lbs.)
Returns received	7,009	2,151,235	359	84,912	7,368	2,236,147
Returns outstanding ...	1,535	443,100	125	29,750	1,660	472,850
Grand Total	8,544	2,594,335	484	114,662	9,028	2,708,997

From the above table, it will be seen that the total area of 9,028 acres yielded 2,708,997 lbs. of seed cotton, an average of 300 lbs. seed cotton per acre.

The above total is slightly greater than the total amount of seed cotton delivered to the ginneries, which figure is given as 2,365,770 lbs. The difference may be due to the fact that not many farmers have the means of correctly weighing their seed cotton in the woolpacks, in addition to which a certain proportion of low grade cotton is usually kept back, as it is difficult to sell at the present time; its value may not cover cost of ginning, rail and ocean freight.

Reckoning the total yield in Empire bales of 400 lbs., we get a figure of 1,974 bales, which comes within 26 bales of the 2,000 bale estimate.

Average Yields per Acre Obtained from 1923-24 *to* 1930-31.

Season	Acreage Planted	Average Yield per Acre of Seed Cotton
1923-24	3,947	428
1924-25	62,868	93
1925-26	66,086	124
1926-27	8,134	90
1927-28	1,340	95
1927-28	(U. 4 cotton seed increased from 15 lbs. to 2,000 lbs. on Cotton Breeding Station.)	
1928-29	(Above ton of seed increased by farmers to 66 tons.)	
1929-30	6,134	289
1930-31	9,028	300

From the above table, it would appear that a slight increase in the yield per acre was obtained, but it is doubtful if the increase is really significant. Taking into account, however, the severity of the drought conditions which prevailed in the Hartley district, and which must have tended to lower the average, the yields are well above the average of the previous seven years. This satisfactory state of affairs may safely be attributed to the fact that only the U. 4 variety of cotton seed is now grown in Southern Rhodesia, and that the closer spacing in the row, combined with the use of a heavier seed rate, is having the desired effect of increasing the yield per acre.

Quality.—The remarks made in previous reports concerning the lack of "character" in cotton from Southern Rhodesia, are not applicable to the cotton produced in the year under review, when a very distinct improvement was noticeable.

Mr. T. G. Hesse, Manager of the Central Co-operative Cotton Exchange, Limited, Durban, writing on 30th October, 1931, in the Rhodesia Supplement to his "Market Notes," stated:—

> "The character of the cotton marked a distinct advance on previous seasons, and the crop has been the best we have yet handled from Rhodesia."
>
> "The evenness of grade and staple was particularly marked. Our Liverpool connections, shortly after receipt of our first shipment, cabled us repeat orders—a compliment which had not previously been paid."

In this connection it may be permissible and necessary to repeat the remarks which I made under this same heading a year ago:—

> "It is not suggested that improvement in the 'character' of Southern Rhodesian cotton will take place suddenly, but steady progress is being made towards obtaining this desirable character. In the event of a favourable growing season, however, we may find a sudden improvement which, should it occur, must not be taken to mean that the difficulty under discussion has been finally overcome."

As mentioned before, it is suggested that the slightly higher minimum temperature towards the end of the season may have had much to do with the improvement in character.

Ginning.—Four ginneries operated throughout the ginning season. These were:—The Bindura and District Co-operative Ginnery, Limited, the Central Cotton Ginneries, Limited, the Hartley District Ginnery, Limited, and the Street Cotton Ginnery. The average ginning percentage varied from 33.1 per cent. to 34 per cent., while the percentage of waste varied from 1 per cent. to 5.8 per cent. The latter figure appears to be on the high side when one considers that the variation in the percentage waste in three of the ginneries ranged from .9 per cent. to 1.3 per cent.

Classification of Seed Cotton.—Three out of the four ginneries in operation made use of the Seed Cotton Classifier's services. That these services were much appreciated is evidenced by the testimony of the Manager, Central Co-operative Cotton Exchange, Limited, Durban, and the Senior Cotton Grader of the Union of South Africa. The latter, in a communication dated the 9th of October, referring to the work of the co-operative ginneries, stated:—

> "The classification of the seed cotton, mixings, ginning and sampling has, to my mind, been done in a most efficient manner, and has helped with the marketing of the lint considerably."

> "The ginneries in question are to be congratulated on the efficient manner in which they have carried out the instructions of the Seed Cotton Classifier, whose timely appointment appears to be fully justified."

Central Co-operative Cotton Exchange, Limited, Durban.—This organisation has again proved its usefulness in effecting prompt sales on behalf of the ginneries in Southern Rhodesia which are affiliated to it. But for the services rendered by the Exchange, it would have been exceedingly difficult, if not impossible, to dispose of the cotton entrusted to them for sale. In addition to the very low prices which prevailed, unforeseen problems arose as a result of the gold standard having to be abandoned by Great Britain, which action was soon followed by Southern Rhodesia. While this has ultimately benefited our cotton growers, the transition period was one in which great care had to be exercised in negotiating sales, and it was a relief to know that these transactions were in the experienced hands of a concern such as the Central Co-operative Cotton Exchange, Limited.

The Manager, Mr. T. G. Hesse, toured the principal cotton growing areas during part of January and March, and had discussions with farmers at various centres.

Cotton Breeding Station, Catooma.—In addition to the work which has been carried out on the Cotton Breeding Station in former years, a beginning was made with extension work whereby records were collected from other districts. This necessitated the creation of sub-recording centres on

farms where plots were laid down by several progressive cotton growers, who willingly co-operated with the staff of the Cotton Station at Gatooma.

Records on the sub-stations were taken by native recorders, who had been trained at Gatooma. When initiating this line of work, it was not known what degree of reliance could be placed on records so taken, but it is satisfactory to state that these exceeded expectations on three out of the four sub-stations where the native recorders were placed. Useful information regarding seasonal development, responses to cultural practices, behaviour of sub-strains and insect attacks were obtained, and used for comparison with results on the main station at Gatooma.

An attempt was made to breed grain moths at Gatooma for the purpose of rearing *Trichogramma lutea* (a bollworm egg parasite). Owing to lack of proper facilities, however, the attempt was abandoned.

Now that the station is being equipped with better laboratory accommodation, it should be possible to follow up such lines of investigation.

It is reckoned that the February-March droughts did more to reduce yields on the station than did the attacks of the various bollworms.

In comparison to former years, Jassid attack was relatively mild.

Evidence was obtained confirming advice given in the past in matters relating to cultural practices, and the non-application of artificial fertilisers.

The detailed report of the year's work on the Cotton Station was forwarded to the Empire Cotton Growing Corporation, London, on the 17th November, 1931.

United Kingdom Trade Mission.—The writer gave evidence before the United Kingdom Trade Mission under the chairmanship of the Right Honourable Lord Kirkley. Two members of the Mission, Mr. Robert Waddington and Mr. John Morgan, paid a special visit to the Cotton Breeding Station, which they inspected in detail. The Mission's reference to cotton growing in Southern Rhodesia may be found on page 52 of the report which they subsequently issued.

Prospects for Current Season.—At the time of writing it is not possible to hazard even a guess as to how much cotton has been planted this season. Owing to the extremely low prices at which last season's crop was sold, there was little inducement to farmers to plant any cotton at all. Nevertheless, many have done so, but on a more moderate scale than last year. On the other hand, it is anticipated that for this year there will be a considerable increase in the acreage of ratooned cotton. How far this practice will prove to be successful, or otherwise, remains to be seen. It is only fair to farmers to state that in general they do not approve of ratooning, but conditions being as they are, it is difficult for them to do otherwise.

In the event of even a moderate recovery in prices, there is reason to hope that the acreage will increase materially next season, as farmers have now regained confidence in their ability to grow cotton. This in itself is a very distinct advance, as it has been difficult to eradicate the bad impression created during the disastrous years of 1925 and 1926. It is safe to say that cotton growing in Southern Rhodesia will readily respond to any general improvement in world economic conditions.

SOIL DRAINAGE AND UTILISATION OF VLEIS.

By R. H. Roberts, B.Sc.(Eng.), Assistant Irrigation Engineer.

The drainage of vlei lands has been frequently effected in the past by cutting a central channel on a steep slope. While this practice is cheap and very effective in the initial years, it merely results in additional trouble before long, as the channel becomes a "donga" and a great deal of expense is involved in controlling it to avoid the total loss of the valuable soil brought under cultivation. Moreover, it is impossible to control the sub-drainage and re-constitute the vlei-conditions if it is desired to do so in years of low rainfall. It is not generally known, perhaps, that tampering with vleis which are definitely the sources of public streams is prohibited under the "Water Act of 1927."

For these reasons the drainage of vlei lands has never been strongly advocated by this Department, and it is only with the adoption of proper methods of drainage that the reclamation of wet land should be attempted.

There is no doubt that land exists on many farms which is extremely rich and capable of producing heavy yields per acre if it were once freed of its surplus moisture. Moreover, land of this type does not usually occur in large self-contained blocks; most frequently it is found in the form of patches or tongues mixed up with "dry" red soils, so that proper working of the whole area as one is very difficult. A common case, for instance, is that of a tongue of wet soil extending from the edge of an adjacent vlei. In passing, it may be observed that wet patches of this nature are often found to be extending and widening themselves as time goes on, so that it is possible that they are caused by the trampling action of cattle in the wet soil of the adjacent vlei. The

extension in area of the wet land is also due to the higher ground being maintained under cultivation, and thus absorbing more moisture, which gradually percolates down to the low-lying area.

Necessity for Drainage.—A soil consists of an aggregation of a very large number of small particles, which vary greatly in composition, size and shape. Since these particles do not fit snugly together, spaces exist between them, so much so that the volume of voids constitutes approximately 50 per cent. of the total. In a well drained soil each particle is coated with a film of moisture which clings to the particle by force of surface tension. The void spaces are therefore filled with air, which is a vital necessity for the maintenance of plant life. If an excess of moisture is forced on the soil it temporarily fills the voids, but proceeds to gravitate downwards and draws in a fresh supply of air behind it—that is if the soil is properly drained, naturally or artificially; if not, the surplus water merely stagnates and prevents the renewal of the oxygen supply.

A plentiful supply of free oxygen is as indispensable to plant life as to animal life. Oxygen is necessary for the germination of the seed for the propagation of roots, for the soil bacteria which produce nitrogen in its various forms, and for many other processes and chemical changes essential to the fertility of the soil.

Here, then, is an urgent argument for good drainage.

Another effect of under-drainage is to encourage the crops to root themselves deeply. If the permanent ground water stands near the surface of the soil early in the season, the roots are compelled to confine themselves to the upper few inches. If a drought develops later in the season, the water surface falls and the shallow soil in which the roots are confined becomes dry, since capillary action is too slow in supplying the necessary moisture. With proper drainage the early roots are compelled to penetrate more deeply into the soil in search of moisture, so that supplies are more evenly drawn upon and the plant is in a much better position to withstand a dry spell. Moreover, the decay of these roots later leaves additional means of entry for air into the deeper parts of the soil.

Wet lands are "cold" lands, owing partly to the high specific heat of water, which demands a greater quantity of heat to warm it than does an equal weight of soil, and partly to the cooling effect of the high rate of evaporation from a wet surface. The effect of drainage, by lowering the level of the ground-water surface, is to raise the temperature of the soil, particularly in the upper 12 inches, and thereby greatly to improve the conditions for plant development.

The most obvious benefit of drainage is in preventing a heavy soil becoming unworkable through excessive moisture. When properly under-drained, the surplus water is quickly removed, so that the heavy soil may be ploughed and planted at the same time as the adjacent lighter soil.

Causes of Water-logging.—As far as Rhodesia is concerned, three main causes may be recognised:—

(1) Surface water running off from high ground and collecting upon adjacent low-lying flat lands, which are unable to pass it off or absorb it sufficiently rapidly.

(2) Seepage water percolating from the lower strata of high ground on to lower lying areas, and reaching the latter either directly on the surface or by rising from below.

(3) Lands in general which are underlaid at a shallow depth by heavy clay beds, forming an impervious sub-soil.

Since these causes do not always work singly, but more frequently combine to a greater or lesser degree, the diagnosis and cure of the trouble is not usually the simple matter it might appear. There is no doubt, however, that in a great many cases water-logging is to a large extent due to surface water from higher ground collecting and lying on the flat black lands below, and to that extent the treatment is obvious. A system of storm drains and contour ridges should be employed on the high ground to collect and divert the surplus water and prevent it reaching the low-lying lands.

Types of Drain.—The aim and object of all systems of under-drainage is to lower the level of the ground-water by providing it with outlets, properly proportioned as to depth and distance apart, so that surplus water will gravitate into them, and leave no more than a normal moisture content in

the upper layers of soil. The flow of ground-water is resisted by the particles of the soil through which it has to pass. The tighter the soil, the greater the resistance it offers, and the steeper the gradient of the surface of the ground-water. Obviously, the steeper the gradient, the closer must the drains be placed together, if the surface of the ground-water is not to lie at less than a given depth below the surface of the ground.

No hard-and-fast rules can be laid down as yet for Rhodesian conditions, but a general guide may be taken from practice overseas, where good drainage is generally secured in average loose loamy soil with drains 100 feet apart and $3\frac{1}{2}$ feet deep. In heavier soils they would need to be correspondingly closer together, but not necessarily deeper.

Open Drains.—Open drains are the most obvious means of removing surplus water, and in certain circumstances they should and must be used. Apart from their use purely as storm water drains, there are often cases where water seeping down from porous strata of adjacent high ground on to the low-lying land can be intercepted by means of an open drain, which would give a cheap solution of the problem. Again, open drains are necessary to collect and dispose of water led into them by other systems of under-drains.

Open drains, however, suffer from several disadvantages: they are an unmitigated nuisance in ploughed lands and require a certain amount of attention for cleaning. Moreover, they are objectionable, in that they harbour weeds, are liable to damage by cattle, and are a potential means of soil erosion. Some form of covered drain is therefore always preferable for the arable land itself.

French Drains.—The earliest development of the open drain was to fill it in, after providing some device in the bottom of the trench through which the water could readily percolate. Numerous expedients have been adopted, ranging from bundles of brushwood to properly-built stone drains with paved bottoms, and top and sides built of flat stones or brick. Two slender poles are sometimes laid side by side and a third laid on top, the whole being covered with brushwood and soil. With the "white ant" problem in Rhodesia, none of the timbered French drains are likely to prove very

long-lived, and some type of stone drain is to be preferred if stone is reasonably available.

If a drain of this type is to prove a permanent asset, a fair amount of trouble should be taken to lay the stone as closely as possible to prevent fine material silting in and clogging the openings. Good broken brick often makes a substitute for stone. The coarser stone should be placed in the bottom, followed by smaller stone and then a layer of gravel, before refilling the trench. Bricks form a neat channel, but can only be recommended if thoroughly well burnt and carefully selected; the ordinary farm-made brick is not usually a sufficiently durable article. An under-drain, like a chain, is only as strong as its weakest link; one soft brick is enough to clog the whole drain.

The depth of the drain should not be less than 3 feet, and very much better results will be obtained if the depth is made 3 ft. 6 ins. or 4 ft. However, where a definite subsoil of very tight clay exists, there is no point in going more than a foot into it, and the drains will require to be correspondingly closer together. For economy's sake, not only in the excavation but also in the stone filling, the width of the trench at the bottom should be as narrow as possible; twelve inches is ample, but the actual figure will be dictated by the size of the stone that is to be used.

The gradient of the trench will often be controlled by the type of lay-out adopted for the whole system, but should be as steep as possible, since a drain of this description offers a considerable amount of resistance to flow. The gradient should be as uniform as possible, and, while a change from a flat slope to a steeper one is permissible, the reverse should always be avoided, to prevent silt deposits clogging the channel.

The lay-out of a system of French drains depends so much on the peculiarities of each individual case that general rules are not of much value, particularly as, before undertaking such work, it is usually advisable to obtain proper engineering advice. Apart, however, from a whole system of drains, very good work can often be done with a single drain to cure an isolated spot or tongue of wet land, in which case the drain is often placed to advantage on the upper side of

the centre of the wet patch. Strips of wet land as wide as twenty yards can usually be effectively treated by a single French drain.

Tile Drains.—The invention and cheap manufacture of circular tiles revolutionised drainage practice. The water was provided with a uniform, clear channel, a great improvement on the tortuous passage afforded by a French drain. Very little fall was required to carry the water off (as little as 2 ins. in 100 ft.). If the work was carefully done and good material used, the drains were practically everlasting.

Tiles should not be less than 3 ins. in diameter, and are usually best laid at a depth of between 3 and 4 ft. Lesser depths are sometimes used, but in a country of cheap labour it is better economy to dig deeper trenches and space them somewhat further apart so as to reduce the amount of tiles required.

The cost of tiles (£12 per 1,000 ft. two years ago) is at present the chief drawback to their use under Rhodesian conditions.

The distance between the tile-drains will vary from 50 ft. or less in tight soils, up to 200 ft. in looser soils, and the actual disposition of the system of trenches will depend on the local conditions of shape, slope, position of natural channels, etc. The trenches require to be carefully dug to secure an absolutely uniform gradient, without bumps or hollows, which would cause clogging. Accurate levelling is therefore required both before and after the excavation of the trench.

The tiles should be laid as soon as the trench has been dug and smoothly graded. Great care should be taken in laying the tiles to ensure a close fit at the joints. It is essential for permanently satisfactory results that the tiles themselves should be perfectly circular in section, straight and with square ends, so that a minimum of adjustment will be necessary in fitting the tiles closely together. No appreciable space is required at the joints; water will percolate through the closest joint, and if too much space is left it will only result in silt gaining entry to the drain and clogging it up.

When the tiles have been properly laid and inspected, they should be covered with a few inches of soil (free from

stones, which might break the tiles) to prevent movement, and then the mass of earth can be filled back into the trench, either by hand or by some form of scraper.

Where a minor tile drain joins a main line (usually of bigger diameter), it should enter above the centre of the main tile and at an angle of 30 degrees or so. A Y-piece is preferable to a T-piece. The joints at the junction should be made with wet clay. The outfall of a line of tile-drain into a natural channel requires special treatment, and should be walled off with brick or concrete to prevent damage by cattle. The additional precaution is often taken of covering the end with metal gauze to keep out rats and other vermin.

Generally speaking, tile draining, if properly carried out, is very efficient and gives permanent results, but cannot be recommended at present for Rhodesian conditions on account of the expense.

Mole-Draining.—Mole-draining is no new discovery, but it has gained prominence in recent years through improvements in the mole-draining plough and the application of mechanical power.

Mole-draining consists essentially of forming a series of miniature tunnels through the subsoil by means of a hardened steel "cartridge" or "torpedo," attached to the bottom of a sharp, strong, vertical coulter, which projects downwards from the framework of the plough, consisting of a skid (often on wheels).

The application of mole-draining is strictly limited to lands having clay sub-soils, for it is obvious that the tunnels will not be permanent in soils of a loose character. Mole-drains are best placed at a depth of 16 to 18 ins., which is sufficient to get them into firm subsoil and protect them from damage due to ploughing at ordinary depths. Modern practice appears to have crystallised in favour of a mole $2\frac{1}{2}$ ins. in diameter. Greater permanence is given to the drain by attaching a hard steel ball or bottle expander to the rear of the cartridge; the expander enlarges the drain, leaving a hard polished surface, and closes up the slit left by the coulter.

The power required to pull the mole-plough is considerable, depending upon the depth and diameter of the moles

and the nature of the soil. The draught may be greatly reduced if furrows are opened up with a single-furrow plough before putting in the mole-plough itself.

It would appear that under Rhodesian conditions the work will be most cheaply and easily done if it is carried out as soon after the close of the rainy season, as the ground surface has dried sufficiently to give a grip for the tractor or oxen. The draining should be done before the land is ploughed (in the case of arable land).

Many different methods have been used for drawing the mole-plough, and may be grouped in two main classifications: (a) direct traction, and (b) cable traction. Direct traction is to be preferred whenever the draught is not too heavy, as being simpler and quicker and avoiding the cost of the cable and winch. Moreover, it is possible to avoid obstacles such as ant-heaps. Cable haulage is economical of fuel, since the dead weight of the tractor itself has not to be moved over the wet ground, and by proper gearing very heavy draughts may be handled.

Since mole-drains are made at a much shallower depth than other systems of under-drains, it is necessary that they should be placed much closer together. In fact, experience shows that more effective drainage is obtained by a large number of shallow drains than by a few large channels at greater distances apart. The actual distance between mole-drains will depend upon the nature of the soil. English practice indicates that the drains at about 18 ins. depth should be only 3 yds. apart, but it seems probable that for Rhodesian conditions this distance could easily be doubled.

Mole-drains require a steeper gradient than tile drains—firstly, on account of the greater resistance to flow, and secondly, because it is impossible to secure an absolutely uniform gradient, since the inequalities of the ground surface are reflected in the level of the drains. As a working limit, the gradient should probably not be less than one in two hundred, and a steeper gradient is to be preferred in order to produce a brisk flow, which will reduce the chance of clogging. The length of mole-drains of small diameter (2½ ins. to 3½ ins.) is limited to about 200 yards.

Main drains, either open or piped, are required to collect and discharge the water from the moles. If a natural channel exists, so much the better. A short length of 2 in. pipe should be inserted into the end of each mole drain where it enters an open main drain to prevent damage through the trampling of cattle.

Mole-drains are not strictly permanent, but under favourable conditions are capable of giving satisfactory service for a number of years. In certain cases in England mole-drains 30 or 40 years old are still in use, but these particular drains were 3½ ins. in diameter and relatively deep.

Tile-draining is being rapidly superseded in England as "impossibly expensive" in comparison with mole-draining, and the difference should be still more marked in Rhodesia, since mole-draining is a method which requires very little (beyond the actual mole-plough) in the way of purchased material, and the cost is therefore almost entirely composed of labour charges. Given conditions where the draught is not too heavy for a span of oxen (or a tractor), mole-draining offers a cheap and simple means of draining a piece of rich, wet land. A number of mole-drains have been drawn on a piece of typical black vlei on the Gwebi Government farm, and comments on the results were published in the "Rhodesia Agricultural Journal" of February, 1931.

Conclusion.—While it is not suggested that under-draining on an extensive scale has been necessary or warranted in Rhodesia up to the present, there are isolated lands on a great many farms which are potentially very valuable either for pasture or arable purposes, but are, for want of drainage, only a handicap to the general working of the farm. Where these wet patches are small, it is probable that a few well-placed French drains will cure the trouble, while mole-draining is applicable to land of greater extent.

Apart from under-drainage, it is important to take steps to prevent surface water collecting and soaking into low-lying land. This is a fruitful cause of water-logging, and, if surplus surface water is collected by a system of storm-water drains and contour ridges on the higher ground, it will be to the advantage of both types of soil.

Finally, a general word of warning should be sounded against the practice of indiscriminately ploughing up vlei lands. These lands are naturally exposed to the discharge of large quantities of storm water, and if the natural vegetative covering is once removed, there is nothing to stop the eventual formation of a large donga. The best practice is to leave a strip of 20, 30 or even 100 yards of natural grass (depending on the local conditions) in the centre of the depression, and if a channel is required for drainage purposes, it should be placed at the side.

Utilisation of Vleis.—The vleis of Rhodesia constitute a most important asset to the country, providing as they do one of the few sources of moisture available during the winter and spring and thus promoting in their vicinity green pasturage during the dry months. For the most part, however, they are capable of being rendered by judicious treatment of infinitely greater value than in their natural state. Speaking generally, they are excessively wet for the greater part of each season and are incapable of carrying summer crops or of producing grasses of high feeding value. The object of drainage is to maintain the moisture content of the land at a more uniform level throughout the year. Apart from its limited use for the growing of wheat and other winter cereals, little has yet been done towards the improvement of vlei land or its utilisation to best advantage. It may well be found that the most economic use to which most vleis can be put will be for the establishment of improved pastures, but even so some measure of drainage will usually be required.

It is necessary that the system of drainage should be as simple and cheap as possible, more so than is permissible for the drainage of good arable soil, although under English conditions no distinction is made. Leaving aside, therefore, the question of French drains and mole-drains (and, of course, tile-drains), it is obvious that some type of open drain must be used.

Where the improvement of the pasture is the objective, each case must be carefully considered on its merits, bearing in mind the type of pasture which it is desired to establish. Clovers apparently will not persist unless moisture is retained throughout the driest part of the year, within two

or three inches of the surface, and white clover is more tolerant of excessive moisture than of very dry conditions. In certain cases, therefore, care must be taken not to over-drain the land, and, if mixed grass and clover pastures are desired, it may be found sufficient merely to prevent excessive water reaching the land by reason of the run-off or percolation from higher lying areas adjoining.

In other cases, and particularly on heavy clay vleis which are unsuitable for clovers owing to the rapid drying out of the surface soil in winter, the land may be laid off in wide ridge and furrow, the furrows being shallow and of an easy rounded shape so as to offer little obstacle to the use of hay-making machinery. Here, for average conditions, it is suggested that the depth of the drains or furrows should be from 1 foot to a maximum of 2 feet, and 3 to 5 yards wide, the width of the intervening ridges being 10 to 15 yards. The system should be laid out with the drains parallel and dropping at the rate of about 1 in 100, either towards the centre of the vlei or, if there is a suitable longitudinal fall, parallel to the axis of the vlei. The gentle undulating shape is important to permit easy movement of the implements and will repay a little care in excavation, which may largely be done with a plough, Martin ditcher or dam scraper. The soil removed in the excavation should be spread out thinly over the elevated strip.

It is not advisable to leave the furrows to natural reversion to grasses, for this will be a relatively slow process, and meanwhile the disturbed soil will be taken possession of by weeds. Moisture-loving grasses should therefore be established in the furrows, those suggesting themselves being swamp couch grass, Hunyani grass, Rhodes grass and paspalum (dilatatum). The last two can be quickly established from seed, and, if this is the intention, it will be advisable to spread a layer, a few inches deep of the surface soil (previously removed) over the face of the furrow in order to provide a more congenial medium than sub-soil, in which young grass plants may establish themselves.

Submerged Dam.—A submerged dam is a device by means of which water percolating underground is checked in its flow and brought to the surface. In other words, an artificial spring is created. The chief condition necessary for

the success of a submerged dam is the existence of an impervious clay bed not far below the surface. A trench is carried down to, and into, this clay bed at right angles to the direction of percolation. The trench is then filled with good puddled clay, the thickness being proportional to the depth and not less than 3 ft. Clay for filling the trench should not be taken from the down-stream site, or there will be a risk of leakage.

A submerged dam can be used to provide a water-hole for cattle, or, if a sufficient stream of water is available, for the irrigation of adjacent land. In the latter case a small furrow is dug behind the dam and led away past one end of it.

Springs and "Sponges."—It is necessary to differentiate between the type of spring which appears usually at the foot of a steep rise at the head or side of a vlei, and the "sponge" proper, consisting of low-lying swampy ground full of decayed humus.

In the former case the vlei below the spring is not naturally a swamp, but is simply impregnated with water from the spring. If a submerged dam is made immediately below the line of springs and a furrow dug behind the dam, the spring water may be diverted from the vlei and either used for irrigation of a better piece of adjacent dry land, or may be led back to the low-lying ground whenever necessary. The vlei will then be relieved of its superfluous moisture and two pieces of land may be put to good use instead of none.

With the typical wet sponge it is usually necessary to go to the lower end and search for a place where an underlying clay bed comes close to the surface. If a submerged dam is made at this place, the sponge will continue to act as a reservoir and should not be interfered with. If a sufficient flow of water is developed, it may be diverted by a furrow and used for irrigation.

It is not usually possible to irrigate more than an acre or two from a seepage spring or sponge, but if conditions are favourable, the submerged dam may sometimes be extended above ground level in the form of an ordinary low earth dam, which will increase the usefulness of the scheme.

Veld Burning.—Although the burning of rank grass on a vlei is occasionally a necessary measure, the general practice

is one to be deprecated, since the burning of the natural covering of grass exposes the soil to the direct heat of the sun, opening up cracks (in the case of black soil) and desiccating the soil, so that the valuable asset of moisture during a dry winter is wasted by evaporation instead of being put to good use by drainage, cultivation and fertilising.

Another dangerous practice is that of opening up a spring or sponge indiscriminately, and it is strongly recommended that engineering advice should be obtained before taking any such steps.

GWEBI PRODUCE PRICES.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

REPORT OF THE REGISTRAR OF CO-OPERATIVE SOCIETIES

FOR THE YEAR 1931.

Number of Companies Registered.—The number of co-operative companies registered at the date of this report is eleven.

Only one new organisation was registered during the year, namely, the Midlands Farmers' Co-operative Company, Ltd. This was established at Gwelo to take the place of an unregistered Association of farmers which had for some years operated a maize pool with a good measure of success. The development of the business had made legal incorporation very desirable.

Two Associations which were registered last year commenced business operations during the period under review. One of these, the Dairymen's Co-op., Ltd., is a combination of producer-distributors of milk in Salisbury, whom circumstances forced to embark upon methods of co-operation. The company has met all the difficulties commonly experienced by an organisation undertaking an intricate task, and the results have not been all that the members hoped. They are, however, according their loyal support, and the future of the company can therefore be contemplated with some confidence.

The second Association was the Producers' Direct Supply Co-operative Company, Ltd., which was established to market vegetables, fruit and other perishable products on behalf of its members by retail. This is one of the most difficult types of co-operation, but the company seems to be receiving good support and to be extending its business. Its first financial statements have not as yet been received.

During the year, three Co-operative Companies interested themselves keenly in the possibilities of co-operative purchases of farming requirements for their members. Means of developing this activity have been closely discussed, the

Department providing what advice and assistance was possible, but the farmer's need of credit in respect of his purchases has prevented much progress being made.

Liquidations.—There were no liquidations during the period under review.

Trade Investigations.—During the year the Registrar carried out an investigation in the Belgian Congo in the interest of Southern Rhodesia's trade in agricultural produce with that territory.

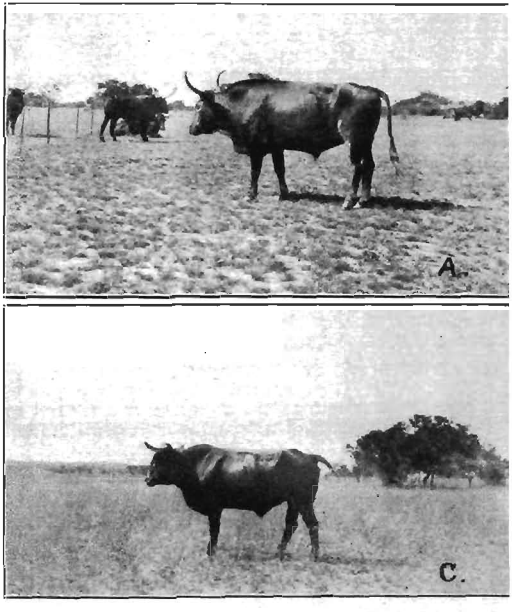
Another investigation was made at Beira in connection with the possibility of developing a market for vegetables and other perishable products in that port.

Maize Control.—The Registrar having been appointed chairman of the Maize Control Board, a considerable portion of his time has been devoted to the affairs of the Board. The Board commenced operations in terms of the Maize Control Act on the 5th June last. At the date of this report (31st January, 1932), it has received into the pool a total of 1,148,236 bags of maize, of which it expects to export approximately 50 per cent. Its sales total 693,354 bags.

The total European crop for the season 1930-31 has been returned at 1,436,000 bags, and in addition some 138,000 bags of native maize were traded. This gives a total of 1,574,000 bags. Of this quantity, 360,000 bags appear to have been retained by producers for their own consumption.

The Board proposes to make a first interim cash distribution of 3s. a bag within the course of the next few weeks. The distribution will be due to holders in due course of Participation Certificates, and, in the instance of participants in the pool who have had advances on the certificates issued them, it will be applied to the repayment of such advances.

The Board's financial year terminates on the 31st May, 1932, and a full report on its transactions will be prepared as soon as possible after that date.



Difference in grazing rate at end of grazing period.
A. Heavy grazing paddock. C. Light grazing paddock.

PRELIMINARY NOTES ON INTENSITY OF GRAZING EXPERIMENT.

By D. G. Haylett, B.Sc.(Agr.), M.Sc., Ph.D.; C. A. Murray, M.Sc.(Agr.); and F. T. Eriksson, Dip.Agr., Matopo School of Agriculture, Rhodes Matopo Estate.

A considerable amount of prominence has been given to the question of close, intermittent grazing during the last few years, particularly in humid climates. As an agronomic problem, it is a field in which there is promise of greater achievement than in any other phase of crop production. The initial impetus was supplied by the success of the German Hohenheim method of heavy fertiliser treatment and rotational grazing (McConkey, 1931*). In the British Isles this work has been further developed by the investigations of Woodman and his co-workers (1926, 1927, 1928, 1929, 1930).

The focus of attention on the whole problem of grassland management has now made it an Empire-wide research project with ramifications throughout the British Dominions.

Under humid climatic conditions it has been shown that the feeding value of pasture, especially with regard to protein and mineral content, can be maintained at a high level for a longer grazing period than if the pasture is allowed to become rank. Apparently close-grazing, judiciously practised, does not impoverish the pasture, but tends to improve it.

Under semi-arid conditions, however, whereas close grazing may prolong the feeding value, as shown by the work of Husband (1931), nevertheless it is not yet known to what extent this heavy grazing will ultimately result in a degeneration of the pasture. The work of Staples (1928) at Cedara, Natal, showed that even under the relatively high rainfall of

* Reference to literature cited at end.

Natal, continuous close-grazing cannot be practised for more than one year out of two or three, without marked harm being done to the pasture.

The present experiment was designed in the first instance to determine the effect of different intensities of grazing on the botanical composition of a fairly typical sandveld pasture, under the climatic conditions pertaining to this area. The results of this experiment should enable a sound, practical recommendation to be made with regard to the management of similar types of grazing in order to obtain the maximum carrying capacity without harmful over-grazing. The experiment is in progress, but cannot be brought to finality until a period of years has elapsed.

Previous History.—The experimental paddocks were originally part of a large, partially fenced area, east of the tobacco barns, between the Malemi River and Matopo Hills. For the reason that it was only partially fenced, it is probable that it was never very heavily grazed. Since June, 1930, this area has not been grazed, except occasionally by a few native cattle and the oxen working on the main road.

The area was burned during the late winter of 1931 and was burned similarly during the winter of 1930. The grazing history prior to this time is unknown.

The veld was considered typical, average "sour" sandveld by the Botanist, Department of Agriculture. The grass species at the commencement of the experiment were recorded by means of twenty permanent quadrates in all, five quadrates being located in each paddock. These data should provide a very good index to the botanical composition of the site.

A uniform area of eleven acres was selected and fenced into four paddocks as shown in Fig. 1. Five permanent quadrates were located in each paddock on the position shown in Fig. 1, and from the main basis for gauging the change in the pasture.

A standard grazing unit of three head of cattle and fourteen sheep was used, and the different intensities of grazing were obtained by varying the size of the paddock while keeping the grazing unit and the number of grazing days constant. Thus Paddock A, 2 acres, carrying the same number

of animals for the same number of days as Paddock B, 3 acres, was more heavily grazed than the latter, and Paddock C, 4 acres, under these conditions was grazed with half the intensity of Paddock A. This is a new departure in grazing technique and appears to be working well, the idea being to eliminate variability due to all causes except the intensity of grazing. The effect of group individuality in the grazing units was reduced by random group selection at the beginning of each grazing period. A record is being kept of the number of grazing days per season with the usual gross observations on the animals and pastures.

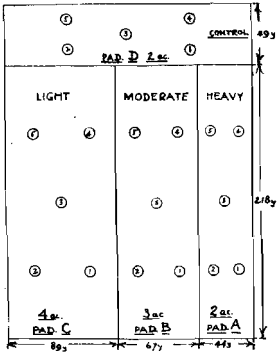


Fig. 1.—Diagram showing arrangement of paddocks and location of permanent quadrates.

Grazing was commenced in each case when the grass in Paddock A was about 9 to 12 ins. high, but before the bulk of the grass was in flower. Grazing was discontinued on all plots when Paddock A was eaten close, practically no leaf and no flowering heads remaining. At this stage all the animals were removed from each paddock, which was allowed to recover until there was sufficient new grass in Paddock A to start a further period of grazing.

PRELIMINARY RESULTS.

Grazing Data.—Grazing commenced on 12th December. Thirty oxen were allowed to graze over the whole area, which had been fenced only on the outside. The internal division fences had not been erected, and it was considered essential to graze to prevent the grass seeding. After the whole area had been grazed at an average rate of 13.64 beasts per acre for one day, the animals were withdrawn.

The second and third grazing periods started on 31st December and 2nd February respectively, with three bullocks per plot.

The fourth, fifth and sixth periods started on 26th February, 29th March and 7th May. After this grazing the plots will be allowed to remain over until the spring of 1932, when grazing is to be continued on the same basis.

The intensity of grazing represented by the number of days one bullock would have grazed one acre averaged 70.34, 51.44, 41.98 and 13.64 days for Paddocks A, B, C and D respectively. The number of grazing days in any particular season will depend on climatic conditions and resultant growth of the pasture.

In order to bring the grazing by sheep to the same basis as grazing by oxen, the factor 0.15 as given by Fraps (1924) has been applied.

The difference between the paddocks became increasingly marked as the number of grazing periods increased. At the close of the season the difference as illustrated was striking. It is anticipated that the accumulation of old grass in the lightly grazed Paddock C will present a problem after the experiment has been in progress for a few years. This will probably introduce a secondary factor which will have to be provided for at a later date.

The animals throughout the experiment tended to avoid the seed heads of *Cymbopogon excavatus*, *Pogonarthria squarrosa* and *Hyparrhenia* spp. in Paddocks A, B and C.

Botanical Analyses.—The detailed botanical analyses from five quadrate determinations in each of the four paddocks have been carefully noted. There are 24 grasses and

32 miscellaneous plants belonging to other families, most of which have been identified. The experiment is particularly concerned with the grasses, but it will be of considerable interest to ascertain the increase or decrease of the legumes and other plants as a result of protracted treatment.

The grasses appear generally in the following order of frequency:—

1. *Digitaria milanjiana.*
2. *Eragrostis* spp.
3. *Pogonarthria squarrosa.*
4. *Hyparrhenia* spp.
5. *Heteropogon contortus.*
6. *Cynodon dactylon.*
7. *Rhynchelytrum roseum.*
8. *Aristida* spp.
9. *Shizachyrium Jeffreysii.*
10. *Sorghum micratherum.*
11. *Cymbopogon excavatus.*
12. *Crossotropis grandiglumis.*
13. *Andropogon shirensis.*
14. *Trichopteryx simplex.*
15. *Brachiaria serrata.*
16. *Perotis indica.*

Acknowledgments.—Acknowledgment is made for the invaluable assistance given by the members of the Division of Plant Industry, Miss S. M. Stent, Senior Botanist, and Mr. J. M. Rattray, Botanist, in identifying the grasses and other plants referred to in the paper and offering valuable suggestions, and to the Senior Animal Husbandry Officer, Dr. A. E. Romyn, for his advice and criticisms.

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FARMING CALENDAR.

August.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather, the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when *the first irrigation is given, this application of fertiliser to be followed* by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is *the best month to cut down citrus trees for re-working to better varieties.* As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal.* Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis,

or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1½ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add

tobacco extract, 1 part to 80 parts *spray*. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tube-rose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should

be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

September.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (*with a pinch of salt and a dash of vinegar*) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both *requiring very careful handling*. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not

forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roiler can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought ont and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—

this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on very young fruit. A useful spray against black aphis and thrip is the following:—Nicotine, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuces, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable

to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

SOUTHERN RHODESIA VETERINARY REPORT.

May, 1932.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.

Roede.—The temperaturing of the infected herd, removed from this farm to Welgelegen, was completed. No cases of Coast Fever occurred.

Melsetter Commonage and Sawerombi.—No further cases.

Rocklands Estate.—The Constantia and Clifton herds were moved to fresh veld and short-interval dipping carried out, but the mortality continued, showing that this veld was infected previously. No cases of disease amongst the other herds on this estate. Arrangements are being made to move the infected herds to a temperature camp on clean veld.

The total mortality from Coast Fever during the month was 89 head.

Laughing Waters.—Post-mortem examinatiou of a beast on this farm showed lesions that suggested Coast Fever, and microscopical examinations confirmed. On the adjoining farm, Newcastle, a sick beast was destroyed, and post-mortem and microscopical examinations showed Coast Fever. The total mortality at Laughing Waters was four head, and as these cattle had been dipping at the Newcastle tank, it would appear that the disease first appeared on the former, and that Newcastle was infected by the cattle going to the tank.

Arrangements were made to move the infected herds to a temperature camp on clean veld.

Glencoe.—A fresh outbreak occurred on the farm Glencoe, adjoining the Tilbury Estate. Mortality, two head.

FOOT AND MOUTH DISEASE.

Gwelo Veterinary District.

A fresh outbreak occurred on Ghoko Block involving about 7,500 head of cattle. All herds were concentrated at the dipping tank, located about the centre of the block, preparatory to inoculation.

On the Aberfoyle Block the inoculation of all herds, numbering 6,258, was completed on the 13th, and the resulting re-actions were most satisfactory.

At the farms Umlangana and Dorset the cattle were recovering rapidly.

Umvuma Veterinary District.

On the Central Estates fresh infection appeared in three paddocks.

Victoria Veterinary District.

Infection was discovered at the Headquarters Section, Nuanetsi Ranch, amongst four mobs of weaners. During the months of January, February and March 499 calves were moved from various sub-sections to central weaning kraals about four miles from Headquarters. The last removal took place on 25th March last and the disease was discovered on 4th May. The infection is undoubtedly a recent one, as in no case were the lesions of more than fourteen days' standing. As far as could be observed only calves born since the disease passed through this section last year are affected.

The source of infection in this case is difficult to account for. All sections of the ranch infected in the first instance were reported as free from infection at the end of June last, and since then there has not been the slightest suspicion of disease on any of them. In March last disease was discovered on that part of the Mtilikwe section lying between the Mtilikwe and Tokwe Rivers caused by infection either from the Mukorsi River Ranch or the Nyadjena Reserve to the north. There has been no movement of ranch cattle

from the Mtilikwe section to any of the other sections for a very considerable period. There have, of course, been the usual movements of ranch officials and mechanical transport between Mtilikwe and Headquarters, but our experience is that infection is rarely, if ever, carried by either.

The most likely source of this fresh infection at Headquarters is the illicit movement or straying of native cattle either from the Mtilikwe area on the east or the Belingwe and Gwanda areas on the west. Several movements of cattle of this nature have recently been detected on the Ranch, and as the area involved is so large, it is certain many such movements take place without detection.

All other previously infected areas in this veterinary district are now considered free from disease.

Bulawayo Veterinary District.

Insiza and Gwanda Areas.—All the cattle concentrated and inoculated in the Bankwe, Senga and Indhlela dipping tank areas were permitted to return to their kraals. The inoculation of the cattle concentrated from the Anglo-French Block and other farms in the vicinity was completed on 1st May, and at the end of the month all were ready for return to their respective kraals. The Grimstone, Lukotsi and Dumbarton herds recovered completely.

In the Onderbrook and Ladi areas inoculation was completed on 12th May.

On 23rd May infection was located on the Donkerhoek tank area and all the cattle involved were moved to Onderbrook for inoculation.

On 26th May the disease was discovered in the Siwazi tank area and in the southern section of the Insiza Reserve. A cattle-free belt was established to the west and north of these areas and arrangements made for the inoculation of all cattle within the cordons.

At Liebig's sub-camp VII. all cattle showed good reactions to inoculation and recovered completely.

TRYPANOSOMIASIS.

Five cases recorded on the eastern border, Melsetter district, and twelve in the Bubi district.

HORSE-SICKNESS.

Eleven cases reported.

SNOTZIEKTE.

Six cases occurred in the Umvuma area.

MYIASIS (SCREW WORM IN CATTLE).

This is prevalent in several districts.

IMPORTATIONS.

From the Union of South Africa: Cows 2, horses 23, sheep 1,357, goats 10.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SOUTHERN RHODESIA WEATHER BUREAU.

JUNE, 1932.

Pressure.—The barometric pressure was above normal over most of the country, but was slightly below normal at Salisbury. There were a number of lows on the south coast during the month. Two were very deep and moved up the south-east coast. The highs all appeared on the west coast and travelled overland, bringing dry air to Southern Rhodesia.

Temperature.—The month was cool, and a good deal of frost was recorded.

Rainfall.—Owing to the extremely dry winds accompanying the high pressure systems, there was no rain except on the eastern border, where very slight rain fell on two days.

JUNE, 1932.

Station.	Pressure Millibars, 8.30 a.m.		Temperature in Stevenson Screen ° F.							Rel. Hum.	Dew Point	Cloud Amt.	Precipitation.			Alti-tude (Feet).
			Absolute.		Mean.											
	Mean.	Normal.	Max.	Min.	Max.	Min.	½ Max. Min.	Normal.	Dry Bulb.	Wet Bulb.	%	F.	0-10	Ins.	Normal.	No. of Days.	
Bulawayo ...	873.5	872.9	72	33	68.3	41.0	54.7	57.3	55.8	47.3	52	38	1.4	...	0.3	...	4,436
Gwelo	867.0	...	72	31	67 9	40.9	54.4	57.1	54.3	47.2	58	40	1.4	...	...	...	4,632
Riverbank ...	...	...	79	32	73 6	41.7	57.7	59.3	51 9	45.5	60	38	...	...	...	...	4,100
Essexvale ...	...	...	83	31	77.5	37.9	57.7	58.2	44.6	41.4	76	38	..	...	...	...	3,828
Gwanda ...	912.1	...	77	32	72.2	40.4	56.3	...	56.4	48.8	57	42	1.0	...	0.1	..	3,235
Mazunga ...	954.5	954.6	83	33	77.8	42.8	60.3	62.2	59.2	52.2	62	47	2,3	...	...	...	1,970
Nuanetsi ...	...	...	83	34	77.5	42.0	59 8	..	57.8	51.2	63	45	2.1	...	0.1	...	1,630
Between Rivers	...	...	76	32	73.3	39.0	56.2	...	53.1	47.7	67	43	2,1	...	...	...	3,970
Enkeldoorn ...	...	...	72	35	68.0	42.1	55.1	57.4	56.0	49.1	60	43	2.2	...	...	...	4,720
Gatooma ...	...	...	76	35	72.9	40.8	56 9	60.0	56.9	49.3	57	42	2.2	...	...	...	3,850
Miami	...	...	75	41	70.6	45.6	58 1	...	57.4	51.0	64	46	1.9	...	...	...	4,090
Salisbury ...	859.2	859.3	73	37	69.3	43.0	56.2	57.1	56.9	49.0	56	42	2.9	...	...	...	4,890
Sinoia, Citrus ...	...	...	77	34	73.5	41.7	57 6	...	55 5	48.8	61	43	...	...	...	...	3,836
Sipolilo... ...	...	...	75	40	70 3	45.5	57.9	...	58.9	51.1	61	42	2.7	...	...	..	3,900
Mtoko	...	...	78	43	66.4	48.6	57.5	...	57.4	50.8	63	45	2.8	...	...	...	4,210
Shamva ...	...	...	80	36	74.0	43.0	58.5	...	56.1	50.3	67	45	...	...	...	...	3,170
Angus Ranch ...	...	...	80	41	74.5	48.2	61.4	61.6	55.5	50.7	71	47	...	...	0.1	...	2,300
Craigendoran ...	...	...	80	34	75.1	44.0	59.6	...	59.4	53.5	68	49	...	...	0.1	...	3,430
New Year's Gift	...	...	80	41	73.4	48.2	60.8	...	57.0	51.3	67	47	...	...	0.2	...	2,700
Nyamasanga ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,080
Riverdene North	...	...	77	27	72.2	34.1	53.2	...	43.3	41.2	84	39	...	...	0.2	...	3,700
Stapleford ...	...	...	66	29	59.7	36.4	48.1	...	51.8	48.1	82	47	3.9	0.10	0 6	2	5,450
Umtali	898.2	897.2	78	39	69.3	46.6	58.0	59 9	59.1	53 4	69	49	2.7	0.03	0.2	2	3,677
Victoria ...	...	...	75	31	70.2	38.4	54.3	55.7	53.2	46.9	62	41	1.5	...	0.1	...	3,570
Melsetter ...	854.6	...	70	39	64.4	44.7	54.6	...	55.9	49.8	65	44	1.2	0.09	0.6	2	5,060
Mount Selinda	...	...	74	43	67.3	47.3	57.3	...	59.5	54.0	70	49	2.0	...	0.6	...	3,520
Manchester ...	...	...	68	37	61.3	41.7	51.5	...	46.7	43.9	80	41	...	0.06	...	1	...

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