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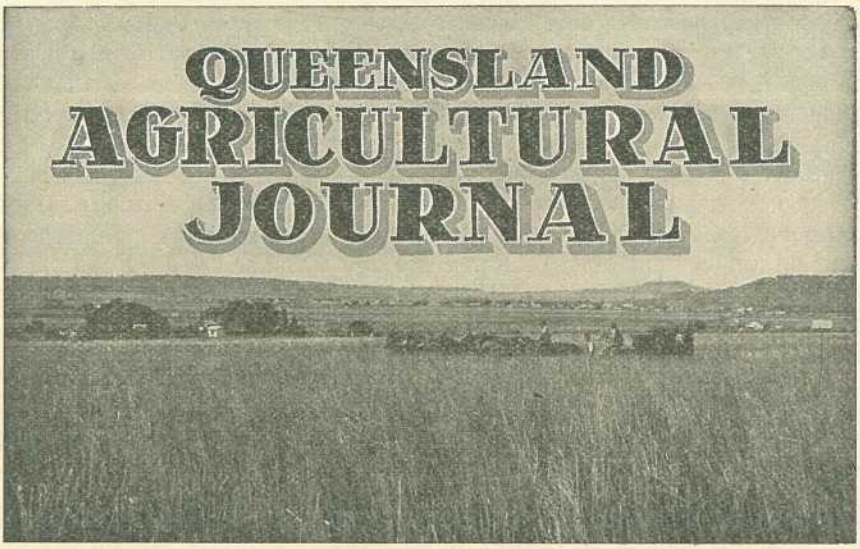


VOL. XLV. 1 JUNE, 1936. PART 6

Event and Comment

Markets and Population.

"WHATEVER may be said about Imperial policy, either now or in the past, I am satisfied that the greatest influence for peace and civilisation to-day is the British Commonwealth of Nations." With that remark the Premier, Hon. W. Forgan Smith, LL.D., M.L.A., prefaced a notable speech at a recent function given in his honour by the Royal Empire Society and the British Empire League in London. Sir Archibald Weigall, formerly Governor of South Australia, was in the chair.

The Premier added: "There are some people who talk of giving away what they are pleased to describe as their possessions. It is a very easy thing to give away that which you do not own. I am satisfied that the progress of the world depends on maintaining and strengthening that great Union to which we all belong."

Speaking of Queensland, Mr. Forgan Smith said that during the depression, price-levels fell, the drop amounting, in Australia, to £200,000,000 per annum. Financial crises took place, and they had to be tackled. The people of Australia had faced up to the position. They had solved many of their difficulties and they were on the high road to a return to prosperity. Considerable sacrifices had to be made, and they were borne by the whole community in proportion to their capacity to bear the burden. Their financial position was such that they could

look forward to a steady return to normal conditions. Queensland, being chiefly an agricultural country, suffered less, probably, than the rest of the Commonwealth, and it was in the happy position to-day of having a smaller percentage of unemployment than other parts of the Commonwealth. The latest figures of normal employment showed that the problem was less acute in Queensland than elsewhere. That was the measure of their success in developmental projects.

In Australia, the Governments worked together on a public policy after having given full consideration to all its implications. The success of that policy laid down a few years age was amplified in 1932, and the recovery that had taken place in all the States was very evident at the present time.

Their immediate problems were markets and population. He took the view that, in the last analysis, the title of an individual to hold land was to be judged by the use to which he put it. The same principle applied to the territory held by a country. The only title to any country that history recognised was successful occupation, and Australia must have population in order that its development should be successfully continued and effective occupation accomplished.

The Australian population was 98 per cent. British. That was a factor the importance of which could not be over-estimated. And, with a reasonable policy carried out by the Australian and Imperial Governments, there was no reason to fear that this percentage could not be maintained. There was no reason at all, in the natural course, why the Commonwealth should not be peopled by our own stock; why we should not bring them out to a healthy climate where men, women, and children would be given the opportunity of developing themselves in the manner for which Nature had fitted them. There were two basic essentials—markets and population, population and markets.

It was necessary that we should come down to essentials before any remedy could be found. In discussing the problem of markets with many people in London, he found that there was a good deal of confusion of thought. Information had not been so widely distributed as it might have been. Australia was not competing with the farmers and producers of Great Britain. What it was doing was to compete with the farmers and producers of what were properly called foreign countries. It was not widely enough known that Australia purchased from Britain more than Argentina and Denmark put together. In considering matters of trade and two-way traffic, it was important that these factors should be clearly recognised. Australia was not willing to accept as a basis of negotiation that it should share equally the British market with foreign countries.

These matters had an important bearing on the problem of migration on the one hand and with population on the other. They required people of British stock, but it was illogical to talk of increasing the

population of Australia by means of State-aided migration, and, at the same time, to speak of restricting the amount of exports it could send. The two things could not be reconciled.

It was a debtor country and must sell more than it bought if it was at all times to be able to meet its obligations, financial and otherwise. It had always met its obligations on the due day, but it must have the means of earning a livelihood so that it could go on meeting these payments.

A man on the land in Australia produced more than he could use himself, so that, in dealing with migration problems, one must take into account the problem of markets. Much confusion and difficulty had been caused in past years by people being misled, and therefore they wanted to provide the people of Great Britain with the facts. They wanted to be able to tell them that they would be able to look forward to a great future in a country like Australia. But they were not going to institute any scheme of mass migration unless they could be sure that this was beyond all possibility of misunderstanding. They wanted to be sure that the people of Great Britain had the facts—that if they were industrious and went to Australia their future would be reasonably assured. They must not forget the lessons of experience in deciding how migration was to be carried on.

The facts of existing price levels and the lack of purchasing power in Great Britain and in Europe must also be considered. A form of perverted nationalism had resulted in closing markets and restricting the channels of trade and commerce in the industrial countries of the world. These processes had greatly affected the market for certain commodities. There were countries in Europe which produced sugar, and they liked to think that they could share in the British free market. Owing to excise and other charges, the prices of sugar in Europe ranged up to 7½d. per lb. in English currency. Thus, the amount sold was kept low by the excessive price. The situation brought about by this form of economic nationalism was largely responsible for the friction and danger existing in the world to-day.

Those were the reasons why nations lacked confidence in one another. They were the fruitful causes of misunderstandings which led to war. Industrial changes and scientific developments had enabled us to produce to-day abundance of food which would not have been dreamed of thirty years ago. We must try to make these products available to the people of the world. Public policy should aim at a better distribution of this plenty as an aid to solving industrial and social problems and minimising the jealousies which concerned us all so much to-day.

The future of Queensland was assured. They intended to develop the country to the best of their ability. They were happy in the relations which existed between them and the sister States and other parts of the British Commonwealth of Nations. They wanted to work in co-operation with other members of that great family which was one in sentiment and objective.

Experiments with Vapours for the Control of Blue Mould of Tobacco.

By L. F. MANDELSON, B.Sc.Agr., Pathologist.

PATHOLOGISTS of the Council for Scientific and Industrial Research recently evolved a method for successfully protecting tobacco seedlings from blue mould infection, by growing them in covered seed-beds in which various liquids were vapourised. The most satisfactory results were obtained by using a concentration of benzol vapour produced by an area of liquid equal to two square inches per square foot of bed. Toluol and petrol were also investigated as evaporating materials. These experiments were carried out during the period 16th November, 1934, to 6th June, 1935. At an interstate conference on tobacco problems held in July, 1935, representatives of the various State Departments of Agriculture were invited to investigate the possibilities of this method for controlling blue mould under their local conditions.

Reports have indicated that benzol has been successfully tested in the various States, and in Western Australia satisfactory results were also obtained with petrol and "X3 solvent" when used at half the recommended strength. The object of this report is to discuss a series of three experiments which have been completed in Brisbane during 1936 to investigate this method of controlling blue mould.

In these experiments, the fungicidal efficiency of four materials—namely, benzol, toluol, "X3 solvent," and "X300 special boiling point spirit"—was investigated. Benzol is a commercial product containing benzene, toluene, xylene, &c., and is obtained from the distillation of coal tar and by scrubbing coke oven gas. It has a boiling point range from 70°C. to 98°C. Toluol is commercial toluene obtained from the distillation of coal tar, and may also be found in certain natural petroleums. The boiling point of toluene is 110°C. The other two materials are hydro-carbon distillates from crude oil, and were supplied by the Shell Company of Australia, Ltd.; "X3 solvent" has a distillation range of 100°C. to 120°C., and "X300 special boiling point spirit" from 150°C. to 185°C.

Details of Experiments.

In the first experiment tobacco seedlings were grown in ten cold-frames, five of which were covered with glass, and five with calico treated with linseed oil, and some were grown in open beds. The volatile materials tested were benzol and "X3 solvent," and were used at both "normal" and half "normal" concentrations. A "normal" concentration of vapour was considered as being produced by an area of liquid equal to two square inches per square foot of bed—i.e., where the area of the evaporating liquid was 1/72 of that of the bed. Two open beds were sprayed with colloidal copper with soft soap as a spreader. The other open beds, one glass-covered bed, and one calico-covered bed contained seedlings which received no treatment, and acted as controls for the experiment.

The liquids to be evaporated were poured into tin vessels of appropriate dimensions in the late afternoon, and the covers of the frames were then placed in position. In the morning the covers were

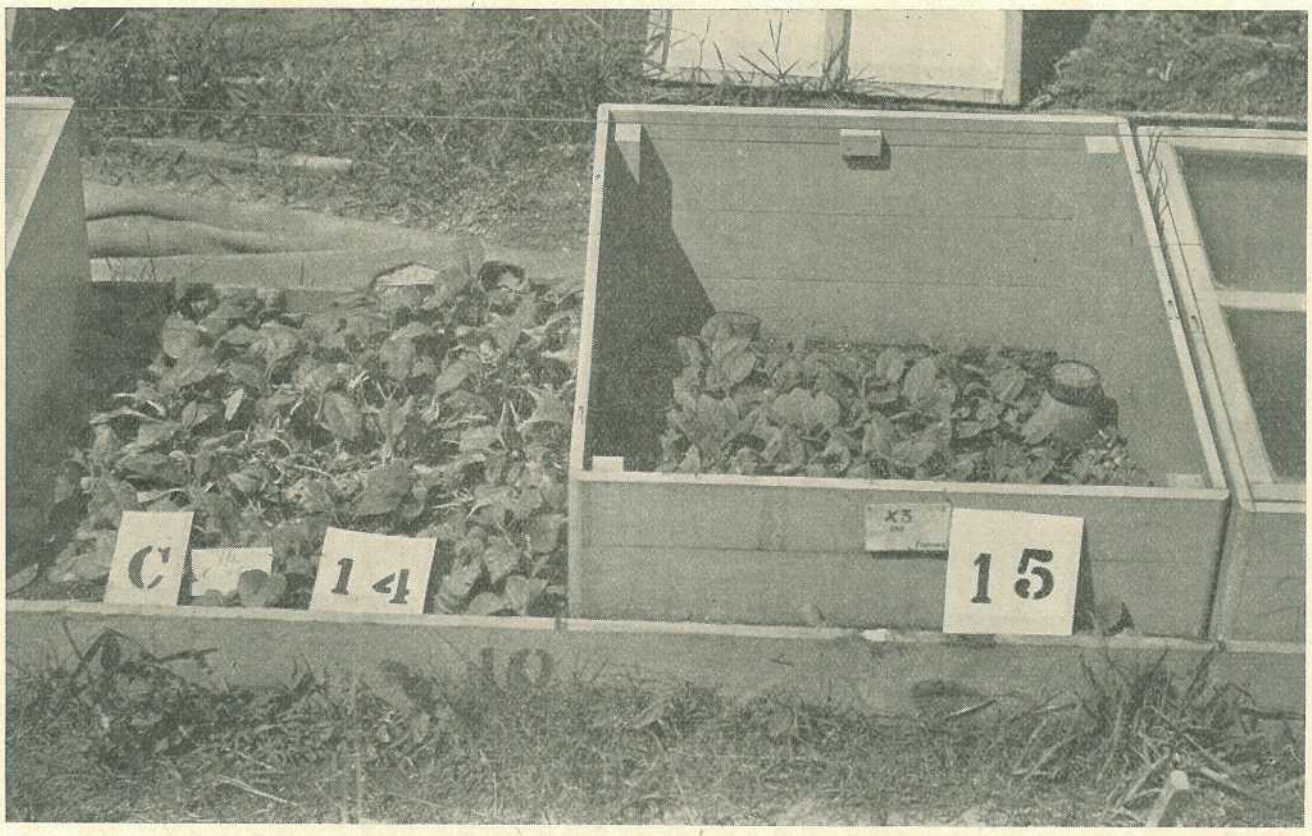


PLATE 199.

Showing untreated plot on left affected with blue mould and plot treated with "X3 solvent" at a "normal" concentration on right. Note the healthy appearance of the latter. Tins used for evaporating the liquid may be seen in the cold-frame. The canvas cover for the frame may be seen in the background, and a glass cover may be seen in place on the adjoining frame.

taken off, the liquids were removed, and the amount which had evaporated was estimated. Maxima and minima temperature readings in both glass and calico-covered frames for the period the plants were exposed to the vapours were recorded, as well as the daily range in open beds. In order to introduce blue mould, a water suspension of spores of the causal fungus was sprinkled over the seedlings, and, subsequently, diseased plants were brushed over the beds.

Throughout the period of the experiment, beds treated with both benzol and "X3 solvent" at both "normal" and half "normal" concentrations remained entirely free from blue mould infection (Plate 199). At the higher concentration, seedlings were stunted and were rather pale. Growth was almost normal, however, at the lower concentration, and plants treated with "X3 solvent" made rather more satisfactory growth than those treated with benzol. At the termination of the experiment, plants sprayed with colloidal copper were only slightly affected with blue mould. All control plots at this time were affected, and seedlings in open beds suffered more damage than those in the cold-frames. In all cases, plants in calico-covered frames did not make as satisfactory growth as those grown under glass.

The object of the second experiment was to investigate the efficiency of benzol and toluol. The same equipment was used, and the experiment was conducted in a similar fashion to that of the first, with the exception that spraying with a fungicide was omitted. Furthermore, in addition to artificial infection, the seedlings were also exposed to natural infection with blue mould from the diseased survivors of the previous experiment.

Unfortunately, seedlings throughout the bed, both covered and uncovered, made very unsatisfactory growth; consequently, it was difficult to estimate the toxic effect of the two materials used at varying concentrations, or the effect of glass or calico covers. At the termination of the experiment, all plants in the open control beds had been killed by blue mould, and those in covered control frames were only slightly less affected. Plots treated with either benzol or toluol, however, remained free of the disease.

The third experiment was an attempt to control blue mould by vapour treatment, and at the same time reduce the initial cost of equipment and cost of operation. The volatile materials tested were benzol and "X300 special boiling point spirit," used at half the "normal" concentration. The latter was included owing to its relative cheapness, and benzol, which had proved effective in the previous tests, was useful as a check on its fungicidal value. A special type of vapour-tight tent was used in this experiment. Oiled calico with wooden rollers attached to its sides was supported by a strained wire running the length of the bed. The ends of the tent so made were blocked with a triangular-shaped piece of board to which the canvas could be attached by means of tapes. In order to admit ventilation or sunlight, the calico sides could be rolled up to any desired height and kept in position by means of pegs fitted into the sides of the triangular wooden ends (Plate 200). Two such tents, 15 feet by 3 feet 6 inches, were used for vapour treatment. A third tent of similar dimensions but without wooden ends was used as a control bed. Short strips at either end of the plot which were not covered and received no treatment served as additional controls.

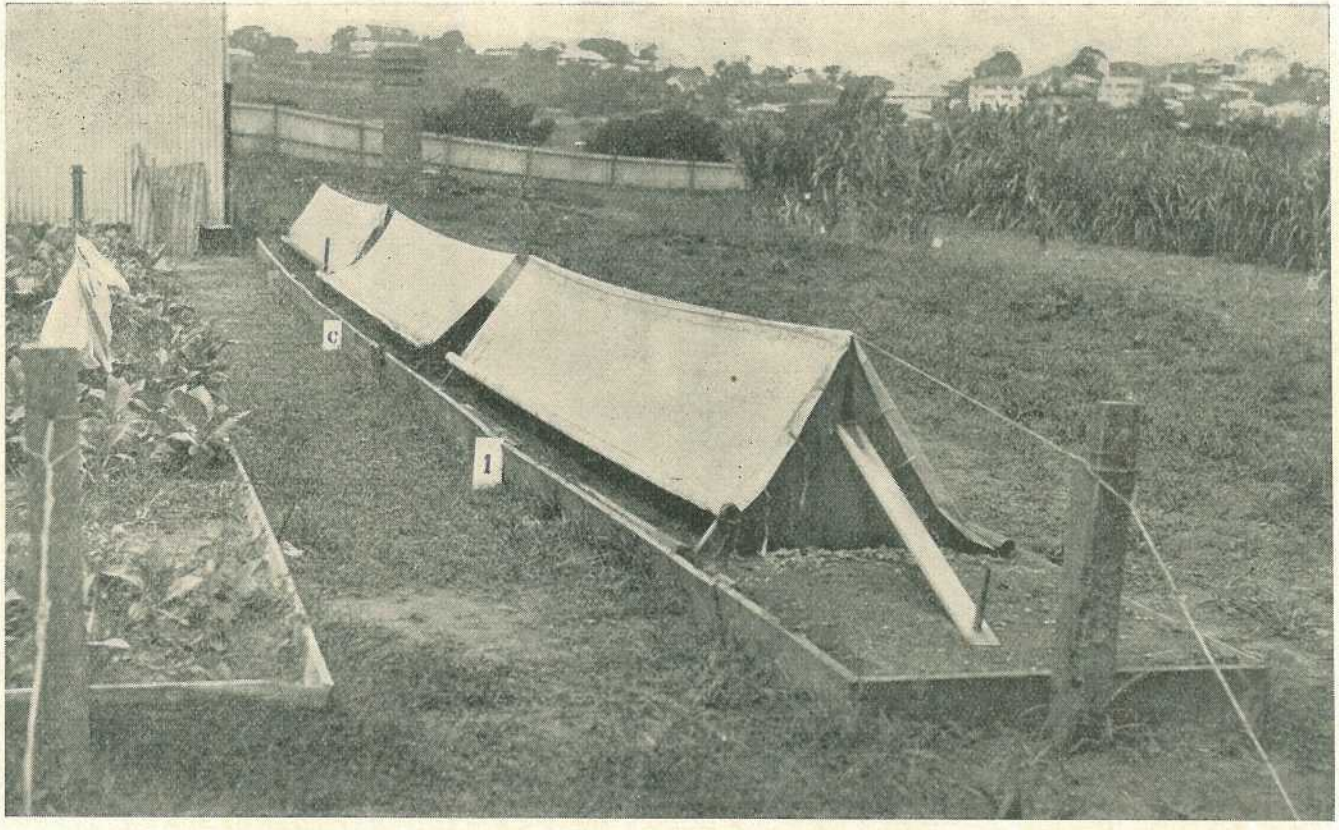


PLATE 200.

Showing type of vapour-tight calico tent used in the third experiment. One side of the tent is partly raised to permit aeration for the young seedlings. Note the tobacco plants in adjoining bed which acted as a source for natural infection.

It was found that seedlings in the control tent, possibly due to better aeration, made more satisfactory growth than those in the vapour-tight tents. At the conclusion of the experiment, plants in the control plots had been killed by blue mould. Those in both gas-treated plots remained free from the disease, but were rather spindly in growth. Plants treated with "X300 special boiling point spirit" were larger than those in the benzol-treated bed, and showed less vapour injury. However, in both cases a certain amount of vapour injury occurred in the vicinity of the evaporating vessels (Plate 201) and along one side of the bed. Furthermore, owing to the triangular construction of the ends, the slack calico sides had a tendency to rub on the soil and so kill young seedlings growing along the edge of the bed; consequently, if beds of this type were adopted in practice, it would be an improvement to have the walls of the bed perpendicular near the surface of the soil. This could be arranged by constructing a five-sided wooden end, which would make a ridge roof for the tent, and also permit the sides of the tent to hang perpendicularly. Furthermore, by arranging for the wooden rollers to overhang the earth supporting walls of the bed, less waste of seed-bed area would result.

Evaporation of Volatile Materials.

Benzol was used in the three experiments under discussion, and its rate of evaporation varied in each (Table I.). This variation was probably associated with differences in the temperature range during the period of the experiments, and also with the nature of the material used for the seed-bed covering, and the volume of the vapour-tight structures employed. The relative rate of evaporation of the other materials may be estimated by comparison with benzol in the respective experiments. It will be noted that this rate varied inversely with the boiling points of each. The actual cost of controlling blue mould by vapours largely depends on the rate at which the materials evaporate, as well as on the price of such materials.

TABLE I.

EVAPORATION OF MATERIALS.

Materials.	Period of Vapour Treatment.	Amount Evaporated.	Percentage Loss.
Experiment I. (in cold-frames)—	Days.		
Benzol (N and N/2)	22	10,950 c.c. (=19·3 pts.)	57·1
X3 solvent (N and N/2)	22	6,625 c.c. (=11·7 pts)	37·7
Experiment II. (in cold-frames)—			
Benzol (N and N/2)	23	14,185 c.c. (=24·9 pts.)	62·4
Toluol (N and N/2)	23	9,360 c.c. (=16·5 pts.)	42·3
Experiment III. (in calico tent)—			
Benzol (N/2)	29	18,480 c.c. (=32·5 pts.)	34·8
X300 special boiling point spirit ..	29	7,050 c.c. (=12·4 pts.)	14·2

(N = "normal" and N/2 = "half normal" concentration of vapour respectively.)

Discussion.

From the results of these experiments, it appears that all four materials tested are equally effective in controlling the disease, both when used at a "normal" and a half "normal" concentration. Although some stunting of seedlings resulted when grown in these vapours, less

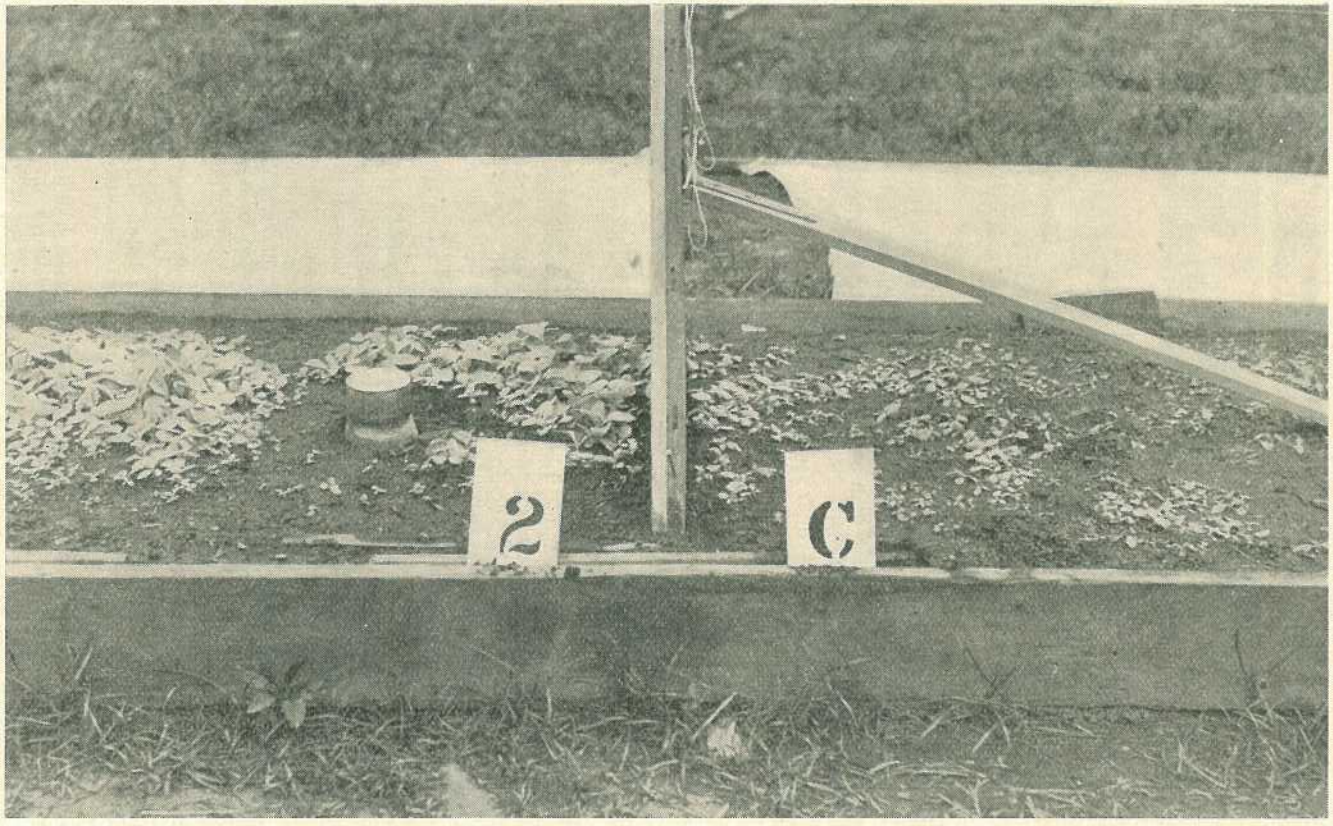


PLATE 201.

Showing plants in control tent (C) and in tent where "X300 special boiling point spirit" was used (2). All the plants in control plot are practically dead. Note the bare patch caused by vapour injury in the vicinity of the tin used for evaporating the liquid, and also the poor stand along the side due to injury from contact with sides of the tent and to the accumulation of toxic vapour.

injury occurred with the lower concentration. The crude oil distillates "X3 solvent" and "X300 special boiling point spirit," furthermore, were less toxic than benzol to plant growth. No doubt the operating cost of controlling blue mould by vapour treatment could be considerably reduced by using a material such as "X300 special boiling point spirit" at the lower concentration.

A further economy could be effected by using a vapour-tight tent rather than the cold-frame type of seed-bed. The type described in this article could, no doubt, be considerably improved upon, and could be constructed relatively cheaply.

It is proposed to carry out further experiments at various tobacco centres during the approaching season, with the object of obtaining confirmation of the results discussed in this article. Readers who may consider using vapours for the purpose of controlling blue mould are reminded that they possess varying degrees of inflammability.

Acknowledgment.

The writer wishes to acknowledge the courtesy of the Shell Company of Australia, Ltd., in making available various volatile materials for these experiments. He is also indebted to various members of the pathological section of the Queensland Department of Agriculture and Stock for observations made on experimental plots during his absence from Brisbane.

PRIDE IN POSSESSION.

The slogan "Better Pigs on Every Farm," adopted by the Stud Pig Breeders' Society indicates a desirable objective and paves the way for progressive action. It is human nature to feel proud of one's possessions and attainments, and a farmer is (or should be) proud of his farm and of his stock. But how often he omits pigs as one of his possessions of which he is proud, and just as often he may overlook them in importance as profit earners.

While it is true, as emphasised by the National Pig Breeders' Association overseas, that pigs have justified the aphorism that they are "copper or gold" in times of general depression, it is surely worth while to have an interest in something which has a chance of bringing in gold than to be solely concerned in undertakings which ought to yield consistent profits, but which, owing to a great variety of circumstances, often fail to do so.

Pig production is a branch of agriculture with immense possibilities. Great Britain imports annually over £40,000,000 worth of pig products, of which, until quite recently, Australia contributed nothing at all. The industry is growing and prospects are good, but better quality is required if we are to maintain our position as exporters and receive the maximum profits.

It is sound business to buy purebred pigs even if the purchaser has no intention of becoming an exhibitor of pedigreed stock, for the purchaser of purebred pigs will derive satisfaction and pleasure from the ownership of those better quality animals, especially if, in addition to purchasing them he gives them that added care and attention which are essential to success.

There are several British breeds of pigs in which farmers generally should be specially interested—the Berkshire, the Large White, the Tamworth, and the Middle White. The breeding and feeding of purebred animals are actually less costly than the breeding of other types of pigs, while there is no reason why the profits should not be materially higher. "Pigs for profit, and better pigs on every farm," should be the slogan adopted by every farmer.—E. J. SHELTON, H.D.A., Senior Instructor in Pig Raising.

The Tobacco-growing Industry in the United States of America.

By L. F. MANDELSON, B.Sc.Agr., Plant Pathologist.

[*Continued from May, 1936.*]

Cultural Practices.

FARMING methods vary greatly in different parts of the flue-cured belt, due partly to local conditions such as soil and climate, and the nature of other crops grown on tobacco farms, the type of labour employed, and the farming traditions of individual areas. Some States, such as Georgia and South Carolina, have only been growing tobacco for a relatively short period, and in such areas new methods are more quickly adopted, and farming tends to be of a more progressive nature. The methods adopted in the Piedmont or Old Belt of North Carolina and Virginia, vary somewhat from those of the New Belt, situated on the Coastal Plain extending from North Carolina, through South Carolina and Georgia into Northern Florida. The former is hilly country with a great diversity of soil types, whereas the latter is fairly uniformly flat, with a poor sandy loam soil.

PLATE 202.

CHOPPING DOWN TOBACCO STALKS.—At the termination of the season tobacco stalks are frequently chopped down with a stalk-cutter. This implement is shown in operation in North Carolina.

Soil Preparation.

After harvest in the Piedmont area, the old tobacco stalks are usually chopped down with an implement known as a stalk cutter (Plate 202), and the hills are ploughed down in the direction of the rows. The soil is then cultivated with a disc cultivator. Rye is planted in the autumn, and the crop is ploughed in when knee high about seven months later. Such a cover crop is very desirable in this section to prevent erosion, and to improve the condition of the soil which is frequently of

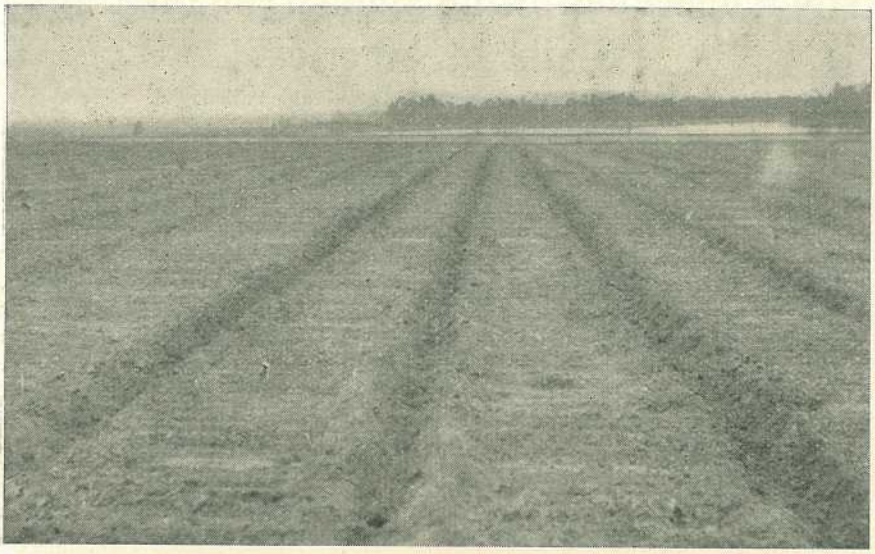


PLATE 203.

TOBACCO FIELD PREPARED FOR FERTILIZER APPLICATION.—A tobacco field in Georgia showing where rows have been opened up with a shovel plough preparatory to applying fertilizer.

PLATE 204.

APPLYING FERTILIZER.—In the foreground fertilizer is being applied with a distributor. The team in the background with a small shovel plough, follows on and incorporates the fertilizer with the soil. The soil is an extremely heavy type in the Piedmont section of North Carolina.

PLATE 205.

INCORPORATING FERTILIZER WITH THE SOIL.—After the fertilizer has been applied to the opened drills it is thoroughly mixed with the soil by means of a small shovel plough.

PLATE 206.

"LISTING" OVER THE FERTILIZER DRILL.—After the fertilizer has been applied and mixed with the soil, a ridge is made over it by two furrows with a turning plough. The operation is known as "listing."

a heavy nature. It also mitigates losses by leaching, which may be considerable between tobacco crops. Lysemiter studies at the Virginia Polytechnic Institute have indicated that 48 lb. of nitrogen may be lost between October and March, whereas where rye was grown, only 1½ lb of nitrogen were lost.

After the soil has been worked up into a good tilth, drills are opened up with a shovel plough (Plate 203), and fertilizer is applied with a distributor (Plate 204). A smaller shovel plough is then used to thoroughly incorporate the fertilizer with the soil (Plate 205). The hills are eventually "listed" by making a furrow with a turning plough on either side of the drill (Plate 206). In the Winston-Salem section where the soil is rather rich, only very small ridges are made, and an

PLATE 207.

A "DRAG" FOR SMOOTHING OFF TOBACCO HILLS.—The usual type of "drag" consisting of a couple of logs, used for smoothing the tops off tobacco hills prior to setting plants in the field.

almost flat method of cultivation is practised. This method, which is not typical of the belt, is possibly adopted to discourage root development, and prolonged growth on this soil type.

Prior to setting the plants in the field, the tops of the hills are at times smoothed off almost to the original level of the ground, by drawing a heavy board or log down a couple of rows at a time (Plate 207). More frequently in the Piedmont area, the position in the row where each plant is to be set is firmed ("patted"), or the top of the ridge is dragged off ("brushed") with a hoe, according to the moisture content and texture of the soil. In Virginia a method peculiar to that district is to pull a "drag," consisting of four boards or runners, across the rows (Plate 208), and so make four depressions where plants are to be set in each row in one operation. A simple method sometimes adopted is for a farm labourer to walk along the top of each row and so mark the position for each plant with his feet. On heavy soils which tend to form clods, a "Climax" harrow (Plate 209), which is a metal implement

specially constructed for clod breaking, is run down the rows. In some cases, plants are set in the rows without any preliminary smoothing of the ridges.

The object of smoothing down the hills or setting plants in depressions is to encourage early and rapid growth of the plants, or in some cases, to afford young plants some protection from winds. On light soils particularly, it firms the bed and so encourages capillarity and the presence of moisture near the roots of the young plants. Furthermore, by starting with a low hill, each cultivation tends to build up the soil about the plants, and this encourages the development of adventitious roots which increases the plants' feeding surface, tends to control root rots and nematod injury, and is generally beneficial.

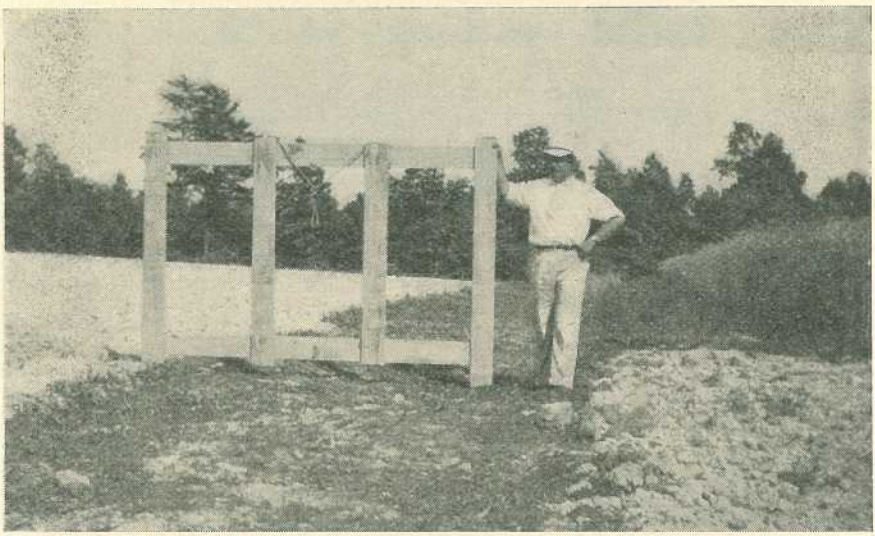


PLATE 208.

A TYPE OF "DRAG" USED IN VIRGINIA.—Showing the type of "drag" used in Virginia. It is run across the rows and makes four depressions where plants are set in each row.

When the plants are set with horse-drawn machines (Plate 210), the "middles," or the soil between the rows is ploughed out, so as to make a wide bed to support the machine. In any case, the most progressive farmers plough out the "middles" as soon as possible after setting, so as to allow adequate drainage for the hills.

A makeshift method of preparing the land, sometimes adopted when farming operations have been delayed by unfavourable weather conditions, consists of "re-bedding." In this case, the original rows are left standing after the crop has been harvested, until the following spring. Fertilizer is then placed in the furrows between the rows, and covered by ploughing down the old rows on either side with a turning-plough. The new hills or beds are subsequently made where the old furrows originally existed.

In the Piedmont area, where soil erosion is becoming an increasingly serious problem, special precautions have to be taken with row cultivated crops (Plate 211). On steep hillsides, tobacco rows are made at right

PLATE 209.

"CLIMAX" HARROW.—"Climax" harrow being used to break down clods on heavy soil in North Carolina. It consists of a number of curved metal bars which are drawn along the tobacco rows.

PLATE 210.

PLANTING MACHINE AND "DRAG."—Showing a planting machine in operation in North Carolina. In the right foreground may be seen a log which is used as a drag for smoothing down tobacco hills.

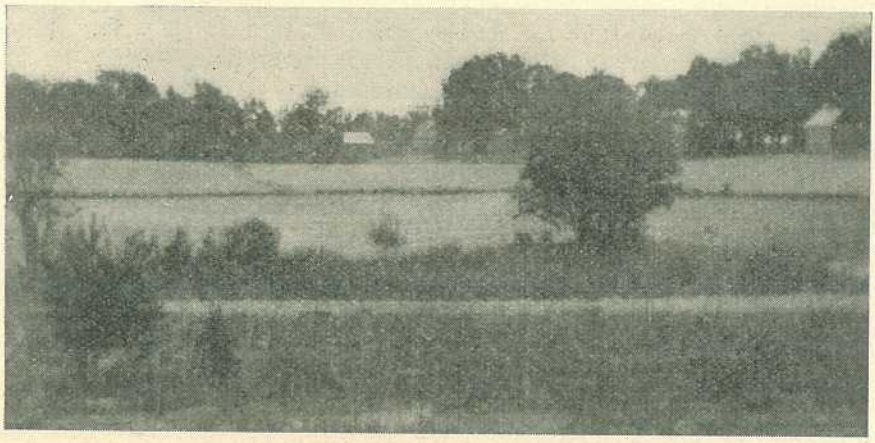


PLATE 211.

EROSION PREVENTION.—A newly planted tobacco field in the Piedmont section of North Carolina. Note the grass-covered earth banks or terraces across the field, erected to mitigate washing of the soil in hilly country.

angles to the direction of greatest slope, and hence follow the contour of the field. Earth banks, or terraces, are also erected parallel to the rows. They are not cultivated, and are allowed to become covered with grass and other vegetation in order to mitigate washing of the soil.

In the New Belt, the best practice is to break up the soil in the autumn or winter in order to facilitate the decay of vegetable matter, and generally "sweeten" the soil. As in the Piedmont, fertilizer is applied in a drill, and is incorporated in the soil with a shovel plough, and beds are subsequently "listed" over the fertilizer with a turning plough. Possibly more care is given to obtaining a uniform distance

PLATE 212.

MARKING OUT TOBACCO ROWS.—A mule-drawn wooden marker in use in Georgia. Four parallel rows are thus marked in one operation.

between the rows and between plants than in the Old Belt. At times a mule-drawn wooden marker (Plate 212) is drawn over the field, which marks the position for four or five drills in one operation. After the beds have been made, the positions where the plants are to be set is sometimes marked by running a spiked wheel down the rows, or by

PLATE 213.

MARKING POSITIONS FOR PLANT SETTING.—A wooden marker in use on experimental plots in Georgia. Various devices are used for setting plants at regular distances apart in the rows to ensure even development of the plants.

PLATE 214.

"LIFTING" TOBACCO PLANTS.—Seedlings being removed from a seed-bed in North Carolina for transplanting in the field. Note the tomato plants growing around the border of the bed.

other devices (Plate 213). Such practices tend to ensure even development of individual plants. In many cases, of course, judgment alone is used in marking out the rows and spacing the plants. The practice of smoothing off the tops of the rows is fairly general; nevertheless, where the soil has been reduced to a very fine tilth, the smoothing procedure is not considered so necessary.

PLATE 215.

SETTING TOBACCO BY HAND.—Hand setting a field of tobacco in North Carolina. Note the mule team with barrels of water and water being poured around the newly set plants.

PLATE 216.

SETTING TOBACCO BY HAND.—A large gang of workers setting tobacco under shade in Florida. Water and plants are carried ahead of the party in a wagon, and a remarkably extensive area can be planted up in a day in this fashion.

Planting.

With the approach of spring, the tobacco plants are pulled (Plate 214) from the beds and set in the field.

Most of the crop is set by hand (Plates 215 and 216). During periods of showery weather, labourers dibble the plants into the hills with short pegs, and firm the soil about them. Should it be considered that there is insufficient moisture in the soil or during dry periods, hand watering is employed. Successful hand setting depends largely on the skill of the workmen, and not infrequently variations in the "stand" of plants in rows set by different labourers can readily be observed. Mule-drawn planting machines are more generally employed in the Old Belt than on the Coastal Plain. They make it possible to plant the crop with great rapidity, and may conveniently be used in dry

PLATE 217.

SETTING BY HAND MACHINE.—"Masters Plant Setters" in operation in South Carolina. An assistant drops a seedling down a side tube and the operator by actuating a lever releases a small quantity of water about the plant in the soil.

weather, since they automatically water the plants while setting them in the soil. A small hand implement, known as the "Masters Plant Setter" (Plate 217), is becoming increasingly popular in the tobacco areas, and quite a large proportion of the crop, particularly in the New Belt, is being planted with it. It consists of a vertical cylinder to contain water, and a side tube large enough to take a tobacco seedling. The operator digs the nose of the machine into the soil, an assistant drops a plant down the side tube, and by operating a control at the top of the machine, a small quantity of water is released and soil is drawn about the plant. The machine has many advantages over other methods, such as low capital cost, ease in operation, and adaptability during dry weather, or on uneven ground. It tends to ensure regularity of stand, and hence is particularly desirable in experimental work (Plate 218).

The distance between plants as well as the space between rows varies with soil types and with individual farmers. The rows are usually 3½ feet to 4 feet apart, and the plants are set 20 inches to 30 inches in the row. On very fertile soil, however, they may be set as close as 18 inches between plants. As a generalisation, it may be said that plants are set about 2 feet apart, and the distance between rows is 4 feet.

The correct time for setting plants in the field is of considerable importance. If set too early, plants tend to develop leaves which are heavy, coarse, and undersized. If set too late, unfavourable weather conditions at the latter part of the season may result in the unsatisfactory ripening of the crop. In the established tobacco growing areas in the United States, farmers definitely know the most satisfactory time,

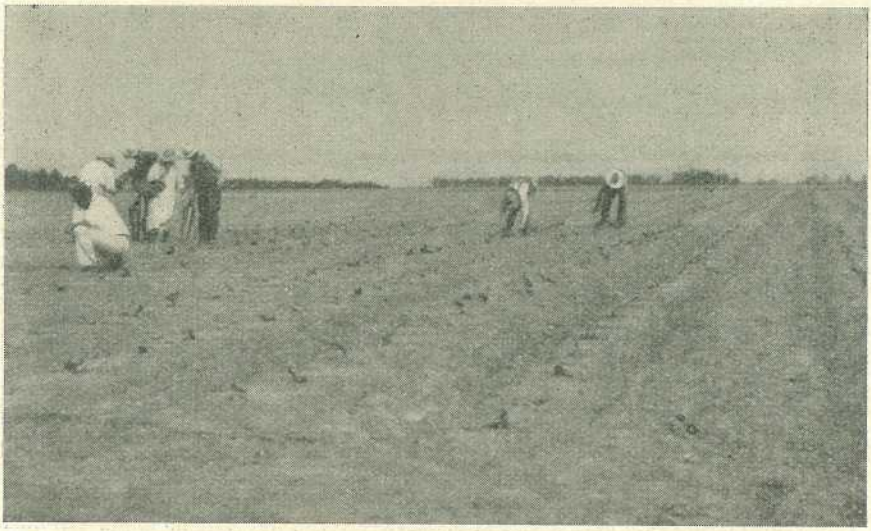


PLATE 218.

HAND SETTERS IN USE FOR EXPERIMENTAL WORK.—Setting a tobacco field experiment at the Coastal Plain Experiment Station in Georgia. Two men following the planters firm the soil to facilitate an even stand. Note how the tops of the hills have been smoothed off almost to soil level and the positions for the plants marked. The plants are not covered or hooded after being set in the field.

to within a few days, for setting the crop in their own districts. Consequently, the dates when crops will be set and harvested are well established, and these operations proceed as the warm weather progresses from South to North.

Plants are not "hooded" or protected with paper or any such material after being set in the field (Plate 218).

Fertilizers.

Tobacco fertilizer formulæ, the sources of plant food to be used in them, rates of application for various soil types, and methods of fertilizer application have been extensively investigated in the United States. At a tobacco conference held in Virginia last year, specialists

from various parts of the flue-cured belt discussed their investigations in this field, and as a result of their discussions, made official recommendations for fertilizers for the 1936 bright flue-cured tobacco crop. They may be briefly summarised as follows:—

(1) *For Heavy or More Productive Soils.*—700 to 800 pounds per acre of 3-10-6. (These figures represent percentages of total nitrogen, available phosphoric acid, and potash respectively, in the fertilizer mixture.)

(2) *For Light or Less Productive Soils.*—800 to 1,000 pounds per acre of 3-8-6.

PLATE 219.

A LOW SULPHUR FERTILIZER EXPERIMENT.—A mature crop in South Carolina where fertilizer ingredients low in sulphur had been applied.

Where high topping is practised and heavy yields are expected, the potash content may be increased to 8 per cent. or 10 per cent. with profitable results. It was further recommended that the fertilizer should be mixed thoroughly with the soil in the row before ridging or applied in bands at the side of the rows, and that it should be applied ten days before setting plants whenever practicable.

Sources of Plant Food.

1. *Nitrogen.*—One-third of the nitrogen should be derived from high-grade organic materials of plant or animal origin (e.g., cotton-seed meal, fish scrap, animal tankage, &c.); one-third from materials supplying nitrogen in the nitrate form; and one-third from urea and/or standard inorganic sources of nitrogen. Not less than a quarter of the nitrogen should be water soluble.

2. *Phosphoric Acid.*—To be derived from superphosphate, double (also called treble), superphosphate, and/or dicalcium phosphate.

3. *Potash.*—To be derived from any source of available potash, provided the chlorine content of the mixed fertilizers so compounded

does not exceed 2 per cent. Where tobacco by-products are used, they must be sterilized to kill any disease organisms which may be present.

4. *Magnesia.*—It is recommended that fertilizers carry 2 per cent. magnesia (MgO), at least one-half of which shall be derived from water soluble materials, or shall be water soluble in the mixed fertilizer.

5. *Chlorine.*—Fertilizer mixtures should contain 2 per cent. chlorine. It has been found that small quantities of chlorine increase the acre value of the crop, but an excessive amount injures growth, reduces quality, and has an unfavourable effect on the burning quality of the cured leaf.

PLATE 220.

SIDE HARROWS.—Showing wooden side harrows, an implement frequently used in the flue-cured belt for breaking the crust of the soil after plants are established in the field.

6. *Sulphur.*—Fertilizers should contain a minimum quantity of sulphur, preferably by reducing the more soluble sulphur compounds used in the fertilizer. Recent experiments have indicated that maturity is delayed, and the colour of the cured leaves has a tendency to be red when large quantities of sulphur are included in the fertilizer mixtures.

7. *Calcium.*—Fertilizers should carry in an available form, a minimum of 6 per cent. of calcium oxide (CaO) equivalent. This recommendation becomes necessary as a result of the present tendency to substitute high analysis materials, often low in calcium, for superphosphate.

It was further recommended that dolomitic limestone should be used as a neutralising agent for non-acid fertilizers, since it contains both magnesia and calcium, which are important plant food materials.

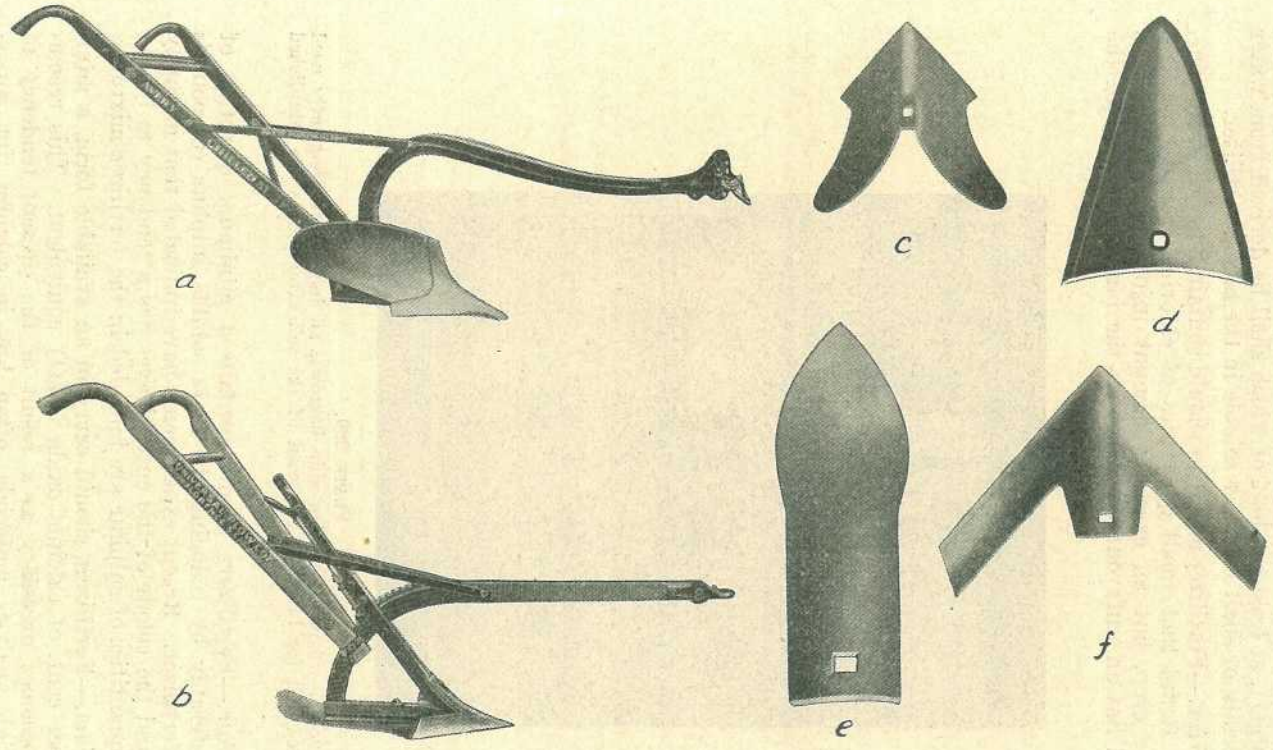


PLATE 221.

IMPLEMENTS.—Farm implements in general use in the flue-cured tobacco areas. (*a*) Turning plough; (*b*) Sweep stock with wing sweep attached; (*c*) Middle-burster blade; (*d*) Shovel plough blade; (*e*) Bull tongue blade; (*f*) Wing sweep blade. The dimensions of the various implements vary for different operations. Large and small shovel ploughs are used for marking out the fertilizer drill and mixing the fertilizer with the soil respectively. Large and small "wings" or mouldboards are also attached to the turning plough for different stages of plough cultivation. The sweep is the most generally used implement and is used both for stirring the soil and cleaning out the middles of the furrows.

The above recommendations are merely suggestions based on many years experience and experimentation as to the best procedure for fertilizer applications for tobacco, and they do not indicate the general practice of tobacco farmers in the flue-cured belt. Probably the 3-8-3 formula is still most generally used in North Carolina, and the usual application is about 1,000 lb. per acre on the lighter soils. In regard to sources of plant foods, the following may be taken as a rough generalization:—Nitrogen is derived from 25 per cent. cotton seed meal, 25 per cent. from dried blood, fish scrap, tankage, &c., 25 per cent. from nitrate of soda, and 25 per cent. from ammonium sulphate. The phosphoric acid is derived from superphosphate. The potash from muriate of potash and sulphate of potash, or sulphate of potash-magnesia. It must be remembered, however, that there is a

PLATE 222.

CULTIVATING WITH A "SWEEP."—Shallow cultivation with a "sweep" is the general practice in the Southern tobacco-growing States. Alternate rows are cultivated weekly in this fashion.

tremendous variation in fertilizer formulæ and ingredients used. There is undoubtedly a tendency at present to increase the percentage of potash in tobacco fertilizer mixtures, and 5 per cent. potash is now fairly generally used in the more southern states.

The suggestion of lowering the sulphur content of fertilizers is of very recent origin, but there are already indications that it will be generally adopted in due course. In recent experiments, nitrate of potash has been substituted for sulphate of potash, and superphosphate by other high analysis phosphates with a low sulphur content, and the results have been satisfactory (Plate 219). There appear to be some points of resemblance between sulphur and nitrogen nutrition. An excess of either results in a heavy leaf, which does not yellow readily, and a deficiency causes chlorosis. A lack of sulphur, however, is not associated with "firing" around the margin of the leaf as with nitrogen deficiency, and the chlorotic symptoms tend to disappear after rain.

The use of lime was at one time recommended for tobacco soils, but it is now considered definitely detrimental. The best quality leaf is

grown on soil with an acid reaction. The excessive use of lime tends to make soils alkaline, adversely affects the quality of the leaf, and permits the development of black root rot. Liming may at first tend to increase yield, but the final result is to more or less permanently reduce the usefulness of the soil for tobacco culture.

Well-rotted horse manure has been found to be a very desirable form of nitrogen, as it produces a smooth, good quality leaf. It is frequently used at the rate of 2 or 3 tons per acre, irrespective of the amount of artificial fertilizer applied, and would probably be used more extensively if it were available. The usual practice, when moderate quantities are applied, is to drill it in rows and hill it over some ten or fourteen days prior to the applications of fertilizers.

PLATE 223.

YOUNG TOBACCO READY FOR THE FIRST CULTIVATION.—A field of young tobacco which has just commenced to make growth.

Cultivation.

Cultivation methods vary somewhat in different areas in the flue-cured belt. The most usual practice, however, is to break the crust after the plants are established with a small-toothed cultivator or "side-harrows," which is an implement with tines set diagonally to the direction in which it is drawn (Plate 220), and to chip between the plants with a hoe. Subsequently, shallow cultivation is practised once a week between alternate rows with a "wing sweep" (Plate 222), the soil between the rows being traversed three or four times to complete the cultivation. The "sweep" is a shallow ploughing implement (Plate 221) with a broad, arrow-shaped blade which is used extensively in the South for row-cultivated crops such as cotton and corn. After the crop has been six or eight weeks in the field, a somewhat wider bed is made with the sweep, and cultivation ceases. The crop is then said to be "laid by."

In the early days of tobacco cultivation the plough was more extensively used for working this crop, and is still used to some extent

in the Old Belt. However, with the extension of tobacco-growing into the Coastal Plain, the methods used there for the cultivation of cotton were applied to tobacco culture as well. The "sweep" method of cultivation, which is shallow and does not develop a very broad bed, is largely dependent on favourable weather conditions for success. Consequently, there has been a tendency in recent years to re-introduce the single-furrow turning plough (Plate 221), for crop cultivation. Plough cultivation is at present being strongly advocated in South Carolina. The method appears to have many distinct advantages, and hence will be discussed in some detail.

PLATE 224.

THE FIRST STAGE OF PLOUGH CULTIVATION.—Two deep furrows being made with a "bull-tongue" on either side of the rows of young tobacco. On the right may be seen a second plough following up with the next operation.

Plough Cultivation.

The object of this method is to deeply aerate the soil and build up a high bed about the plants. In this way, root development is encouraged, moisture is retained in the bed, surface water is drained to the middle of the rows, and leaching of fertilizer is minimised. Such a method should, therefore, tend to lessen the extreme effects of adverse seasons, whether they be excessively wet or dry for prolonged periods. Plough cultivation differs from the more general methods in that two or three good, deep cultivations are given instead of a continual shallow scratching of the soil, and that a broader and deeper bed is built up.

Details of the procedure are as follows:—The first cultivation is given as soon as the plants are established and have commenced to make growth (Plate 223). The first operation consists of making two deep, narrow furrows on either side of the row, and as close as possible to the plants without disturbing them (Plate 224). For this purpose a "bull-tongue" (Plate 221), which is a metal blade about eight to ten inches long by about two inches broad, is generally used attached to a "sweep" stock. It is inadvisable to leave the soil exposed in this state

PLATE 225.

THE SECOND STAGE OF PLOUGH CULTIVATION.—Two furrows being made with a turning plough, fitted with a small wing or mouldboard, on either side of the row of tobacco.

PLATE 226.

THE THIRD STAGE OF PLOUGH CULTIVATION.—Two more furrows being made with a turning plough fitted with a larger wing. At the right may be seen a group observing a hoeing demonstration.

PLATE 227.

THE FOURTH STAGE OF PLOUGH CULTIVATION.—The crust around the young plants being broken with a hoe.

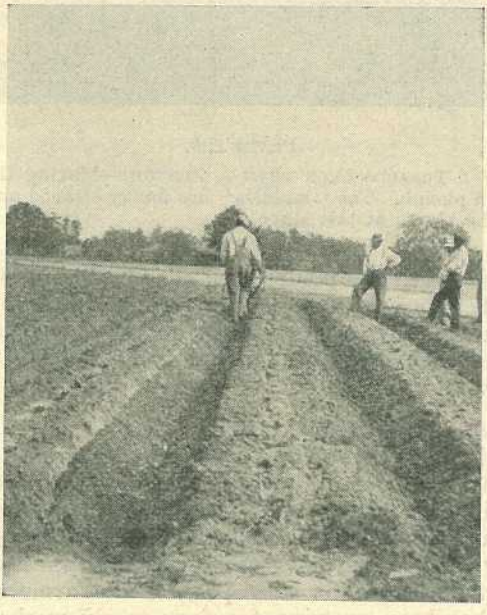


PLATE 228.

FINAL STAGES OF PLOUGH CULTIVATION.—Making a single furrow with a "sweep" to widen the bed and clean out the middle of the furrow.

for more than an hour before proceeding with the next operation, as there is a danger of unduly drying out the soil. After a few rows have been thus treated, two more furrows are made with a small-winged turning plough (Plate 225). Thirdly, the bed is further built up with two or more furrows, made with a turning plough fitted with a larger wing or mouldboard (Plate 226). At this stage the soil crust immediately around the plants is broken with a hoe (Plate 227). Finally the bed is still further widened, and the middles are cleaned out by making a single furrow down the centre of the row with a "sweep" (Plate 228). At this stage, the more careful farmers make furrows across the ends of the rows to protect the crop from washing during periods of heavy rainfall.

PLATE 229.

"LAYING-BY" A TOBACCO CROP WITH A PLOUGH.—Making the second series of furrows with a turn plough. The "middles" are finally cleaned out with a "sweep." Note the size of the plants at this stage.

A second cultivation is made when the plants are about six or eight inches high. The "bull-tongue" is not used in these subsequent cultivations, but as before, furrows are made on either side of the row with turning ploughs with short wings and large wings; the soil is hoed about the plants, and the middles are cleaned out with a sweep.

In some cases, two thorough cultivations may be quite sufficient for the season, but more usually three cultivations are made before the crop is "laid by." Some judgment is required in deciding the best time to discontinue cultivation. It is not advisable to cease cultivation too soon, but damage is more frequently caused by carrying on too long and so injuring roots which have grown out into the space between the rows. The tendency with the more progressive farmers is to "lay by" after the crop has been growing for four to six weeks, and is a little less than knee-high. It is always advisable to carefully examine the soil in the furrows for roots before making the final deep cultivation.

The procedure advocated for the final cultivation or "laying by" a crop is as follows:—The soil around the plants is first hand-hoed, the earth being pulled up well around the stalks, and even covering the lower leaves. The first furrows are made on either side of the plants with a turning plough, to which a large wing or mouldboard is attached. These furrows are made far enough away so as not to damage roots, and yet as close as possible in order to throw the soil high up to the plants. After four or five rows have been so ploughed, another ploughing is made alongside each of these furrows (Plate 229). As in previous cultivations, the middles are finally cleaned out with a "sweep."

PLATE 230.

"LAYING-BY" WITH A "MIDDLE-BURSTER."—Running a "middle-burster" between the rows to "lay by" a crop which is too big to be worked with a plough.

If it has been found that roots have grown too far into the space between the rows to safely permit the use of the above method, it is then preferable to merely run a suitable implement down the centre of the furrow. For this purpose, a "middle-burster," which is a large type of shovel plough, is generally employed (Plates 221 and 230).

It is inadvisable to continually cultivate tobacco when it is suffering from dry conditions, as the condition is accentuated by roots being damaged in the process. Consequently, "laying by" the crop at the correct stage is particularly desirable when the latter end of the season is dry.

Topping and Suckering.

There is probably no operation in tobacco production which requires so much judgment and care, or which may have such disastrous results through lack of judgment, as that of "topping." The object of "topping" or removing the flower head and upper portion of the plant is to divert its growth to the production of marketable leaf rather than seed. If weather conditions were entirely dependable, this operation could be standardised, and would be consequently simple. However,

PLATE 231.

SUCKERING TOBACCO.—Suckering a field of tobacco in South Carolina.

since the weather is usually the opposite, and growers frequently "top" according to the weather being experienced at that time, or according to their anticipation of future weather conditions, the leaf produced may consequently be too coarse or too thin. The former occurs when plants are "topped" too low and a dry period is followed by rain

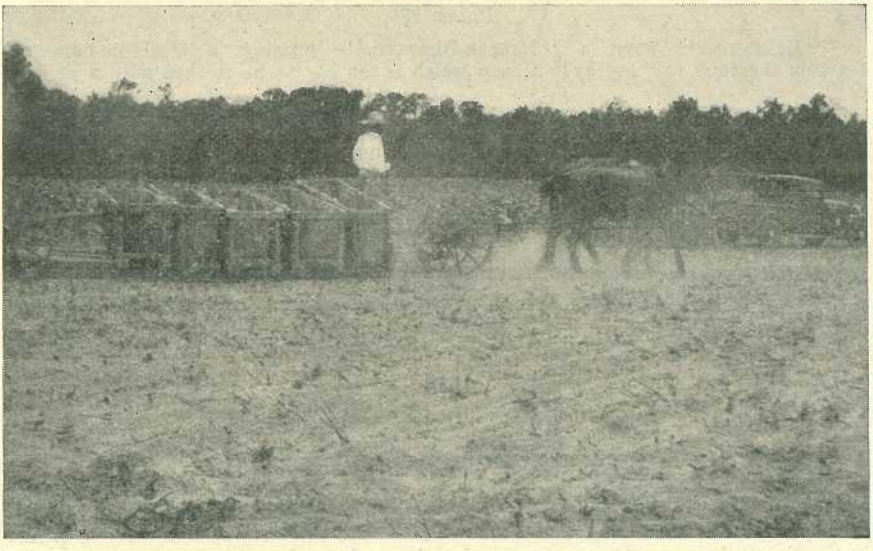


PLATE 232.

HARVESTING TRUCKS.—A load of trucks or sledges being hauled on to a field prior to harvesting.

PLATE 233.

HARVESTING TOBACCO.—A hessian-covered truck and team of labourers harvesting a field of tobacco in South Carolina.

which results in excessive new growth. The latter may occur when plants are "topped" high and with insufficient rain the anticipated growth is not realised.

One of the best growers interviewed indicated that he "topped" according to the known productivity of individual fields irrespective of the weather conditions of the current season. His procedure was to

PLATE 234.

ARRIVAL OF LEAF AT CURING BARN.—A truck of tobacco arriving at the curing barn. Note women stringing tobacco nearby.

allow plants to develop as many leaves to maturity as past experience had shown would be the case under average weather conditions. Over a period of years this method had been found very satisfactory.

A very sound and simple practice of "topping" is being advocated in South Carolina. It consists of pinching out the flower head only, during a normal season, as soon as a few flowers are in bloom. Later in the season, while suckering, those leaves which apparently will not develop to a marketable size are eliminated. Should the season be abnormally dry, it is advisable not to interfere with the plants at all, but to wait until rain falls and the plants respond to the plant food then available, prior to "topping."

"Suckering," which is the next operation, consists of removing secondary branches, which tend to develop after plants have been "topped." The usual practice is to remove suckers once a week after "topping" (Plate 231). They should be broken off as soon as they are large enough to handle, and should not be allowed to grow too large.

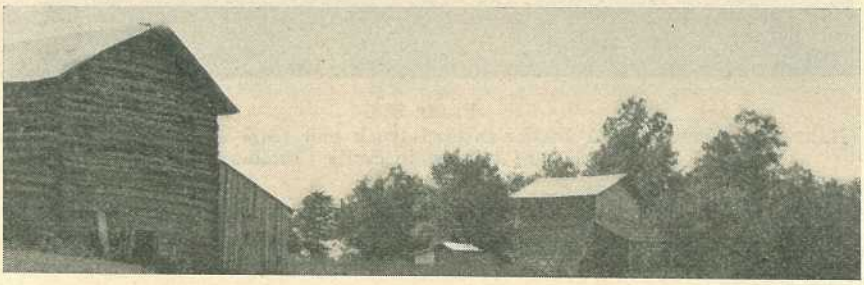


PLATE 235.

CURING BARNS.—Flue-curing barns in the Old Belt of North Carolina. Note tin roofs and log walls.

Harvesting.

Practically all flue-cured tobacco is harvested by "priming" or removing leaves separately from the plant as they reach maturity. Until recently, most of the leaf in Virginia was harvested by cutting the entire plant near ground level, and curing the leaf on the stalk. However, with the advent of a crop restriction policy, the priming method was rapidly adopted, since it is more efficient and more profitable.

The most important aspect of harvesting is to allow the leaf to thoroughly mature in the field before it is removed. With certain varieties, such as "Gold Dollar," and during dry weather, some judgment is necessary to distinguish between true maturity, and a yellowing, which may be a varietal characteristic or a physiological manifestation of insufficient moisture in the soil. Quality is very adversely affected if leaf is not properly ripe when harvested.

A wooden sledge or "truck" with walls lined with hessian (Plate 232) is employed usually to collect the leaf and carry it to the barn. It is drawn by a mule between the rows of tobacco (Plate 233), and some half-dozen men working on either side of it very rapidly fill the truck with leaf. Considerable care is necessary to avoid bruising the leaf during handling, and it should not be exposed to direct sunlight for any length of time. The trucks are usually covered with hessian when full.

On arrival at the barn (Plate 234), the leaf is strung on sticks in a similar manner to that practised in Australia. This operation is carried out in the shade of a shelter adjoining the barn.

Flue-curing.

The construction of flue-curing barns and the methods adopted for curing tobacco in the United States are relatively primitive and simple, in comparison with Australian practice. The use of the wet-bulb thermometer is not known, and facilities for the accurate control of the relative humidity of the air within the barns are in most cases lacking. Consequently, it would seem that the quality and condition of the leaf when harvested is such that it is relatively easily cured with success. Hence soil and weather conditions under which tobacco is grown, and

PLATE 236.
CURING BARNS.—Flue-curing barns in Georgia. Note the small window at the gable end. The roof is made of shingles.

cultural methods employed in its cultivation are apparently of far greater importance in the successful production of tobacco than the actual process of flue-curing.

Flue-curing Barns.

Curing barns vary somewhat in detail throughout the flue-cured belt. They are usually wooden structures about 16 feet by 16 feet, and are frequently on a brick foundation. The walls may be of weather board on the outside, with a board lining and a coase builders' paper insulation between them, or may be of logs chinked with mud (Plate 235), or occasionally of brick tiles, tin, or rubberoid. In the more southern states, the roof is almost invariably constructed of shingles, which, incidentally, provide constant top ventilation. In North Carolina, owing to the relative shortage of timber, roofs are frequently made of tin (Plate 235). There are usually two doors (Plate 236), one on each side of the barn, and a small window at the gable ends of the roof,

PLATE 237.

CURING BARN UNDER CONSTRUCTION.—A well-built curing barn in South Carolina. Note the large lean-to shelter roofs, the gable end window, and the fixed ventilator along the roof ridge.

which are useful for examining the leaf during curing (Plate 237). In South Carolina, the roof is frequently extended on two or three sides to provide shade for stringing the tobacco (Plates 237 and 238), and is often a storage place for tobacco sticks and implements. These overhanging roofs also protect the walls of the barn from the weather to

PLATE 238.

CURING BARN.—A typical curing barn on a farm in South Carolina.

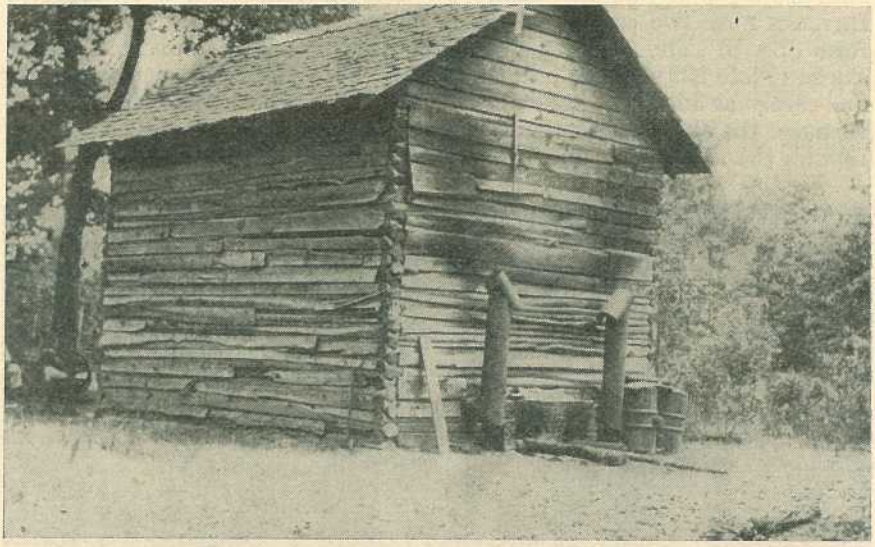


PLATE 239.

DOUBLE FURNACE CURING BARN.—A crude flue-curing barn in Northern Florida. Note the height of the smoke stack.

some extent. In North Carolina, this aspect of barn construction is generally not so elaborate, and consists of a shelter on one side of the barn only (Plate 235).

The heating system is built of a series of sheet iron flues about 12 inches in diameter, leading out of one or more, frequently two furnaces. The furnaces are made of stone or brick, are five to ten feet in length,

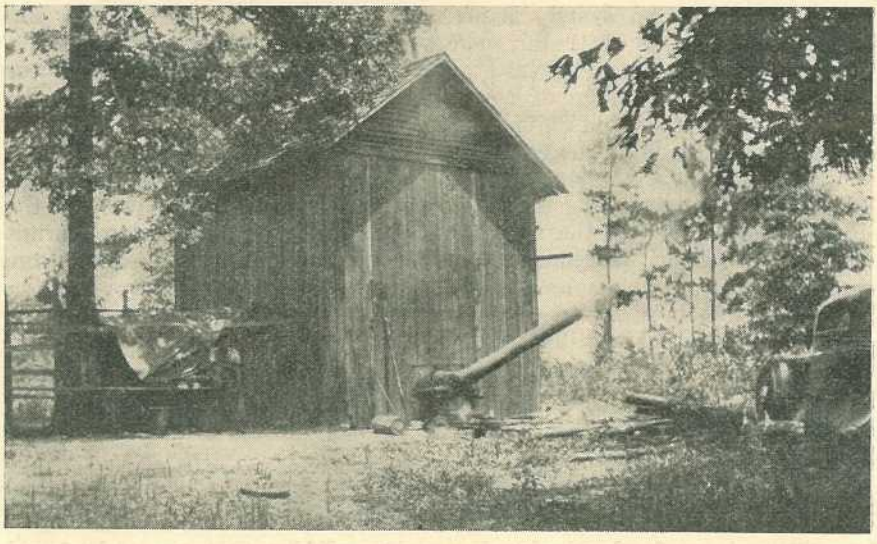


PLATE 240.

SINGLE FURNACE CURING BARN.—Note the shingle roof, board walls, and short smoke stack.

and project well into the barn. The most general plan is to have the furnaces near two corners of the barn, and each system of flues in the form of a U. The flues either terminate separately in individual smoke stacks (Plate 239), or are united into one (Plate 240). The smoke stacks are rarely as high as the walls of the barn. Where there is only one furnace, the flue crosses the barn, branches at right angles, each arm follows the side walls, and eventually leads to a single smoke stack.

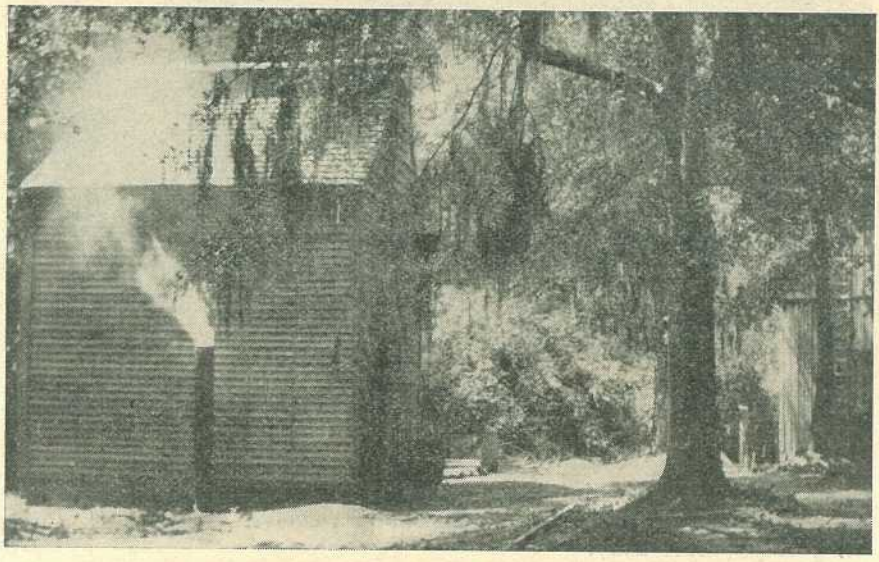


PLATE 241.

CURING BARNS IN AN IDEAL SITE.—Flue-curing barns in a well sheltered situation in South Carolina.

The ventilation system is often very crude. In many cases, top ventilation depends on the air spaces in the shingle roof, and spaces in the log walls entirely (Plate 239). At times an adjustable top ventilator is built along the ridge of the roof, but more frequently this ridge ventilator is a fixture (Plate 237) which allows a space of about two inches on each side of the roof. At times it does not extend completely along the length of the ridge, and not infrequently it is lacking entirely. In the better types of barnes, there are usually two loose bricks in the foundation of each of the four walls which may be removed to permit bottom ventilation. In many cases, however, there are no special bottom ventilators at all, and holes are dug under the walls to allow for ventilation should such be found necessary. Doors and windows may also be used for additional ventilation.

The more careful growers use discretion in building their barns in a suitable location. Sites are selected where the configuration of the country or belts of trees will tend to protect the barns during adverse weather (Plate 241).

Flue-curing Methods.

There is no fixed rule for flue-curing. Different types of leaf and leaves from different positions on the stalk require slightly different

treatment. Furthermore, the methods adopted by individual growers differ somewhat in detail, and this, incidentally, tends to strengthen the suggestion that well grown, good quality leaf is relatively easy to cure successfully.

The general plan adopted is somewhat as follows:—The leaf is yellowed slowly at moderate temperatures, so that the process is completed at about 120°F., after 24 to 36 hours of curing. Ventilation is

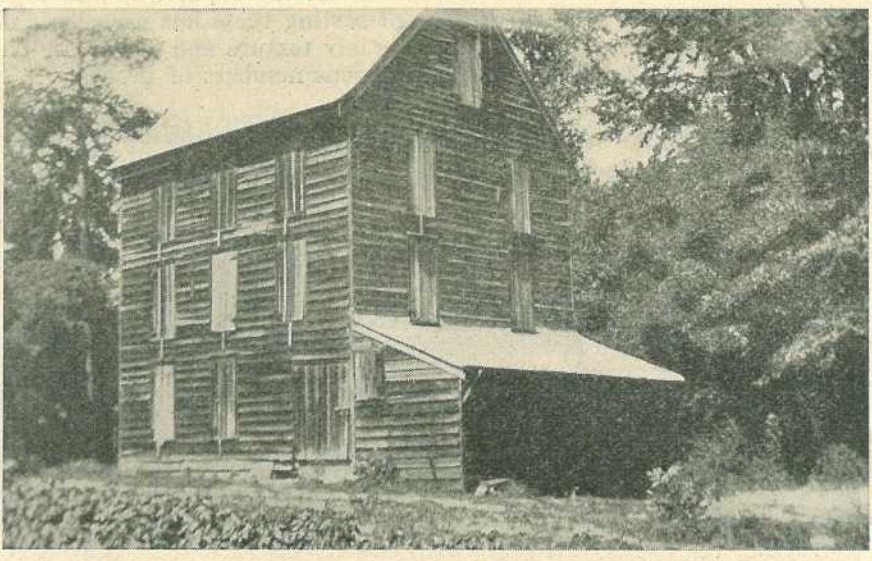


PLATE 242.

TOBACCO PACK HOUSE.—An elaborate pack house on a large plantation in South Carolina where the tobacco is bulked and graded.

usually increased gradually during this stage. The colour is fixed, and the web of the leaf dried out by increasing the temperature and maintaining it at from 130°F. to 140°F., for a period of ten to eighteen hours. It is desirable to allow ample ventilation during this phase of the curing process, to obviate "sponging," and to avoid too rapid an increase in temperature, which might result in "scalding." The stems are dried out by reducing the ventilation and increasing the temperature to about 170°F., at the rate of five degrees an hour. This temperature is maintained until the stems are thoroughly dry and brittle. Too high a temperature results in a reddish discoloration or "scorch."

Bulking and Grading.

After curing is completed and the leaf is sufficiently flexible, or in "order or case," so that it can be handled without breaking, it is removed to a pack house (Plate 242). It is there placed in long piles or "bulks," as in Australia, until it is graded. It is important that it should be kept in satisfactory condition after it is bulked, by shutting the pack house closely in damp weather and opening in dry weather, and by covering the tobacco with hessian, bags, or cloth.

In some cases the tobacco is transferred after a few days from the "bulk" to a "square coop." The latter is constructed by making a

square pile of the leaf while still attached to the sticks. It is considered that tobacco retains its colour and keeps better for protracted periods by this method.

After at least ten days, but generally longer after bulking the tobacco is graded. There are apparently no set grades from the farmer's viewpoint, and the process is practically one of sorting the leaf into similar classes. As the curings are kept separate, and the leaf sold in small lots, it is automatically graded as to position on the stalk, i.e., into lugs, leaf, and tips. The grading consists of sorting these lots on a basis of colour, size, amount of damage, and possibly texture and body. Individual growers divide their crops into various numbers of grades.

PLATE 243.

A TOBACCO MARKET STREET.—A truck load of leaf, carefully covered with hessian arriving at a tobacco market town in North Carolina. In front of it is a mule drawn wagon similarly laden.

Prior to grading, the leaf is brought into order, if necessary, in either specially constructed ordering rooms, or by using the curing barn.

In grading tobacco, the quality of light used is most important. Hence, in the Northern Hemisphere it is preferable to have the windows of the grading room facing the north, so that the light is indirect and uniform, in Australia, being in the Southern Hemisphere, they would face the south. The grader should sit with his back to the light.

After grading, the leaf is tied in hands in all flue-cured tobacco producing areas, with the exception of Georgia. There the tobacco is handled loosely as separate leaves, and is marketed in "sheets" or squares of hessian.

The United States Department of Agriculture has evolved a very comprehensive grading system for defining the grades of various types of tobacco, with the object of facilitating sales and obtaining the most satisfactory prices for growers. With flue-cured tobacco alone, six

groups, six qualities, and five colours are recognised. The growers grade their own leaf, and, if they wish, they may have it inspected for a nominal charge by a government grader who issues a certificate as to grade according to the United States standards. The Tobacco Section of the Bureau of Agricultural Economics, during the selling season, also issues daily and weekly lists of average tobacco prices obtained at the various markets, for the guidance and protection of growers. Farmers who definitely know the actual grades of the tobacco they are offering for sale and the current prices for similar leaf, can consequently ascertain the true value of their product.

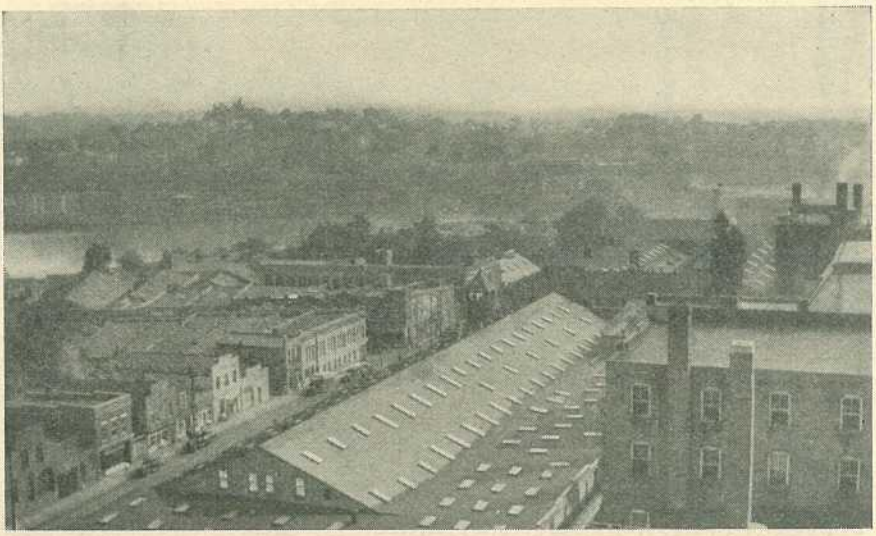


PLATE 244.

NATURAL LIGHTING OF TOBACCO WAREHOUSES.—Warehouse roofs in a Virginian tobacco market town. Note the numerous skylights to facilitate the examination of leaf at tobacco auction sales.

Marketing Flue-cured Tobacco.

Prior to taking tobacco to market the hands are straddled on thin smooth sticks. The sticks of tobacco are packed into a conveyance, well covered with hessian (Plate 243), and drawn to market. Good roads and modern motor transport enables the farmer to quickly travel considerable distances, and hence he usually has the choice of several market towns. Tobacco warehouses, where the leaf is auctioned, are usually constructed with ample natural light (Plate 244). On arrival, employees slide the hands of tobacco off the sticks and neatly pack them in shallow baskets. The contents of each basket is weighed. The weight of leaf, the grower's name, and the lot number is written in triplicate on a ticket and placed in each basket. A "floor sheet" is also made out for each vendor, giving details of the various lots to be sold on that day.

The baskets of tobacco are arranged in long lines on the warehouse floor. Several warehousemen, an auctioneer, and possibly a dozen buyers walk slowly down the aisles, disposing of the tobacco as they go. The bidding is started by a warehouseman who makes a rough estimate of

each pile. On the completion of the sale, the price and the buying company's grade are marked on the card. Two clerks follow the auction and record details of the sales on each vendor's "floor sheet."

The rapidity of the procedure is remarkable. It is understood that the law prohibits sales progressing at a greater rate than 360 each hour (i.e., one sale each ten seconds), and the actual rate is not much less. At this speed, the recording clerks must find the correct sheet, record the weight and price obtained, and mentally calculate and enter the value of each pile. Immediately after the sale is recorded, unless the vendor is dissatisfied, the baskets are removed from the auction floor

PLATE 245.

A TOBACCO WAREHOUSE.—One of several tobacco warehouses in a town in South Carolina where flue-cured tobacco is sold by auction.

and are dispatched to a redrying plant. One sales ticket is retained by the warehouse, one is sent to the buying company, and the third goes with the tobacco.

The farmer may collect the proceeds of the sale, less certain selling charges, almost immediately from the warehouse, which pays on behalf of the buying company. During 1935, if the grower was not a contracting producer under the Agricultural Adjustment Administration, a fine was also deducted, and a further deduction was made by the government if it had loaned money to the grower. The multiplicity of bookkeeping thus involved in these various transactions proceeds almost as rapidly as the sales, and hence a farmer may have the net proceeds of his sale within a few hours of bringing his leaf to town.

Individual warehouses (Plate 245) may dispose of 200,000 to 300,000lb. of leaf daily in piles of an average weight of about 100 lb., and large marketing towns may have a daily turnover of several million pounds. Hence it will be noted that this selling system involves the disposal of huge quantities of leaf in small parcels with great rapidity. A tremendous amount of handling and bookkeeping results, and it is surprising that it works with such smoothness and satisfaction.

Redrying.

All individual purchases of flue-cured tobacco are dehydrated and brought to a uniform moisture content prior to packing and storing. As soon as the leaf is purchased (Plate 246), it is conveyed to a redrying house, which is usually situated close to the market warehouse (Plate 247) for this purpose. There the various lots of any one grade are blended by piling on to a conveyor belt, and during the process, damaged leaf is discarded and dust is removed. The hands of tobacco

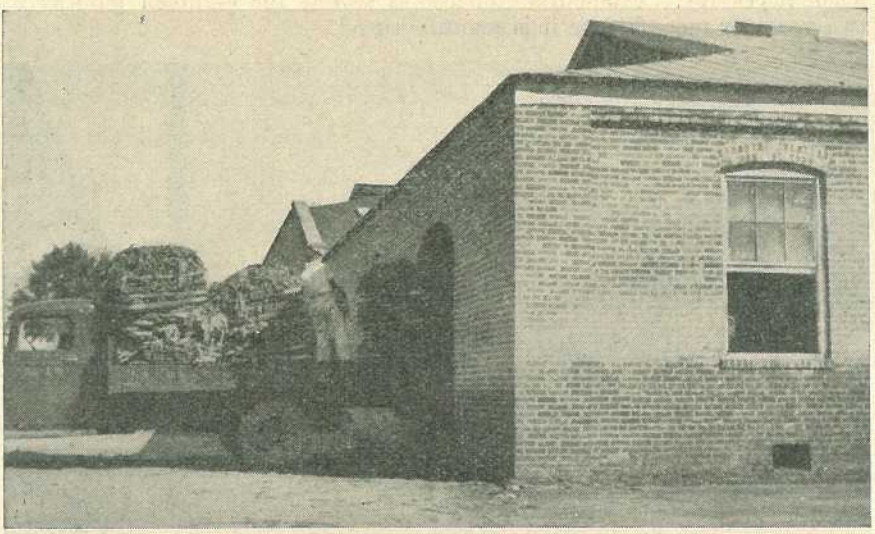


PLATE 246.

AFTER A TOBACCO SALE.—Leaf being removed from a warehouse selling floor immediately after it has been auctioned. Note the wickerwork baskets in which the tobacco is sold.

are then straddled on sticks which take it through the redrying machine. Should the tobacco be in a loose state, it is distributed evenly on a revolving belt and taken through the machine in that fashion. The time taken to pass through the machine, which is about 130 feet long, varies from 30 to 70 minutes. By means of heat, up to 200 deg. F., and air currents, all moisture is first removed from the leaf. At the far end of the machine, the tobacco is cooled to about 100 deg. F. and reconditioned or allowed to re-absorb moisture to any desired moisture content. Usually different grades of leaf are packed at specific moisture contents, which vary from about 10 to 14 per cent. For instance, wrappers are given a moisture content of about 13 per cent., fillers from 12 to 12½ per cent., and cutters from 10 to 11 per cent. Tobacco for export to England is packed at 10 to 10½ per cent. moisture content. On leaving the redrying machine, samples of leaf are continuously being taken and tested for degree of dryness. It is finally packed into hogsheads, each with a net capacity of 1,000 lb. or more, and firmly pressed or "prized" under hydraulic pressure, and nailed down ready for storage. It may reach this stage in a few hours after being purchased in the market.

Storage and Manufacture.

Owing to the tremendous size of the tobacco manufacturing industry, huge building space is required for the storage of tobacco, when it is being aged or mellowed, prior to manufacture. One large company advertises that it has 4½ miles of storage houses for its purposes alone. Tobacco is usually stored in sheds with open sides and overhanging roofs, but closed buildings which may have several floors are also used. Tobacco ages more rapidly in the former, but the latter have the advantage of being able to be effectively fumigated for the control of insects when necessary. Flue-cured tobacco is stored for eighteen months to two years or more before it is manufactured.

PLATE 247.

A REDRYING HOUSE.—A busy scene in the street of a North Carolina market town. Tobacco warehouses are situated on each side of the street. On the left, hogsheads of leaf which has been redried are being loaded on to a truck. The truck in foreground is conveying leaf from a warehouse to a redrying house.

In due course the leaf is stemmed, which is the process of removing the midrib. Prior to stemming, the tobacco is first conditioned for ten minutes or so, in order to put it into a fit state for handling, and is then conveyed to the stemmery. Stemming is usually a manual process, and great numbers of negro women are employed in this work. Machines, however, have been perfected for this purpose, and one type seen had a capacity of 14,300 leaves an hour. During this handling process, the tobacco is further cleaned of adhering sand and rubbish. The stemmed leaf may now be redried and again packed in hogsheads until required for manufacture, or go straight to the factory.

For the manufacture of cigarettes in the United States, tobacco is blended with regard to class, grade, and type. Several distinct classes, such as bright flue-cured, Burley, Maryland, and Turkish are used. In the factory, the leaf is conditioned, blended, and finely cut. Remarkably efficient machinery is employed for cigarette making, packing, and testing for defects. The daily output from individual factories and from cigarette manufacturing towns is tremendous.

[TO BE CONTINUED.]

Groundsel Bush or Tree Groundsel.

(Baccharis halimifolia.)

By C. T. WHITE, Government Botanist.

As the Groundsel bush is becoming a serious menace in parts of Queensland, and numerous requests have been received for a description and illustration of the plant, Mr. White's notes on the pest will be welcomed by all concerned.—ED.

DESCRIPTION.—A tall shrub, dicœcious (i.e., the sexes on different plants), smooth or the young shoots somewhat scurfy. Leaves 1-2 inches long, obovate, prominently-toothed with a few large teeth in the upper portion, the lower portion gradually narrowing into a petiole or leaf stalk. Flower heads on the male plant, inconspicuous subglobose, small solitary, or a few clustered together. Flower heads on the female plant solitary in the axils of the upper leaves and clustered at the ends of the branches, forming large terminal loosely-branched panicles. Achenes (seeds) ribbed, straw-coloured, scarcely one line long, capped with a white pappus about ½ inch long.

Distribution.—A native of Tropical America; a naturalised weed in Queensland. Has increased a good deal of late years, and capable of becoming a considerable pest if not checked.

Botanical Name.—*Baccharis,* a name given by the Greeks to some aromatic plant dedicated to Bacchus; *halimifolia,* Latin relating to the plant having leaves like a Halimus, plants now placed under the genus Atriplex, which contains some of the Australian salt bushes.

Supposed Poisonous Properties.—*Baccharis* is a large genus of plants principally South American, and one species there, *B. cordifolia,* the Romerillo or Mio Mio of the Argentine, is well known as a stock poison.

As *B. halimifolia* has quite commonly been suspected of poisoning stock in Southern Queensland, particularly about Caboolture, Bald Hills, and other localities on the North Coast line, feeding experiments were made with the plant at the Stock Experiment Station, Yeerongpilly, and a report published in the Annual Report of the Chief Inspector of Stock, 1919-1920 (Annual Report Department of Agriculture and Stock, Brisbane, p. 677). Two heifers were fed continuously for a period of a fortnight on a ration of mixed leaves and chaff in almost equal proportions. Three guinea-pigs were fed for almost twelve days on the leaves, and ate them with avidity. One died and post mortem examination proved that the internal viscera were normal and full of partially-digested food. This animal was greatly emaciated, and although apparently the food was bulky, it lacked the necessary nutrient material to support life, and death had resulted from malnutrition. The two remaining animals looked healthy, but greatly emaciated and anaemic. These were started again on the normal ration and did well. Constipation was a marked feature in the stock fed on groundsel. From this, it would appear that the plant is not definitely poisonous to stock, but is quite valueless as a fodder.

Eradication.—It is possible that some mechanical means such as a roller of the kind used for breaking down Mallee might be employed, and the ground sown with a robust-growing grass such as *Panicum muticum* (Giant Couch), Guinea grass, &c. But experiments would have to be carried out before trying this system on an extensive scale, particularly as Groundsel Bush is rather a pest of second-class country. Where it invades the better and more fertile areas such as the Blackall Range and similar country, it seems to be confined to damp spots such as along creek banks.

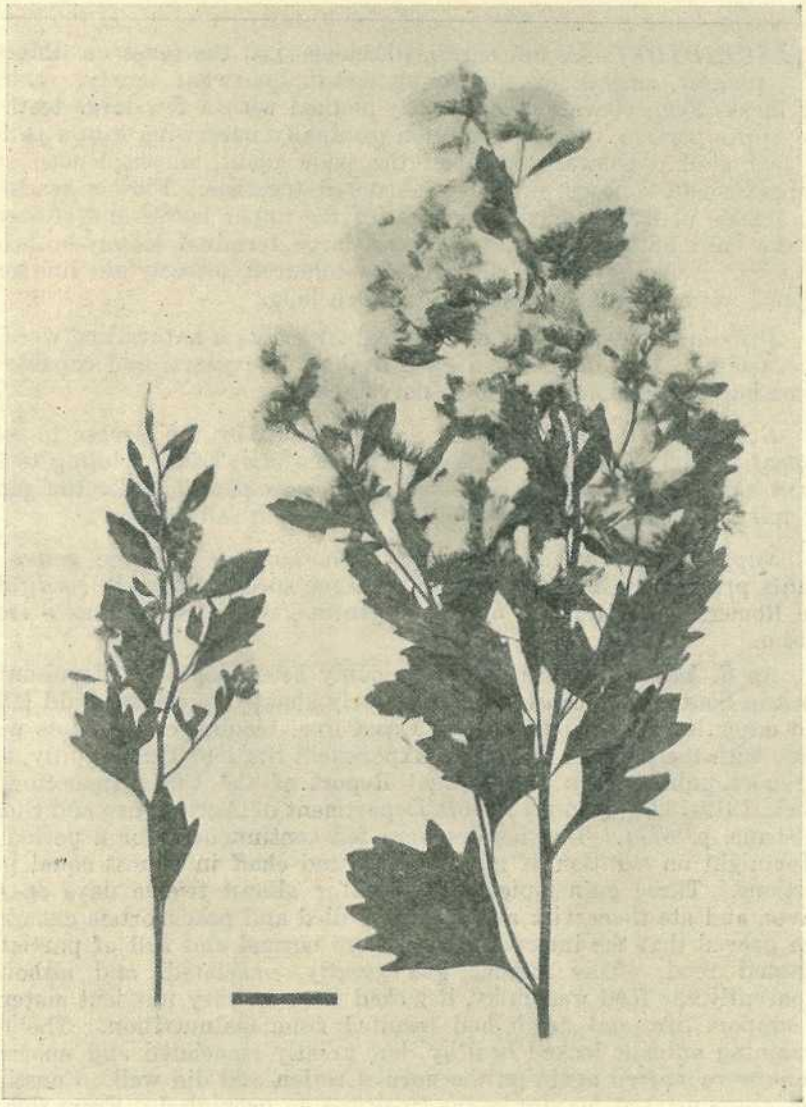


PLATE 248.
Tree Groundsel (*Baccharis halimifolia*).

A Programme of Pasture Improvement.

By C. W. WINDERS, B.Sc.Agr., Assistant (Agronomy), Agricultural Branch.

IN view of the interest which is now being taken in pasture improvement throughout the closer settled areas of Queensland, it is thought that a few short notes on various lines along which the farmer and grazier in the agricultural and adjacent districts may proceed towards better pastures would be of use to those contemplating planned pasture improvement.

There are three distinct angles from which the problem may be approached, namely:—

(1) Better utilisation of existing pastures;

(2) Improvement of existing pastures by renovation and topdressing;

(3) Laying down of superior pasture mixtures.

1. Utilisation of Existing Pastures.

Most improved grazing properties in the areas of medium to good rainfall carry a certain acreage of grasses which have up to date shown themselves superior for general grazing purposes in each particular district to other grasses. Thus in Southern Queensland on good class coastal lands *Paspalum dilatatum* is the chief dairying grass, while in the sub-coastal valleys Rhodes grass is pre-eminent. On all such properties one of the first steps which should be undertaken is the subdivision of large paddocks of the more useful pastures, with the object of putting into operation a system of management which will permit of the maximum grazing value being obtained from the areas.

The greatest advantage resulting from subdivision is the opportunity afforded of always during the grazing season having short young grass available to the animals. Under existing conditions on many properties the control of the grazing areas is so lax that much of the pasture runs to maturity early in the season and is useless for further grazing during that season. This waste can be prevented only by efficient subdivision and subsequent proper management. Correct management, when weather conditions permit, consists in grazing small paddocks in rotation, the pasture on each paddock being grazed when short and of highest feeding value and allowed to recover by spelling for a few weeks. Towards the end of the season the stock may not be able to cope with the growth on all paddocks and the mower will then have to be used to keep the grass down.

A practice which might with advantage be adopted on all dairy farms is the scattering of animal manure by means of harrows. Grass growing through animal droppings is generally avoided by stock, resulting in the growth of worthless clumps of grass. If the droppings are evenly distributed over the pasture by harrowing at intervals, much benefit to the pasture results and a good deal of waste is avoided.

2. Improvement of Existing Pastures by Renovation and Topdressing.

Many areas of sown pasture which have been laid down for some considerable time are producing much below their capacity. A considerable improvement in these pastures may be effected by breaking up the matted grass, either by ploughing or by drastic harrowing with special

implements. The action of renovating implements is to correct the sod-bound condition of the grasses and to improve the soil conditions. The net result is a fresh lease of life for the pasture, and pastures which show a marked decline in productivity may to some extent be restored to their original condition by renovation treatment. In those situations where crops can be grown, a more effective means than periodical renovation of maintaining high-producing pastures is to treat pasture as a unit in a crop rotation, allowing one or two seasons' cropping between 3-5-year stands of pasture.

Though very often adverse weather conditions prevent the full benefit of fertilizer application from being realised, many dairy farmers and graziers have used pasture fertilizers with encouraging results. Much of our coastal grazing country is deficient in lime, and applications of 1 ton of agricultural lime per acre have produced a marked improvement in the pasture. Superphosphate in most instances has a marked effect on pastures on all but the richest soils, and applications of nitrogenous fertilizers produce results which may be economically obtained. Usually it is necessary to renovate a pasture by mechanical treatment before efficient top-dressing can be carried out.

3. Laying down of Superior Pasture Mixtures.

On a great number of properties the best of the proven general purpose grasses are well-established, but each has its limitations and information is every day being sought by dairymen and graziers regarding pastures for special purposes. There is an increasing demand for advice concerning winter pastures, and information obtained from numerous trials is made available by the Department of Agriculture and Stock. Of the pasture plants which can be recommended for winter grazing, the following are of chief importance:—

Perennial species:—*Phalaris tuberosa* (Toowoomba Canary grass); Perennial Prairie grass; Perennial Rye grass; Cocksfoot; White Clover; Red Clover; Lucerne.

Annual Species:—Italian Rye Grass; Wimmera Rye grass; Prairie grass; Burr Trefoil.

The choice of a pasture mixture for winter grazing purposes must be based upon a number of factors, including the average winter rainfall, the chemical and physical characters of the soil, the cultivation treatment the land has received, the length of time the pasture is expected to remain, the aggressiveness of weeds, &c.

Farmers and graziers interested in sowing winter pastures are invited to avail themselves of the services of the Department of Agriculture and Stock. Pamphlets dealing with sown pastures and their management will be supplied free on request to the Department of Agriculture and Stock, William street, Brisbane.

BROWN HAWKS AND CATERPILLARS.

For its services in exterminating caterpillars the brown hawk exacts a tribute of poultry, but apart from its random raids on the poultry yard it is a most valuable friend of the farmer. John Gould, "father" of Australian ornithology, found the brown hawk congregating in hundreds in a district where a caterpillar plague was raging. The birds battened on the pest. In the centre of Australia, when some of Gould's party fired the spinifex grass and as small marsupials, lizards, and mice were disturbed by the flames, the brown hawks appeared in large numbers, and, dashing through the dense smoke, seized their prey as it dashed from tussock to tussock.—From "Bush Notes," by Norman McCance in "The Australasian."

FARMERS' WOOL SCHEME.

THE object of this scheme is to make available to small growers a scheme by which to have their wool properly classed for market in the hope of selling it to best advantage. Where an owner is only running a few hundred sheep the quantity of wool is not sufficient to be skirted and classed into bulk lines on the property. There is no necessity for skirting the fleeces when preparing it for despatch to the scheme; merely to remove wet stains, roll the fleece and pack it for preference in a good pack. Keep the bellies, locks and sweepings separate, or if packed in the same bale, partitioned off with paper or other light material. Bags, butts, fadges and parcels of any size and shape are received, but no matter what wool comes to hand all the consignments are treated alike. Each individual package or bale is weighed on receival, numbered and entered up in the receival book, then partly opened and valued. The colour, condition and type of wool is noted and placed according to the above in their respective groups. These groups are added to as their respective types are received, which assists greatly in the classing, as it allows for even classes to be maintained until bulk lines are secured. The scheme is available to the following:—

(*a*) Holdings of less than 1,500 Merino sheep;

(*b*) Wool from crossbreds or British breeds from any holding;

(*c*) Bags and butts from any holding;

(*d*) Star lots from our present selling agents.

As shown in (*a*) it will be seen that an owner of less than 1,500 sheep has the privilege under the scheme to forward all or any portion of his clip.

Under the heading (*b*) the wool from crossbreds and British breeds will be received from any holding regardless of the number of Merinos they are running. This provision was inserted owing to the introduction of sheep of the British breeds for cross-breeding and fat lamb production under the Fat Lamb Scheme. Very few, if any, owners forward crossbred wools to the Brisbane market in classed bulk lines, therefore it must be placed on the market at a disadvantage unless advantage is taken of the scheme.

PLATE 249.

WOOL ROOM, DEPARTMENT OF AGRICULTURE AND STOCK—Weighing Classed Wool for Bulked Lines in the Bins.

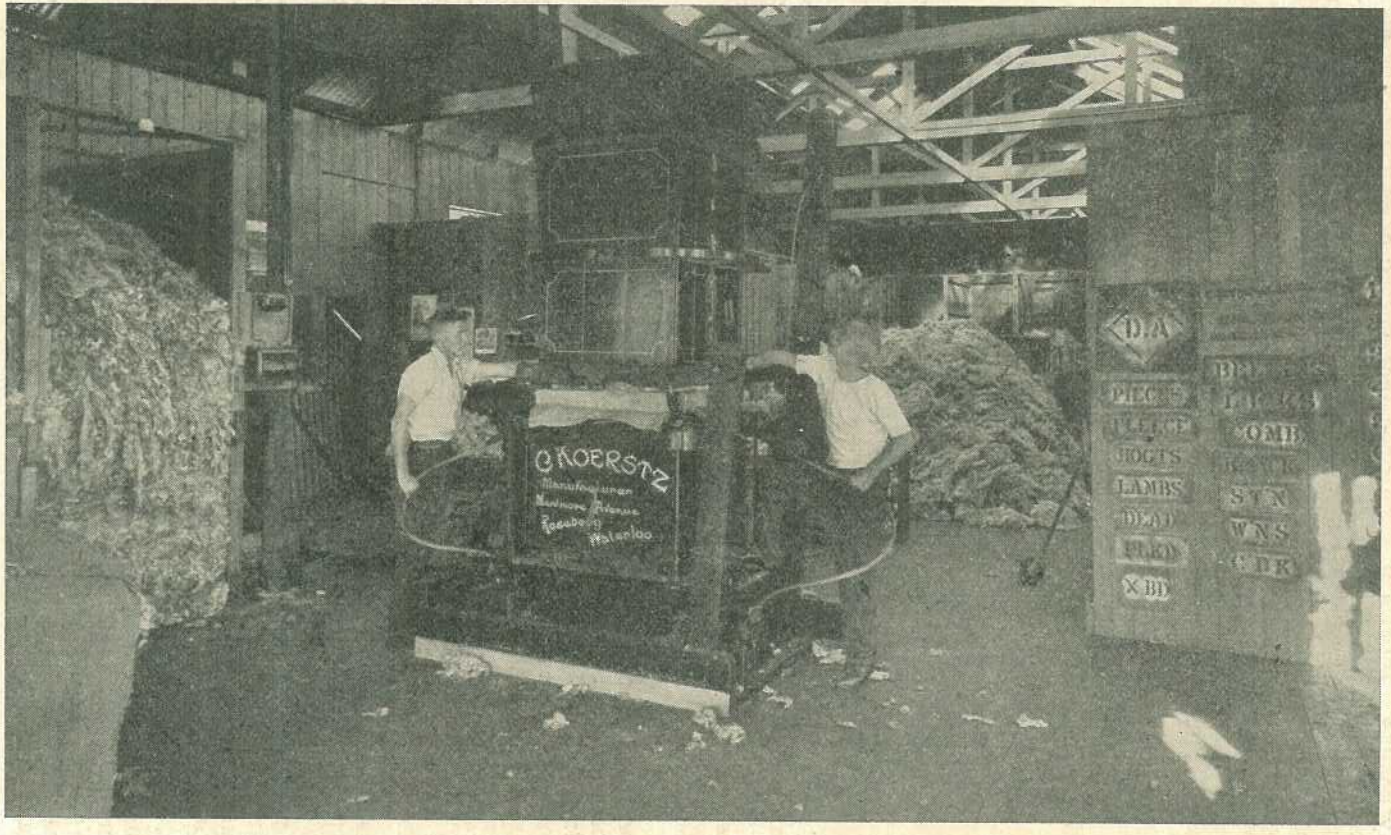


PLATE 250.
Pressing and Baling Classed Wool.

It is provided in (*c*) that bags and butts will be received from any holding. By this it is intended that instead of sending bags and butts to the market in that state, they may be forwarded for classification and thereby pooled into bulk lines. This was intended to be an important addition to the scheme and one deserving of the support of all wool growers. Its importance evidently has not been recognised as very few consignments have been received to date. Naturally, it loses its value unless the quantity received will give sufficient accumulation to form bulk lines of the different classes included in all consignments.

Too much importance cannot be placed on this phase of the scheme and the odd lots that big growers despise as not being worth while would so assist the small growers who would benefit that an advantage of value would result if all wool growers would support it.

(*d*) provides that star lots from our present selling agents be received. This provision was introduced to allow the agents, selling the wool for the season, to make full use of the scheme in order that their clients may secure the advantage likely to be gained without detriment to other brokers. Still it must be borne in mind that a large percentage of star lot wools are properly classed and command attention as such.

Sixty per cent. of the estimated value of the wool is advanced free of interest to those owners who are running less than 1,500 sheep. Cartage and railway freight is paid in addition to the 60 per cent., and if the owner advises that he is shearing a given number of sheep and consigning it to the Department, the wool is covered by insurance from the sheep back to shipping.

When the wool is brought forward for classing it is again weighed for checking up purposes, thus making sure that the correct weight goes to the tables for classing. As the wool is classed it is weighed and placed into its respective bins and each weighing entered in the classification book. When all one grower's wool is weighed into the respective bins and entered up in the day book his name together with the total weight of each class is entered on a bin card which is attached to each bin. The bins are classed into until the accumulation is sufficient to go into bulk lines or until all that particular type of wool is classed.

The wool is then pressed with an up-to-date power press, recently installed, the bale is numbered, weighed, entered up in the bale book and branded "DA" in diamond, class number, together with "Classed on owner's account by the Department of Agriculture and Stock" when it is ready for despatch. The number of each bale is recorded on the bin card, so that when the card is passed on to the Accounts Branch the name of each grower who has wool in a given class is shown, together with the amount of wool he has in it and the bale in which it is included.

When each consignment of wool is received it is entered up in quadruple form, three of which are kept by the Department and one is forwarded to the selling agent who has the arrivals recorded with the Wool Selling Brokers' Association for inclusion in the catalogue under the usual closing date regulations. When the wool is sold our agents make payment to the Department in keeping with their usual method.

When the statement and cheque is received by the Accounts Branch they in turn make out the sales account for payments to the various

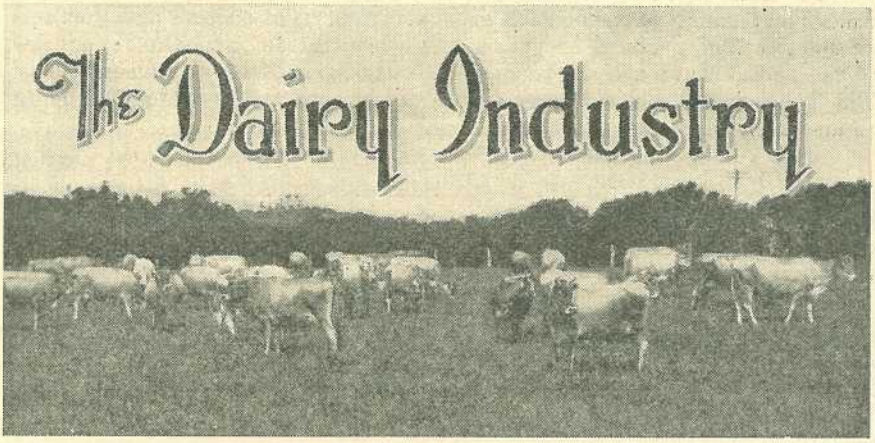
PLATE 251.
Weighing Bales for Despatch to Selling Agents.

farmers who are included in the sale. This is no easy task, as probably thirty farmers may have wool in ten or fifteen classes sold in one sale. All bales that can be used again in forwarding the wool to market are credited to the grower in keeping with the average bale weight of the sale, while those for whom bales are supplied are debited in keeping with the weight of their wool in the sale.

[TO BE CONTINUED.]

PLATE 252.

One of many unnamed waterfalls in the Lower Coomera, near Binnaburra, Lamington National Park, Macpherson Range, Queensland.



THE COMPOSITION OF MILK.

L. A. BURGESS, A.A.C.I., Dairy Research Laboratory.

MILK may be defined as the white fluid secreted by the mammary glands of female mammals for the nourishment of their young. The fluid which is most commonly called "milk" is that obtained from the cow. This animal, by a process of selection, has been developed to such an extent that certain types secrete much more milk than is required by its calf and this is utilised by man for his own nourishment. Milk obtained from the goat, camel, buffalo, ewe, mare, reindeer, and certain other animals is used in certain countries for the same purpose.

As a food, milk and its products are gaining favour. This is not surprising as each of the solid constituents has a definite food value.

The average composition of cow's milk is as follows:—

	Per cent.
Water	87.1
Fat	3.9
Proteins	3.2
Lactose	5.1
Mineral ash	0.7

It is shown in greater detail in Table I.

Other constituents which are present in smaller quantities, but which play an important physiological role include enzymes, vitamins, iodine, lecithin, and cholesterol. Dissolved gases such as oxygen, nitrogen, and carbon dioxide are also found in milk. Figure 1 shows the relative proportions of the main milk constituents and Plate 253 shows the constituents of one quart of milk.

Water.

The water of milk is the same colourless liquid which is known to everyone.

In milk it serves two important purposes. Firstly it holds the other constituents in suspension or in solution. The lactose and portions of the ash and proteins are dissolved, while the fat and the remainder of the proteins and ash are suspended in the form of very small particles. The food constituents are therefore in a condition capable of being immediately digested without the need of mastication.

Secondly it dilutes the solids to such a bulk that it forms the perfect food for the calf. With less water, the solids would form a too concentrated food for the delicate digestive organs of the young animal. These are some of the reasons why milk is such a valuable food for children and invalids.

As water comprises such a large proportion of milk, and the cow in addition requires water to sustain its own life, a liberal supply of good clean drinking water should always be available . An average of fifteen gallons of water per day is required by a cow in milk.

The constituents other than water are known as milk solids. These may be divided into "fat" and "solids not fat."

Milk Fat.

Milk fat is not the simple substance it appears. It is a mixture of at least nine fats, which are given in Table II.

Most of these are liquid at ordinary temperatures. Various factors influence the proportions of the constituent fats. Young succulent grass causes the proportion of the liquid fat olein to increase, and a softer fat is therefore obtained in spring and early summer following the response of the grass to rain and warm weather.

The flavour and aroma of butter is influenced by the proportion of the soluble and volatile fatty acids. When these form a greater proportion than usual, a butter with a stronger and more pleasant aroma and taste results. This is easily explained, as it is only volatile substances which can be smelled, and only soluble substances which can have any effect on the sense of taste.

The fat exists in milk in the form of very minute globules which are in a state of suspension throughout the milk serum; this being the name given to that portion of milk other than fat. These fat globules vary in size with the breed of the cow and a number of other factors, but the average diameter of a globule is one ten-thousandth part ($\frac{1}{10,000}$) of an inch. To give some idea of their very small size, one drop of milk may contain from 100,000,000 to 150,000,000 fat globules.

Solids not Fat.

The solids not fat consist of lactose, proteins and the mineral ash.

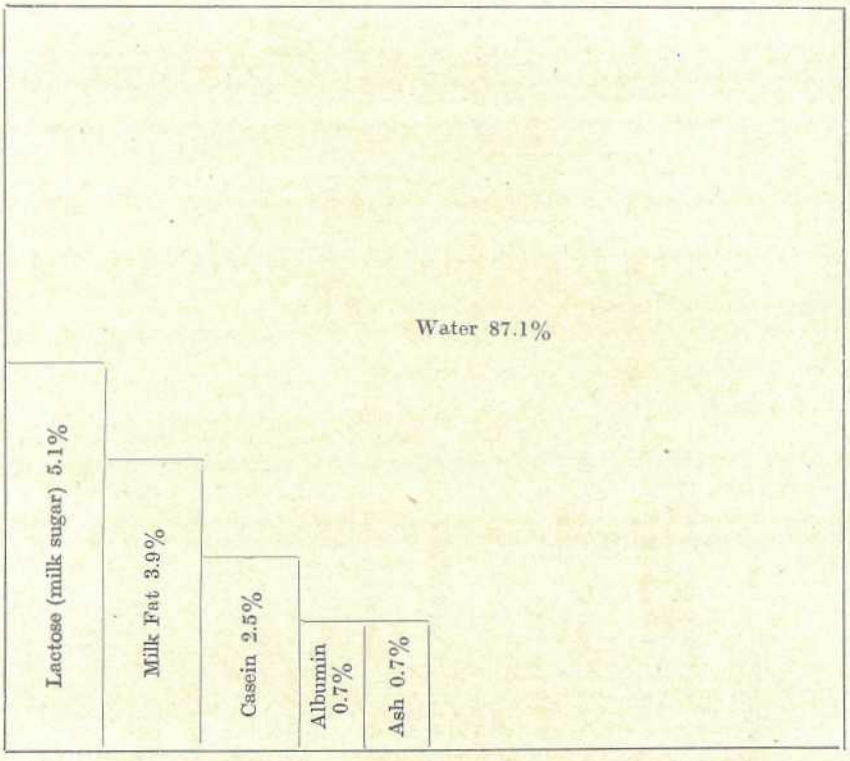
Lactose.

Lactose, or milk sugar, is only found in nature in mammalian milk. It contains the same elements, namely, carbon, hydrogen, and oxygen, and in the same proportion as in sucrose or cane sugar, but differs in certain of its physical and chemical properties. It is less sweet to the taste and is not so soluble in water as is cane sugar. It is one of the constituents which is entirely in solution. It is easily decomposed by

TABLE I.—COMPOSITION OF MILK.

							Per cent.				
Milk	Per cent. 100	Fat	Per cent. 3·9	Olein, Palmitin, Stearin, Myristin	Glycerides of insoluble and non-volatile fatty acids		3·4	Fat	3·9	Total Solids	Per cent. 12·9
				Butyrin, Caproin, Caprylin, Caprin, Laurin	Glycerides of soluble and volatile fatty acids		0·5				
						Per cent.					
		Milk Serum	96·1	Casein	2·5	Total Proteins	3·2	S.N.F. (Solids not fat)	9·0		
				Albumin	0·5						
				Other Proteins	0·2						
				Lactose	or	Milk Sugar	5·1				
				Potassium Oxide, Sodium Oxide, Calcium Oxide, Magnesium Oxide, Iron Oxide, Sulphur Trioxide, Phosphorus Pentoxide, Chlorine		Ash	0·7				
				Water			87·1				
							100·0				

FIGURE 1.—THE CONSTITUENTS OF MILK.



lactic acid bacteria when in solution, with the formation of lactic acid. This bacterial action is the cause of the souring of milk, and is one of many changes which occur during the manufacture of cheese.

The proteins of milk consist mainly of casein and albumin.

Casein.

Casein forms about 2.5 per cent. of milk. It exists in the form of an exceedingly fine colloidal suspension. There are reasons to believe that it is loosely combined with calcium or lime compounds.

The presence of casein makes the manufacture of cheese possible. As milk sours casein is coagulated, or precipitated, and this solidification

TABLE II.—COMPOSITION OF MILK FAT.

Fat.	Per cent.	Melting Point °F	Condition at Ordinary Temperature.	Properties of the Fatty Acid.
1. Butyrin ..	4	about—80	Liquid ..	Soluble and volatile
2. Caproin ..	3·5	..	ditto ..	ditto
3. Caprylin ..	0·5	16	ditto ..	Partly soluble and volatile
4. Caprin	2	31	ditto ..	ditto
5. Laurin	7	44	ditto ..	ditto
6. Stearin ..	2	123	Solid ..	Insoluble and non-volatile
7. Myristin ..	20	88	ditto ..	ditto
8. Palmitin ..	26	145	ditto ..	ditto
9. Olein	35	41	Liquid ..	ditto

of the casein traps much of the fat and lactose. Cheeses made from such sour milk curd include what is generally known as cottage cheese. When rennin, or rennet, is added to milk, the casein is again coagulated but, in this case, the curd traps more of the mineral constituents of milk notably calcium. This curd is the source of most varieties of cheese, the different varieties depending on the after treatment of the curd and the action of different types of bacteria.

In addition to its value as a foodstuff, casein has a considerable commercial value. It finds use in the manufacture of artificial jewellery, imitation bone and ivory, buttons, piano keys, imitation amber and ebony, cold water paints, leather dressings, waterproof glues, paper sizing, horticultural sprays, and a number of other ways.

Albumin.

Albumin the other main milk protein, is present to the extent of about 0·5 per cent. This protein differs from casein, being in solution in the water portion. It differs also in not being coagulated by souring or by the action of rennin. However, by heating milk above 158 degrees F., albumin is coagulated, while casein remains unchanged.

Ash.

The mineral portion of milk is generally known as ash. It is not known in what manner the mineral matter is arranged or combined in milk, but the following constituents are all present in the ash:—Sodium, potassium, calcium, magnesium, iron, phosphorus, chlorine, sulphates, carbonates, and smaller quantities of other substances.

Pigments.

Milk also contains two colouring substances. Carotin, a yellow substance dissolved in milk fat, causes the familiar yellow colour of butter. The second, known as lactochrome, is dissolved in the water of milk, and to this is due the greenish yellow colour of whey.

Vitamins.

A description of the constituents of milk would be incomplete without mentioning the vitamins known to be present in milk.

Vitamin A is present in the milk fat. This vitamin is essential for the maintenance of good health inasmuch as its absence from the diet results in a lowered power of resistance to disease, particularly diseases of the throat and lungs. Milk, cream, butter, cheese, and other milk products which contain milk fat are, therefore, of considerable value. Any excess of this vitamin which may be taken into the system is not wasted as it is stored in the liver until such times as it is required. Most vegetable oils are lacking in this particular vitamin.

Vitamin B is soluble in water and milk is one of the main sources. A lack of this vitamin results in nervous disorders such as beri-beri and pellagra.

Vitamin C is also soluble in water and is essential for the prevention of scurvy. Although citrus fruits are the chief sources of this vitamin, it is also present in milk in valuable amounts.

Vitamin D is a fat soluble vitamin known as the anti-rachitic vitamin. This vitamin prevents such complaints as rickets, provided sufficient lime and phosphoric acid are also available in the diet. Milk fat is a valuable source of this vitamin, while vegetable oils contain practically none.

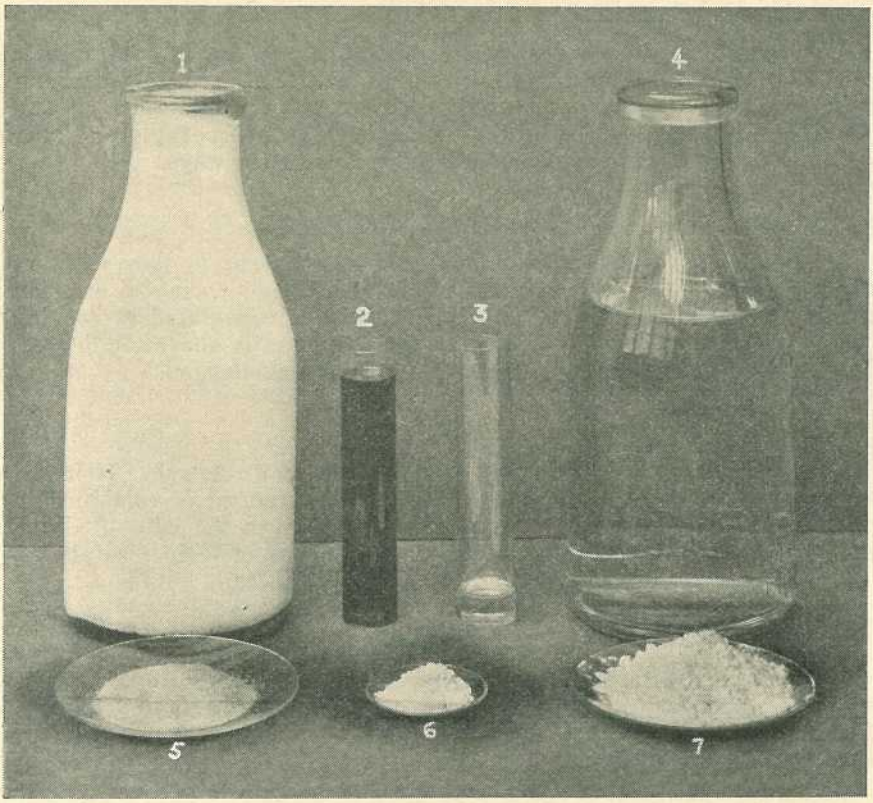


PLATE 253.

THE CONSTITUENTS OF ONE QUART OF MILK.—1. Milk. 2. Milk fat. 3. Albumin. 4. Water. 5. Casein. 6. Ash. 7. Lactose.

Vitamin E is also a fat soluble vitamin, and a lack of this vitamin results in the degeneration of the reproductive organs. This vitamin is considered to be more widely distributed among the foods than most of the other vitamins, and milk is said to be one of the secondary sources of supply.

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KEEPING PIGS HEALTHY.

* By L. A. DOWNEY, H.D.A., Instructor in Pig Raising.

NOW that pig-raising is taken more seriously by Queensland farmers, as is indicated by the vast increase in pig production during recent years, larger numbers of pigs are being kept on farms, and this more intensive pig population necessitates more care in the handling of the pigs to keep them healthy. Where five or six pigs are kept on a property the risk of disease is small, but if the stock are increased to fifty or sixty head, the provision of food and accommodation must increase in proportion if these pigs are to be kept healthy.

Health in the pig is a normal state of the body, and when the animal is normal it is able to grow and reproduce according to its inherited ability and the feeding and care which it receives, and as the farmer's primary object in keeping pigs is to have them growing and reproducing to the best of their ability on the available food supply which they are expected to profitably convert into pork, it is his duty to maintain his stock in a healthy condition.

Pigs may be unhealthy to a slight degree, insufficient for the average person to notice, but even in this condition, which may be caused through some deficiency in the diet or by a light infection, pigs are not able to convert their food to pork in the most efficient manner. Such minor troubles can best be detected by weighing the pigs regularly through their growing period and checking their food consumption and rate of gain. Losses caused by such slight troubles which are only apparent when carefully kept records of growth and food consumption are available probably cause greater waste in the pig industry than the very obvious cases of disease which cause death of pigs on the farms or condemnation of carcasses by meat inspectors.

The percentage of actual losses of pigs or carcasses in Australia is very small in comparison with that of other countries, this happy state of affairs being due to our sparsely distributed pig population, our congenial climate, and our quarantine system, which prevents the introduction of diseases from other countries and controls the spread of diseases within the Commonwealth.

The troubles which we have affecting the pigs of Australia are causing sufficient wastage to command the attention of every pig raiser

* In a broadcast address from Radio Stations 4QG, Brisbane, and 4RK, Rockhampton. By courtesy of the Australian Broadcasting Commission.

in an endeavour to eliminate losses as far as is practicable. Australia is now established as a pork-exporting country, and to be able to sell on the world's markets it is necessary to produce at least as efficiently as other countries, and the elimination of waste will help towards that objective; it is therefore essential that every pig raiser study his business carefully, keep records of production which will aid in detecting the small losses, and then set about eliminating these losses. Also with the increasing pig population greater care must be taken in pig husbandry to avoid outbreaks of more serious diseases which are usually associated with dense pig population.

As in the case with all farm animals, when increased production is brought about by the work of stud breeders in selecting and breeding individuals which inherit high production, those highly bred stock must be given more than ordinary food and attention if they are to be kept at a high state of production, and if the food requirements are not kept up to such animals, they will probably go on producing in accordance with their inheritance but to the detriment of their constitution, which would eventually collapse. For example, consider the breeding sow that, through advanced animal husbandry, has been bred capable of producing a litter of ten pigs, which weigh 40 lb. each when eight weeks old; she is a very productive sow, and a vast improvement on the wild sow running under natural conditions. This very productive sow requires large amounts of food—in fact, she will eat up to 16 lb. of dry meal daily while she is rearing her litter—and her food must contain certain minimum amounts of particular nutrients; if she receives insufficient of any of these nutrients, she will most likely draw on supplies from her own body, but there is a limit to this source and eventually her health is injured and she is a fit subject for attack by disease-producing organisms. Some pig raisers maintain that high-producing stock are more susceptible to disease; they are not necessarily so, but they do require a better supply of food than low producers.

Practically all diseases and parasitic infestations in pigs in this country can be prevented or efficiently controlled, and the methods of doing so are fortunately identical with recommended practices of economic pig-raising, so that the maintenance of healthy pigs is a matter of sound pig-raising practice.

The necessary precautions for keeping pigs healthy may be dealt with under the headings of breeding, nutrition, and accommodation, although these three factors intermingle in piggery management.

When selecting prospective breeding stock, the pig raiser should either be satisfied that he is a capable judge or he should hand the job over to someone who is capable of determining as far as is possible whether the stock in question are desirable from the points of view of apparent constitution and productivity. There should be proper balance of constitution and trade requirements in the make-up of the pig. For example, the bacon and pork trades require that pigs should be light in the fore end which gives the cheaper cuts of meat, but from the breeder's point of view chest capacity is essential for a strong constitution, and therefore, while the shoulders and neck should not be too pronounced and covered with excessive deposits of fat, the chest should be reasonably deep and broad if the pig is to be vigorous, healthy, and fast-growing.

There should be more certainty of securing good sound stock from registered stud breeders than from unregistered breeders, and in most cases such men can be relied upon to select good stock for clients. The value of pedigreed pigs lies in the fact that they have been bred for many generations along particular blood lines with the object of maintaining or improving standards, and as no studmaster breeds from pigs which he considers are not going to improve his herd there is every probability of those pigs inheriting the most desirable characteristics. It must be remembered, however, that environment, including food, plays a big part in developing the pig and it is possible for even stud pig breeders to lose good qualities in their pigs if they neglect the feeding. Therefore, don't select pigs on pedigree alone; select on appearance, performance, and pedigree, the pedigree being a fairly good guarantee that the stock will reproduce their characteristics.

Whilst probably no stud pig-breeder can guarantee his pigs positively free of disease or parasites one can usually gain information regarding the possibility of infection by observation of the condition of sanitation in the piggery and by asking a few questions.

The mating of closely related pigs is a frequent cause of weak constitutions, and while line breeding does in some cases produce good results, the practice should be left to those breeders who are prepared to experiment and cull the weeds if the results are unsatisfactory.

Any tendency towards a constitutional weakness as indicated by faulty conformation of breeding sows may be remedied in their progeny by using a boar which has pronounced strength in the point where the sows are weak; such practice is known as corrective mating.

Pigs can only reproduce their inheritance of growth and production if they receive the necessary fuel. The feeding of pigs is dependent on the availability and cost of foods, but if too much notice is taken of these two points there is a big chance of dietetic deficiencies occuring. It is always practicable, however, for pig raisers to add to the readily available cheap foods such other foods as are necessary to prevent deficiencies. With some systems of feeding there is a probability of deficiencies of minerals which cause disturbances of health and lead to more serious disorders. In order to avoid such pitfalls, the pig raiser must have some knowledge of the principles of nutrition. The man who thinks that molasses and water will satisfactorily replace separated milk in a pig's ration is courting disaster.

Nutrition is a complex subject and too vast to be dealt with now, but for those who require more detailed information on the subject there is a free publication entitled "Pig Feeding," available from the Department of Agriculture and Stock, Brisbane.

Without knowledge of the principles of nutrition the pig raiser can avoid a lot of trouble by feeding his pigs plenty, variety, and food that is free of disease-producing organisms.

In accommodation, more than in any other aspect of pig raising, there is scope for improvement with the objective of maintaining healthy pigs. In planning pig accommodation, comfort and sanitation for the pigs must be the chief consideration.

Protection from the extremes of climate is necessary if pigs are to be absolutely healthy. Exposure to cold and dampness predisposes pigs

to various ailments, whilst excessive heat from the sun may cause considerable distress or even death; hence the necessity for shelter from the extremes of weather.

As most infections are caused by microbes or worm parasites the infective stages of which lurk on the floor of pig pens and yards or in troughs, it is necessary to have control over the hygiene of the surface of these floors and troughs. Impervious material such as concrete is adaptable to thorough cleansing and is therefore very suitable for pig pen construction, provided there is ample water and labour to do the cleansing. Concrete is expensive and pens made of same must necessarily be small; so where such pens are used pigs are run intensively on small areas.

Another way of maintaining sanitation and health in the piggery is to have the pigs spread over a large area of land which is periodically rested and grassed or cultivated and planted with some grazing crop. This is the paddock system of pig raising which is becoming more popular with Queensland farmers and is giving excellent results.

In the paddock system the object is to keep the ground as fresh and free from infection as possible; the best means of doing this is to plough the paddocks at least twice yearly, working the implements close to fences. Sheds, troughs, and other equipment used in the pig paddocks should be movable so that in cultivation, the soil near the equipment, which is usually more fouled than the rest of the paddock, can be turned over. The paddocking of pigs is not only health-promoting but economical in every way.

Sunshine is the farmer's cheapest germicide and it also destroys embryo worms which affect pigs. Every use should be made of this powerful weapon by allowing the early morning sun's rays to penetrate into every part of sheds and troughs in the piggery; by facing open-fronted sheds to the north-east this can be accomplished and the pigs still have protection from inclement weather and sun's rays during the hotter part of the day. Pigs are very healthy animals if given a chance, and it is in the interests of every pig raiser to give his pigs that chance.

THE PERSIMMON.

By H. BARNES, Director of Fruit Culture.

THE Persimmon, or Japanese Date Plum as it sometimes called, is a hardy fruit tree which will grow almost anywhere in Queensland in a good soil supplied with ample moisture.

It does not attain large size—about 12 to 15 feet in height—whilst the leaves, which are broad, glossy, and handsome, fall during the winter months.

No special care by way of pruning is required, as the trees naturally form nicely-shaped heads. Some trimming may be necessary at planting, and perhaps the removal at times of an odd branch or two which tend to crowd other growths.

There are a number of kinds, some of which are of Japanese and others of wild American origin, but the Japanese varieties are the most common, and produce the finer quality fruit.

Dia-Dia-Maru is probably the best in most situations. The fruit is large and flattish in shape, almost seedless, juicy, and possesses a delicious flavour. Other good varieties are Heycheya and Kuro Kumo, which in shape are more rounded.

Under local conditions Persimmons ripen during late February, March, April, and early May. They are, therefore, somewhat subject to fruit fly attack.

The fruit should only be eaten when fully mature, i.e., when the flesh becomes soft like an unset jelly. When unripe, even though highly coloured, it has a peculiar astringent taste which is most objectionable.

Young trees should preferably be planted late in winter.

FRUIT MARKETING NOTES.

By J. H. GREGORY, Instructor in Fruit Packing.

FOR the next eight weeks or so we can expect the market prices to take short, sharp fluctuations as periods of cold or wet weather are experienced. Prices for custard apples, citrus, and fruits of a like nature are always affected by weather changes, whilst apples and other cooking fruits do not show the same tendency to price fluctuation. With the advent of larger consignments of citrus, and cooler weather, prices have eased slightly. Custard apples show the same result. It must still be borne in mind that good-quality well-packed fruit is always the first to be sold, and usually realises top market prices. Regularity of consignments should be the aim of all growers, coupled as far as possible with rotational marketing for size. "Keep on sending the larger fruit, and give the small sizes a chance to grow" is a good maxim to use.

Apples.

From now on fresh apples will become scarcer, and cold-stored fruit will supply demands. Where are the Stanthorpe Granny Smiths? Many of those growers who hurried their crops away should now be realising the mistake of picking the whole crop by the end of March. With the practice of careful rotational picking, quite a large amount should have been available for storage on the farm. Careful handling, together with the cold nights now being experienced, should enable Granny Smiths to be held and marketed satisfactorily until the end of June at much better prices than those realised during the season. Cold-storage lines of Jonathans should now be very carefully watched, and placed on the market whenever a good price is available. Regular small weekly quantities give better results than a few large haphazardly placed parcels.

Prices at the middle of May were:—Delicious, from 8s. to 10s.; Jonathan, from 5s. 6d. to 8s. 6d.; Granny Smith, from 8s. to 11s.; slightly hail-marked Granny Smith, from 6s. to 7s.

Custard Apples.

Consignments have increased in quantity and prices have eased. It is now more necessary than ever to market only matured fruit, which is indicated when the interstices are a rich creamy colour. By carefully observing this rule, no black or hard ripening custards will be placed on the market.

Brisbane prices are 3s. to 4s. per half-bushel, and Melbourne prices 5s. to 7s. per half-bushel.

Matured custards carefully packed with woodwool padding carry quite satisfactorily to Sydney and Melbourne.

Pears.

Prices for Winter Coles varied from 10s. to 13s. 6d.; for Beurre Bosc, from 6s. to 8s. 6d.; and for Keiffers, from 6s. to 8s.

Papaws.

Winter papaws will now be seen on the market. Growers should allow more colour to develop before marketing their fruit, especially in the case of Southern consignments. Tropical fruits do not have the benefit of a high humidity and sunshine to assist them in ripening when on the Southern markets. Plenty of padding around each fruit, coupled with wrapping, will give good results.

Brisbane prices:—For locals in trays, from 1s. 6d. to 4s.; in dump cases, from 3s. to 6s.; for Yarwuns, from 9s. to 10s. per tropical case.

Melbourne prices:—From 15s. to 17s. per tropical case.

Sydney prices:—10s. per tropical case.

Bananas.

Bananas have maintained their rise in price, although, owing to an increase in the percentage of smaller sizes, the quality of the fruit is not quite so good. Prices over the next few weeks should remain steady.

Brisbane prices:—Sixes, from 7s. to 9s. 6d.; Sevens, from 7s. to 11s. 6d.; Eights, from 9s. 6d. to 12s. 6d.; and Nines, from 10s. to 13s.

Melbourne prices:—Sixes, from 12s. to 13s.; Sevens, from 14s. to 15s.; Eights and Nines, from 16s. to 17s.

Sydney prices were slightly easier than Melbourne.

Pineapples.

The necessity for closely watching that green pines are not sent must again be stressed. With the advent of cool weather, the fruit can be allowed to remain longer on the plantation without increasing the risks of faulty carriage.

Brisbane prices:—Smooths, from 3s. to 6s. per dozen, and from 5s. to 8s. per case; Ripleys, from 3s. to 6s. per dozen, and from 6s. 6d. to 9s. per case.

Melbourne prices:—From 10s. to 16s. per case.

Sydney prices:—From 9s. to 13s. per case.

Passion Fruit.

Prices have eased considerably. Growers should not include crinkled fruit with the smooth, as this will affect the price of the lot.

Brisbane prices ranged from 5s. to 8s. per case, and Melbourne prices from 9s. to 18s.

Rosellas.

Rosellas are not in very popular demand on the Brisbane market. Prices received were from 2s. to 2s. 6d. per bag.

Grapes.

Cold-stored consignments are now on the market, and are in many cases faulty, particularly the Cornichons, for which prices range from 2s. to 8s.; Southern Ohanez, bringing from 8s. to 10s., are the most satisfactory at present.

Citrus.

Increasing quantities have tended to reduce prices. Growers are warned against trying to gas-colour immature fruit, as it simply cannot be done in a sufficiently satisfactory manner to make it worth while.

Benyenda lemons have been bringing from 13s. to 15s. per case. There is no doubt that the excellent pack is the reason for this fruit maintaining such high prices compared with other lines. There is no reason why other growers should not be obtaining the same prices if they put a little extra effort into their pack and get-up. Other brands at from 8s. to 10s. show great discrepancy. Lines of fruit are often seen, of which the quality is equal to anything produced, spoiled from the marketing point of view by the mixing of first and second quality. These remarks apply also to oranges, mandarins, and grapefruit. Melbourne and Sydney prices for lemons range from 6s. to 10s. 6d.

Brisbane prices for oranges are as follows:—Navels (Benyenda) from 11s. to 14s.; other Navels, from 6s. to 9s.; common oranges (Benyenda), from 8s. to 10s.; others from 5s. to 6s. Melbourne prices for Washington Navels ranged from 10s. to 13s., and for Thompson's Navels from 9s. to 10s.

Grapefruit prices in Brisbane were from 6s. to 7s. 6d., and in Melbourne from 8s. to 12s.

Mandarins in Brisbane brought from 5s. to 6s. for Fewtrells, and 5s. to 8s. for Emperors. Melbourne prices were 8s. to 10s. for Fewtrells, and 10s. to 12s. for Emperors, with some higher.

Tomatoes.

Brisbane prices for locals are:—Coloured, from 3s. to 4s. 6d.; and green, from 1s. to 3s. Stanthorpe tomatoes brought from 1s. to 2s. 6d. per case. Attention is drawn to the difference in price between coloured and green tomatoes.

General Notes.

Many growers still persist in placing lids on their cases that are too narrow, both for local markets and for country orders. Much fruit is damaged and reduced prices are realised through this foolish practice. Country-order buyers will not risk buying consignments of this type to send out, and consequently the growers' market is considerably restricted.

HOME TANNING.

An American formula for home tanning of cattle hides:—Ten gallons of soft water, ½ bushel of bran, 7 lb. of salt, and 1½ pints of sulphuric acid. After the hide has been cleaned and fleshed it should be immersed in the solution for twelve hours, then washed and dried. The more the hide is stretched and worked while drying the softer and more pliable will be the finished product. Sheep pelts may be treated also, but only 1 pint of sulphuric acid should be used in the solution for pelts. [Sulphuric acid should, of course, be handled very carefully. A bucket of clean water should be kept handy, in case the acid is splashed on the hands or other parts of the user's body or clothing. Quick immersion in clean water of the affected part will prevent serious harm.—Ed.]

THE far north coast received beneficial rains early in May, but elsewhere the falls have been light, with the exception of certain favoured areas such as Nambour, Bald Knob, and Nerang, where over 2 inches were registered.

At the time of writing (20th May) the agricultural areas are generally in need of good soaking rains to refresh pastures and all growing crops. The dry spell is being severely felt on the Darling Downs, where many stockowners have been obliged to seek agistment for their flocks and herds. Dairy farmers are utilising reserves of hay, chiefly lucerne, but as large quantities have been railed to central and western districts there is a possibility of their being insufficient remaining for local requirements. Better conditions prevail west of Dalby, where a fair winter is assured owing to the excellent summer rains. Grasses are commencing to seed along the Western line, and if handled judiciously the heavy seeding should result in a thickening up of the pastures.

The Instructor in Agriculture at Roma (Mr. C. H. Defries) states that Rhodes grass and Blue Panic are giving good results on the lighter soils, and now that natural pastures are drying off, such grasses will be very useful in providing succulent feed until winter fodder crops are available. On the Downs existing crops of feed sorghum will be very valuable, but supplies are unfortunately limited in quantity. More attention should be devoted to this crop for both silage and fodder purposes, as, unlike the grain sorghums, bird pests do not greatly affect its value as feed. Some few early-sown wheat and oat crops are holding out, but as recent rains rarely exceeded half an inch, the general sowing will depend on future seasonal falls. As there is little subsoil moisture, at least 2 inches will be required to assure a good plant.

In common with the majority of summer crops, maize will return only light yields in Southern Queensland, a fact which is reflected in the increased prices now being realised. However, conditions were very much better on the Atherton Tableland where the crop is estimated at 23,000 tons.

PLATE 254.
Looking across fields of Sorghum and Sudan grass, Coreena Station buildings in the distance.

Tobacco.

As in many of the tobacco areas the operation of grading is in full swing, opportunity is again taken to warn growers to pay more attention to this important phase of the industry. No grade should include any trace of green, as again and again buyers have refused to make a bid for lines showing traces of immature leaf.

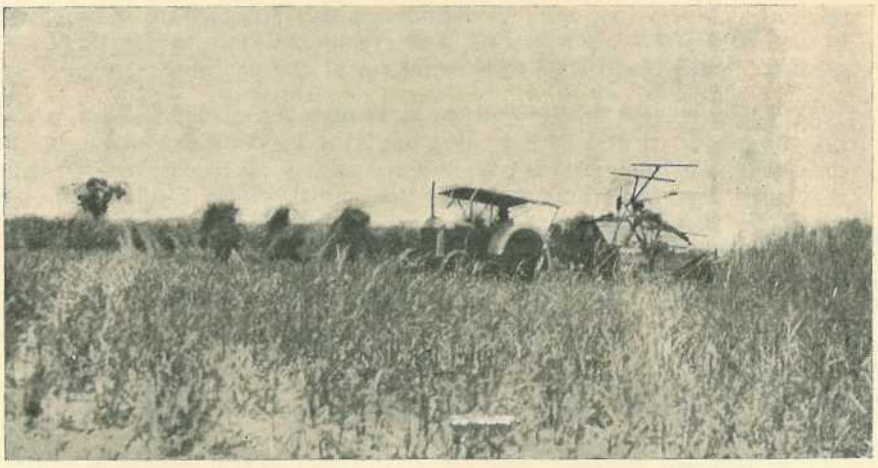

PLATE 255.
Reaper and Binder in action on a crop of Sudan grass, Coreena Station.
Fodder cultivation and conservation is practised successfully and extensively on this western property.

Another point which cannot be too strongly stressed is the irregular grading and baling of the leaf. When a bale is submitted containing mostly fair-quality leaf, together with a percentage of other grades, the buyer immediately places a valuation upon it equal to the lowest grade in the bale, as, until the bale is fully opened, there is no guarantee as to the percentage of the respective grades. In this manner growers are losing pounds in their annual returns.

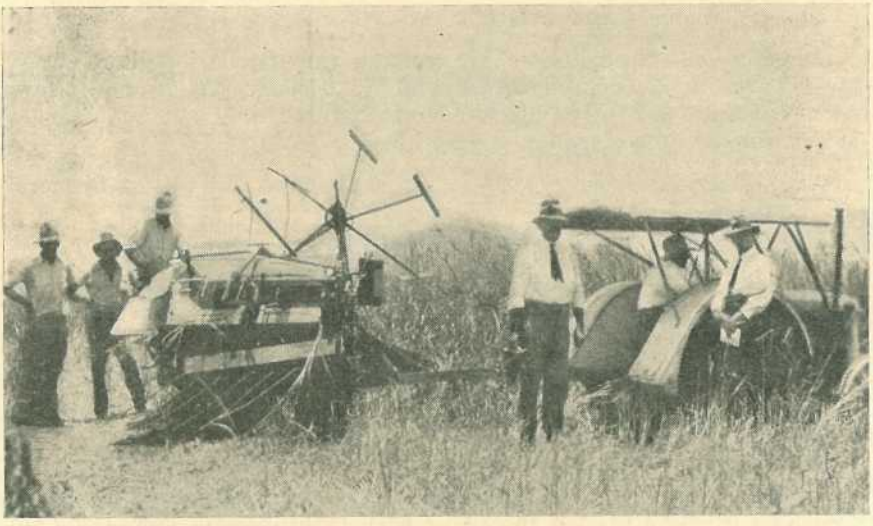

PLATE 256.
Scene on Coreena Station, where fodder crops are in regular cultivation and are chaffed and bagged for future use.

Sugar.

During May, useful rains were experienced in all cane areas except the Burdekin. Though air temperatures were too low to favour vigorous crop growth, some progress was made, and the good supply of soil moisture will keep the crop in good order.

Crop estimates to hand indicate that a very high record yield of sugar will be harvested in Queensland this year.

Cotton.

Cotton harvesting has proceeded throughout the month, and during the period rain has fallen over most of the cotton areas, generally in small amounts.

Insect damage continues to be severe, especially on the late-planted cotton, and it is not anticipated that the crop will yield as much as was previously thought.

Receivals at both ginneries are good, and the quality of the cotton is being maintained.

No frosts of sufficient intensity to kill the cotton bushes have yet been reported.

Seeds Every Farmer Should Know.

II.

(Part I. published in October, 1935.)

By F. B. COLEMAN, Officer in Charge, and R. J. HOLDSWORTH, Inspector, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

Sorghum Sudanense (Figs. 5 and 6).

Common name.—Sudan Grass.

Description.—Seed hulls shiny, colours varying dark-yellow, many of which are tinged with red, brown, and black, canary yellow, and a few in most samples brown to black. Hairs may or may not be present. Rachilla jagged appearance at top and base.

Size.—Varying from 4½ x 2½ mm. to 7 x 2 mm. and 1¼ to 2 or more mm. thick.

Caryopses (Kernels).—Dull light-brown coloured, plump.

Size.—4 x 2½ mm. and 2 mm. thick.

Occurrence.—A commercial crop of considerable value for feed and seed.

Sorghum Halepense (Figs. 7 and 8).

Common name.—Johnson Grass.

Description.—Seed hull shiny, black, sometimes brown or dark-yellow, seed slightly smaller than Sudan as a rule. Rachilla cup shaped at top and rounded at base of seed. Each rachilla, as a rule, is intact on the seed. Hairs may be present.

Size.—4 x 2 mm. and 1 mm. thick.

Caryopses (Kernels).—Dark coloured.

Size.—2½ x 2 and 1 to 1½ mm. thick.

Occurrence.—In Sudan grass seed; unfortunately, this impurity is found in Queensland grown seed.

Usually with Sudan grass and Johnson grass the rachillæ from which two other seeds have been broken are attached to each seed.

The suture (groove marking natural division between seed and rachilla) (Plate 258—c) is present only in Johnson grass, resulting in a clear cup-shaped break at the ends of these rachillæ when the seed is detached from the remainder of the plant. In Sudan, the suture being absent, a jagged fracture occurs at the base of the seed and at the apex of the rachilla.

Fig. 5. Sudan Grass x 5.
Fig. 5a. Sudan Grass, Natural size.
Fig. 6. Sudan Grass, Caryopses x 5.
Fig. 6a. Sudan Grass, Caryopses, Natural size.
Fig. 7. Johnson Grass x 5.
Fig. 7a. Johnson Grass, Natural size.
Fig. 8. Johnson Grass, Caryopses x 5.
Fig. 8a. Johnson Grass, Caryopses, Natural size.

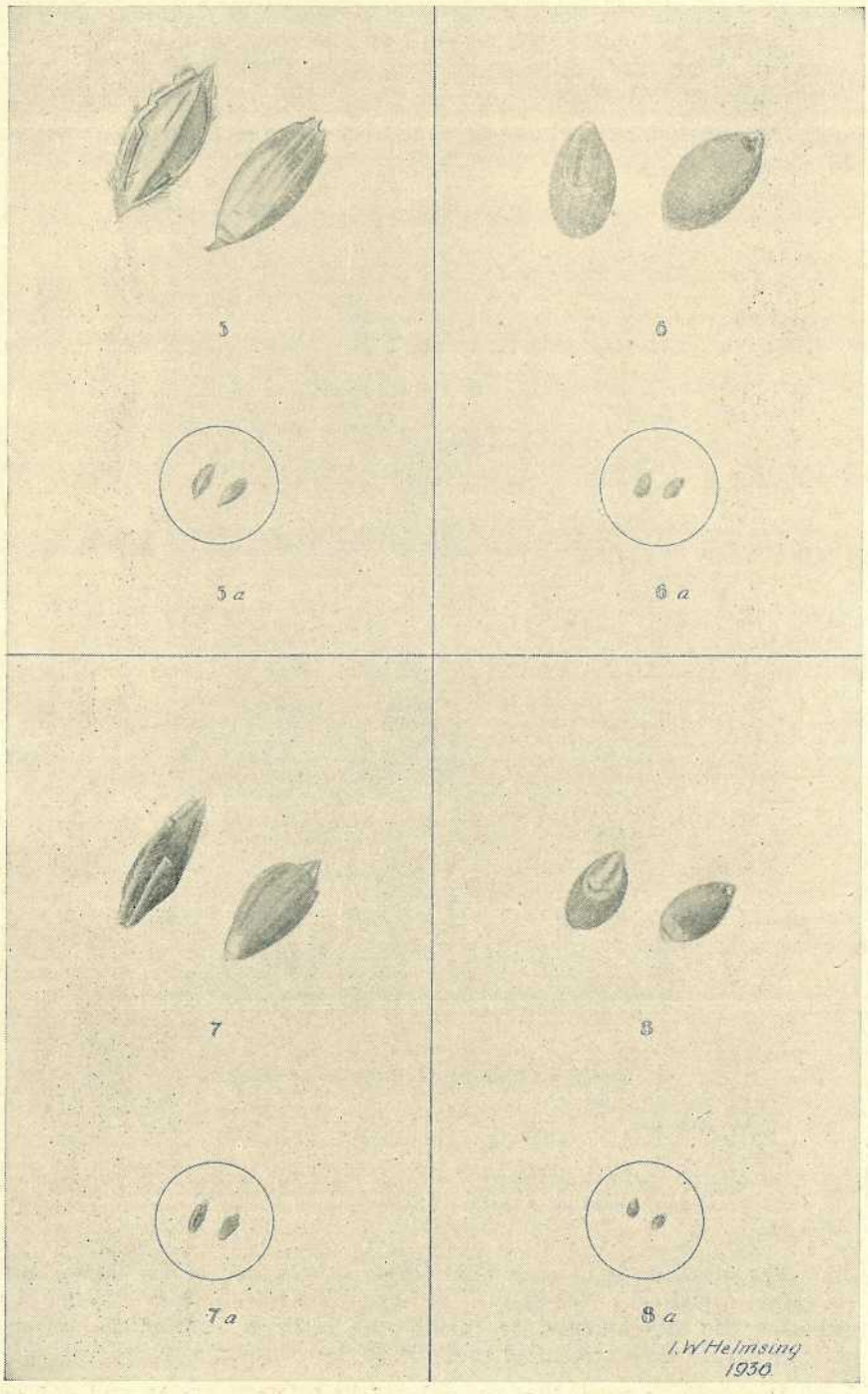

PLATE 257.

Many samples of commercial Sudan grass seed have suffered considerable damage in the process of thrashing and cleaning, therefore we find that the outer coat or hull is somewhat shortened; also the rachillæ (Plate 258—*c*) may be present or absent and the hairs are frequently rubbed off.

The function of the rachilla is to attach to the plant a fertile seed, to which in its turn one or more other seeds are attached.

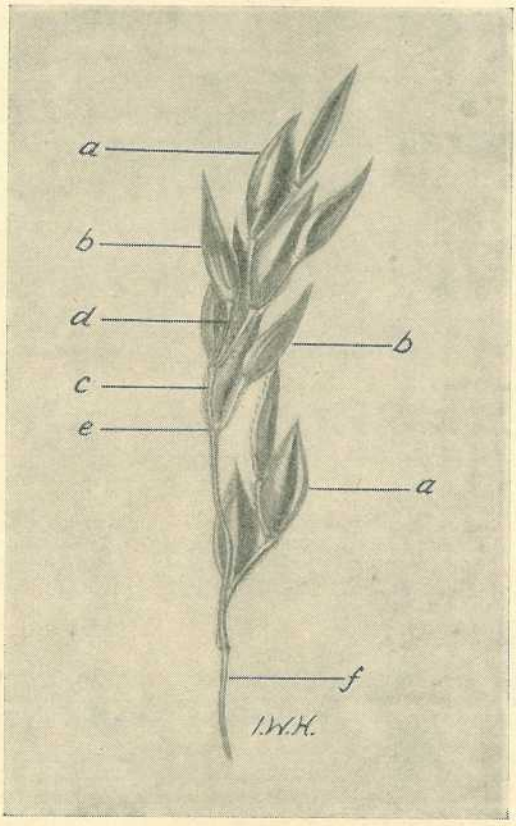

PLATE 258.
SEED CLUSTER OF JOHNSON GRASS.

a.—Fertile spikelets (seed).
b.—Sterile spikelets.
c.—Rachilla.
d.—Pedicels of sterile spikelet.
e.—Suture (groove marking a natural division).
f.—Rachis.

The attachment of each final single sterile seed of the seed cluster is called a pedicel. Normally it is impossible to tell from a single seed whether the attachments are rachillæ or pedicels but for the purpose of this article they are called rachillæ. (See Plate 258.).

It should be noted that the differences between Sudan and Johnson grass seeds are very difficult to detect with certainity, and the indentification should only be undertaken by a trained person, who in most cases

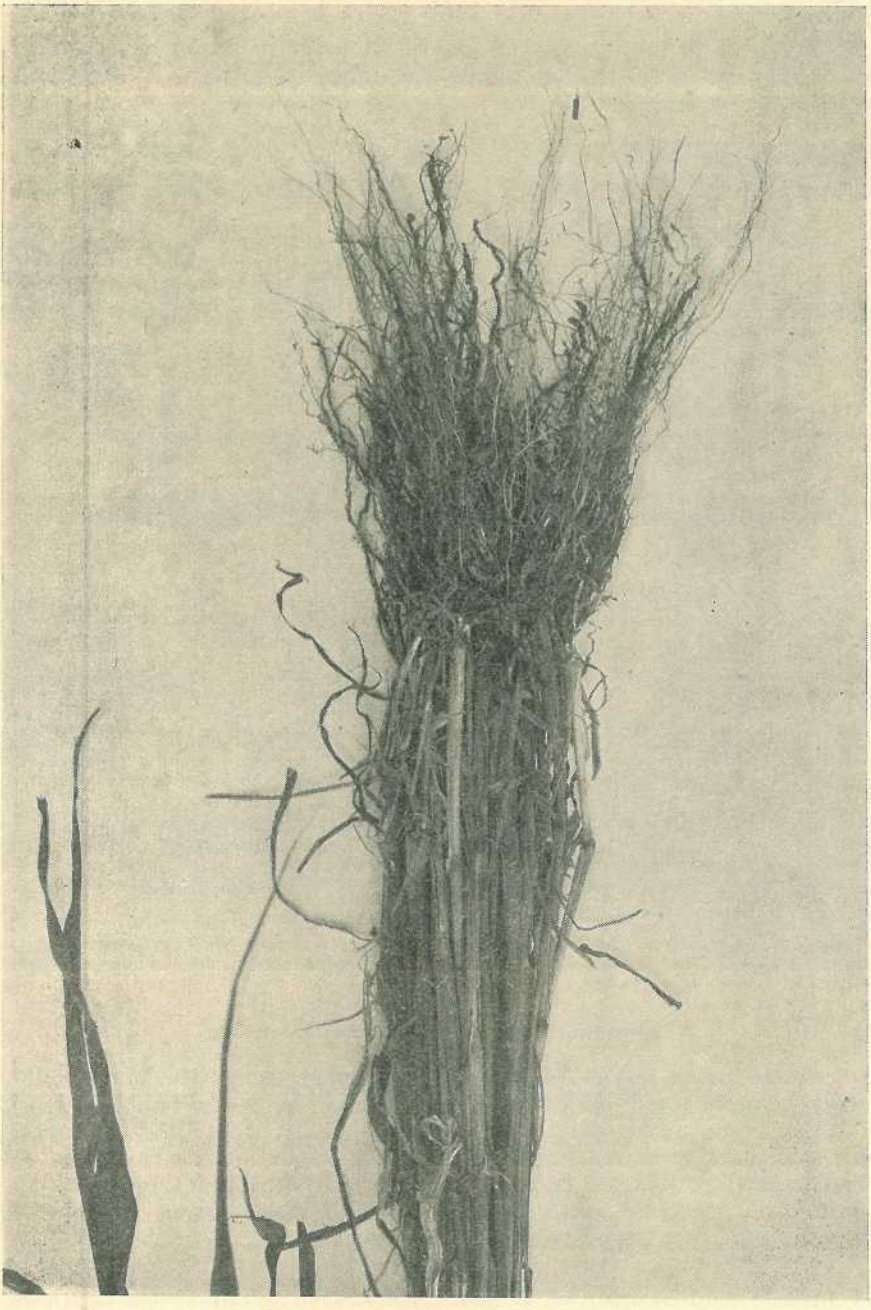

PLATE 259.
Sudan Grass showing the fibrous root system.

owing to the damage sustained by the seeds in harvesting, would not be prepared to certify as to Sudan grass samples being free of Johnson grass seeds.

The only definite means of identification exists in an examination of the root systems of the two plants, the difference being well illustrated by Plates 259 and 260.

PLATE 260.
Johnson Grass showing the persistent rootstock.

Sudan has a fibrous root system and consequently the plant could easily be eliminated by cultivation, whereas the roots (*rhizomes*) of Johnson grass, a true perennial, being of a fleshy nature and extending to a considerable extent under the earth, have the ability to throw up fresh stems; cultivation only assists to spread this plant by breaking up the underground root system, the small pieces being capable of growth even when separated from the parent plant.

It is well known that the poisonous properties (due to the presence of prussic acid—HCN) of Johnson grass are far in excess of those of Sudan.

It should also be noted that its persistent root system is able to produce herbage under very dry conditions, thereby providing a dangerous feed when animals are green grass hungry.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. C. T. White, F.L.S.

Burch Spear Grass.

A.D. (Bundaberg)—

1. Burch spear grass (*Heteropogon contortus*). This grass is one of the commonest in Queensland. It is much relished by stock in its younger stages, and even in its old stages we have seen it in dry periods used as a coarse chaff with some success. The spear-like seeds of grass are a decided disadvantage. Generally speaking, however, stock do not care for it when it is old.
2. Red Natal Grass (*Rhynchelytrum repens*). See reply to "Sap."

Rhodes Grass.

C.H.D. (Roma)—

Chloris virgata is commonly known as feather top, sometimes feather top Rhodes grass. The true Rhodes grass is, of course, *Chloris gayana*. *Chloris distichophylla*, the winter growing Rhodes grass, is now, we think, fairly widely spread in the State and is easily told by its wide leaves and many spikes on the head. Although Queensland-grown specimens have been examined by the Agricultural Chemist and shown to be strongly cyaniforic, we have had no reports of trouble from the grass. Stock frequently eat this prussic acid yielding species without ill effect. The condition of the animal and other factors may have an influence.

Dalby District Grasses Identified.

R.D. (Moola, via Kaimkillenbun)—

1. *Iseilema actinostachys.* Flinder's grass.
2. *Danthonia sp.* Wallaby grass.
3. *Chloris virgata.* Feather Top.
4. *Enneapogon avenaceus.* White Heads.
5. *Sporobolus pallidus.* Fairy grass.

We will always be pleased to report on grass and weed specimens at any time.

Specimens from the Central-west.

R.C.W. (Ilfracombe)—

1. *Hibiscus trionum.* Bladder ketmia. An annual species of hibiscus that is widely spread over the temperate and subtropical regions of the world. It is very common in Central-west Queensland during the summer months.
2. *Trichinium exaltatum.* A plant of the amaranth family, Amarantaceæ, common in Western Queensland, but for which we have not heard a local name. Most species of the Trichinium are generally regarded as quite good fodders.
3. *Psoralea sp.* Probably *Psoralea patents.* This and other species of *Psoralea* are sometimes called native lucerne. Other species are common in North Queensland and Northern Territory, and in some parts are looked upon as excellent fodder, particularly valuable for fattening.
4. *Andrachne decaisnei.* A plant of the family Euphorbiaceæ, very abundant in parts of the north-west and central-west, but for which we have not heard a common name. This plant possesses a prussic acid yielding glucoside, and if eaten in any quantity by hungry stock may cause considerable trouble. Ordinary paddock resting stock seem to eat many of these prussic-acid-yielding plants with impunity, although, of course, the danger is always present.
5. *Indigofera parviflora.* A native species of indigo that in recent years has spread very much in parts of the central-west and north-west. It is not known to possess any poisonous or harmful properties.

General Notes

Staff Changes and Appointments.

Messrs. R. E. Churchward, B.V.Sc., P. F. A. Hardman, B.V.Sc., M. R. Irving, B.V.Sc, J. C. J. Maunder, B.V.Sc., C. R. Mulhearn, B.V.Sc., Government Veterinary Surgeons, and F. H. S. Roberts, D.Sc., Entomologist and Parasitologist, Department of Agriculture and Stock, have been appointed also Inspectors under the Pig Industry Act.

Messrs. J. P. Reynolds, T. H. Francis, E. W. Berzinski, R. D. Rex, W. H. Mullavey, J. Noli, T. Otterspoor, G. S. Andrews, J. Frederiksen, J. D. Johnston, W. McE. Stewart, J. Groves, J. M. Pringle, W. H. Crawford, D. E. L. Crees, E. J. O'Brien, R. Johnston, P. Blain, G. Quaid, and L. E. Rossi, of the Mossman District, have been appointed honorary rangers under the Animals and Birds Acts.

Mr. E. A. Taylor, Sub-Foreman of the Mary Valley Working Plan Area, Eel Creek, via Gympie, an officer of the Forestry Department, has been appointed also an honorary ranger under the Animals and Birds Acts and the Native Plants Protection Act.

Mr. S. M. Powe, previously Clerk of Petty Sessions, Boonah, has been relieved of his appointment to be also Acting Inspector of Stock at that centre, and Mr. F. B. Bergin, Clerk of Petty Sessions, Boonah, has been appointed to be also Acting Inspector of Stock in place of Mr. Powe.

Constable C. F. Robson, Wallangarra, has been appointed also an Inspector under the Slaughtering Act.

Messrs. John Cunningham and Thomas Maree, junr., members of the Hambledon Mill Suppliers' Committee, via Cairns, have been appointed honorary rangers under the Animals and Birds Acts.

Northern Plywood and Veneer Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts giving notice of intention to extend the operations of the Plywood and Veneer Board for the period from 3rd May, 1936, to 2nd May, 1939. A petition on the question of whether or not the Board shall be continued may be lodged on or before the 1st June next.

Rail Rebates in Freight on Stud Boars and Sows.

Acceding to requests from the Queensland Branch of the Australian Stud Pig Breeders' Society, the Mackay District Pig and Bacon Association, and other interested breeders, the Minister for Agriculture and Stock (Mr. Frank W. Bulcock) recently conferred with the Minister for Transport (Mr. John Dash) with a view to ascertaining the position in regard to rail rebates on the transport per rail of stud boars, and also to ascertain the possibility of making a similar concession in rail freight on transport of stud sows for breeding purposes. Mr. Dash now advises there has been a 20 per cent. rebate allowed since 1933 on the transport of boars declared on the consignment note "for breeding purposes," and that he has now approved of a similar rail rebate on breeding sows similarly declared "for breeding purposes."

It is essential when stud boars or sows are being forwarded by rail for breeding purposes that the consignment note be endorsed accordingly by the railway official receiving the consignment, otherwise the department would have no means of determining whether the pigs were forwarded for breeding purpose or for slaughter, for it is sometimes necessary to transport individual pigs to bacon factories in crates.

These concessions should be an additional encouragement to breeders of stud pigs, and to those farmers who desire to introduce purebred boars or sows. The Railway Department should always be advised in ample time beforehand when stud pigs are to be consigned, so that suitable arrangements may be made for the quick transport of the animals to their destination.

Station-masters have been advised as to these concessions in rail freight.

Rural Topics

Care of Farm Tools.

Carelessness in regard to farm tools, both as regards their replacement after use and their protection from atmospheric exposure during indefinite periods when they are not required, is accountable for depreciation and loss to an extent more than the average farm manager is aware. Necessary tools demand attention just as does any other part of the farm-working equipment, and their oversight should be an essential part of thorough supervision. Indeed, they should be included in every periodic machinery overhaul or treatment in preparation for between-seasons storage. A recommended method for keeping both machinery and tools free from rust and in perfect condition for their work after long intervals of disuse, is to give them a coating of beeswax, dissolved in benzol. The benzol speedily evaporates, leaving the steel or iron covered with a thin coating of the protective wax. The advantage of this treatment over the application of paint is that plough mould-boards, shovels, and hoes remain polished and ready for instant work, whereas paint and grease coverings have the effect of making soil adhere. The beeswax coating is equally effective in hot or cold weather, but as benzol is highly volatile and inflammable, the mixture should be kept in a tightly-corked bottle and kept far away from any exposed light. Where small tools, such as spanners, bits, and pliers are to be given this protective treatment, an effective method is to dip them in boiled linseed oil and let it dry on them; or the tools may be warmed on a stove and then smeared with white beeswax, after which they should be heated again to permit the wax spreading thinly and evenly over the surface to penetrate all interstices in the metal. One treatment of the metal of machinery or tools by one or other of the methods described will keep the machinery and tools rust free and bright for as long as a year, if need be.—"The Australasian."

What Is Over-run?

What is over-run? This question was asked by a bystander as a result of a teasing conversation, when a milkman was heard "joshing" a dairy farmer about the commercial use of water. "If the milk in the jug is a little blue, the housewife always suspects me," said the milk vendor. "But what about you? In every 116 tons of butter you have 14 to 16 tons of added water which costs you nothing and fetches £100 a ton." He was referring, of course, to the over-run. This is a term which every supplier of cream to a butter factory should understand. It is peculiar to the dairying industry, for the dairy farmer is paid more for the butter than is actually in the cream he supplies. The reason for this is that, during the process of churning, the butter-maker, in addition to consolidating the butter-fat in the cream supplied by the farmer, adds moisture and salt to it, which correspondingly increases the weight of the resultant butter, as compared with the butter-fat in the cream when received at the factory. That increase is defined as the over-run. In this connection the individual supplier is largely at the mercy of the factory employees, upon whose honesty and exactitude he must perforce rely. The correctness of all scales at a butter factory is an important factor in the controlling of over-run. If the weights are entered as higher than the actual quantity received, they increase the estimated manufacture and decrease the difference betwen it, and that actually manufacturd is increased. The testing of the cream for its butter-fat content is a factor equally important as that of weighing. Both these factors, weights and tests, can operate independently or together. Then losses of cream may occur after weighing, as in the case of fat loss in buttermilk, which is influenced by the size of the grain and churning temperature. The type of machinery, the temperature of the cream, the capacity of the churn, and the condition of the equipment may all play a part in the determination of the over-run. No butter can be exported or sold (legally) which contains more than 16 per cent. of moisture. Higher over-run is evidence of either lax methods at the factory or that the factory has manufactured a butter which does not comply with the legal standards.—From "Things We Talk About," by "Himi" in the "New Zealand Farmer."

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable deaths.

OUR DAILY BREAD.

FOR several thousand years civilised mankind has derived most of the energy value of its food from cereal grains. Of these wheat has for the last few centuries obtained the pre-eminence, especially among people of British race. The wheat was torn into fragments by stone rollers forming wholemeal flour, from which was prepared wholemeal bread. These contained a very large proportion of starch, a considerable proportion of vegetable protein, and three valuable vitamins. It was an excellent foundation for a healthy dietary.

If a grain of wheat is cut through, it is found to consist mostly of a white substance, which contains all the starch and nearly all the protein. At one end is a small germ of wheat embryo, which contains all the vitamins with the exception of some two of them. Surrounding the whole is a thin skin, the bran, which contains the rest of the vitamins.

About the year 1870, that is less than seventy years ago, a revolutionary change occurred through the introduction of steel rollers into the flour mills. By this process the wheat embryo was crushed, not pulverised. It and the bran were sifted out, leaving a fine white flour. This was a great commercial advantage. Wholemeal will keep for only a short time. White flour will keep for much longer, and the problem of world transportation was solved. The new flour satisfied the eye with its snow-white colour, and the fingers with its softness. The bread made from it became popular to the displacement of wholemeal bread, and everyone was pleased. It was not known that all the vitamins were absent in this white bread. They had been sifted out with the wheat-germs and the bran.

The vitamin that is most likely to be deficient in our diet as a result of this change is Vitamin B (or B1). It is true that this vitamin is present in many other foods. Some contain none at all, for instance, white flour and white bread, macaroni, rice, sago, tapioca, arrowroot, sugar, golden syrup, &c. Others contain sufficient to balance the food itself, but not to compensate the shortage in our bread—for instance, milk and potatoes. Some contain a small surplus only—for instance, oatmeal, oranges, and tomatoes (but not most fruits), cabbage, and some other vegetables (but not most vegetables). Among those foods that contain a large surplus are whole wheatmeal, peas, beans, nuts, eggs, liver, and yeast extract (marmite or vegemite). But these last are only occasional foods, not a basic food eaten daily by everybody, as was wholemeal bread before 1870. Probably most of us live somewhere near the edge of Vitamin B insufficiency, but being fortunately not within that edge (more by good luck than good management) suffer no evil consequences. Those most likely to suffer are expectant and nursing mothers, who need a double or treble allowance of this vitamin, and young children, who are often fed on excessive quantities of starchy foods and sugar.

The most obvious consequence of Vitamin B insufficiency is constipation, which has become a national disease. Huge quantities of pills, salts, vegetable and mineral oils are consumed yearly in the effort to correct this. They may do so in a clumsy and often inefficient manner, but aperients should be reserved for occasional use only and for emergencies. They are valueless in preventing the other harmful effects of the vitamin insufficiency—loss of appetite, failure of digestion, poor growth, general weakness, including heart weakness, &c.

The problem how best to prevent these effects has been a difficult one, but promises to be easier in the future. There are still a very few Queenslanders who grind their own wheat. We cannot expect many to do so. As just stated, a liberal and varied diet is a safeguard, but this from economic and other reasons is not always possible. The simplest and best solution is to restore to our bread what has been taken out of it. Some of our bakers propose to sell wholemeal bread, and so long as this is guaranteed to be made wholly from wholemeal ground with stone rollers, it can be recommended. We can recommend also a new bread made from white flour, to which has been added 10 per cent. of separately ground wheat embryo. This has been named cerevite bread. Another excellent safeguard is porridge made of whole wheatmeal, or of cerevite, which is composed of mixed cereals with the addition of 10 per cent. of wheat embryo. These foods should suffice for all ordinary purposes. In special cases or where these are not obtainable, wheat germ itself has been obtainable under the trade names of bemax and Vita B. It is now available at a much reduced price from all chemists under the name "Cerevitamin."

IN THE FARM KITCHEN.

PUDDINGS FOR COLD WEATHER.

PAY particular attention to the cooking of anything that contains suet. Now let me give you some suggestions and recipes:—When making a crust for a savoury pudding or a fruit dumpling, use half quantity of flour and half quantity of stale breadcrumbs.

If you like your savoury dishes well seasoned, add a little minced parsley and crushed herbs to ingredients for suet crust.

Always be sure to have your gravy or stock at a full rolling boil when you wish to cook suet dumplings.

Never let the water in saucepan go off the boil when steaming a sweet or savoury pudding.

Steak and Kidney Pudding.

Take 1½ lb. stewing steak, 1 lb. bones, ¾ lb. flour, pinch salt, ½ lb. ox kidney, salt and pepper, 6 oz. suet, water or stock.

Wash bones, place in a saucepan and cover with cold water. Bring to the boil and skim, then season to taste and simmer for three hours. Cut steak and kidney into small pieces, roll in flour seasoned with pepper and salt to taste. Sift flour and salt into a basin. Mix in the shredded suet, and add enough cold water to make into a stiff paste. Cut off one-third of the paste for a lid.

Roll out remainder of paste, and line a greased pudding basin with it. Put in the steak and kidney. Almost fill basin with stock from the bones, or if you do not have bones, use water. Roll out paste for lid and fix over basin, pressing the edges well together. Cover with greased paper and then with a floured pudding cloth. Tie down with string. Place basin in a saucepan of boiling water to cover, put on the lid and boil for 3½-4 hours. Enough for six to eight persons.

Sausage Pudding.

Take 1½ lb. sausage-meat, ½ lb. flour, 4 oz. suet, ½ teaspoon baking powder, ¼ pint gravy or rich stock, ¼ teaspoon salt, cold water.

Finely shred the suet. Add to flour sifted with salt and baking powder. Add enough cold water to make into a fairly stiff paste. Roll the pastry out on a floured board and line a deep, well-greased basin with part of it.

Mix the sausage-meat with gravy or stock.

Then turn the mixture into basin. Cover with remainder of suet crust, then with greased paper. Tie down. Place in pan with boiling water coming three-quarter way up the sides of the basin and steam for 2¾-3 hours.

Enough for six persons.

Meat Roly Poly.

Take 4 oz. shredded suet, ½ lb. liver or cold meat, 1 onion, 1 gill water, ½ lb. flour, ½ teaspoon salt, 1 gill gravy or stock.

Chop the liver or meat and onion. Mix with flour, shredded suet and salt. Moisten with the water to make a fairly stiff paste, roll lightly and shape into a roll. Lay roll on a scalded and floured pudding cloth. Roll up in cloth and secure ends tightly. Place in a saucepan of boiling water, and boil for 2 hours. When cooked, remove cloth and serve with the gravy or rich stock heated and poured over. Enough for two or three persons.

Marmalade or Jam Pudding.

Take 5 oz. jam or marmalade, 4 oz. suet, 4 oz. sugar, ½ teaspoon baking soda, 1 egg, 4 oz. breadcrumbs, 4 oz. flour, milk.

Sift flour with a pinch of salt into a basin. Mix with finely shredded suet and breadcrumbs. Add beaten egg, marmalade, and soda dissolved in a little milk. Dust a well-greased pudding basin with brown sugar. Pour in the mixture. Cover with greased paper and steam for 2 or 3 hours. Serve with heated marmalade or jam, diluted with water to taste. Enough for two or three persons.

Prune Suet Pudding.

Take ½ lb. prunes, 2 oz. mixed candied peel, ¼ teaspoon baking soda, ½ lb. suet, ½ teaspoon mixed spice, 1 lb. flour, 1 egg, ½ lb. currants, ¼ lb. sugar, milk to moisten.

Wash prunes in warm water and stone them, then roughly chop. Clean currants. Mix prunes, currants, flour sifted with spice and soda, and finely shredded suet together. Add sugar, chopped peel and spice. Stir in beaten egg, and enough milk to make mixture of a sticky consistency. Beat for a moment or two. Turn into a well-greased pudding basin, cover with greased paper, and steam for 2½-3 hours. Serve turned out on a hot dish, sprinkled with caster sugar. Enough for ten to twelve persons.

Apple Pudding.

Take 1½ lb. apples, ½ lb. flour, 1 teaspoon baking powder, brown sugar, 3½ oz. suet, pinch salt, milk to moisten.

Peel and slice apples. Sift flour with baking powder and a pinch of salt into a basin. Add finely shredded suet. Mix to a stiff paste with milk, roll out and line a greased pudding basin, leaving enough paste to make into a crust for top. Place a layer of sliced apples in the bottom of basin, sprinkle with sugar. Repeat layers until apples are all used. Cover with paste lid, then with greased paper, and steam for 2½-3 hours.

NOTES ON ROSE CULTURE.

The following notes on rose culture are taken from the Pacific Nurseries catalogue (Messrs. C. W. and A. C. Heers), Manly, Brisbane:—

Time for Planting.—From May until the end of September. For the coastal, excepting perhaps the Central and North, we specially recommend the later period, and, in support, advance the following reasons:—

Every horticulturist must admit that all roses, particularly in the coastal area of Queensland, invariably exhibit luxurious and succulent growth and wealth of bloom during the months of March, April, May, and early June. This being so, we contend that as the plants are full of flowing sap they are not in a fit condition for transplanting during that period. There are, however, odd seasons when plants ripen earlier. In such circumstances, we would not object to extra early planting, but consider May and June do not give the plants time to establish themselves sufficiently to withstand the approaching winter.

Roses planted during the earlier months readily respond to the warm periods which assuredly occur in the middle of our winter, only to be as surely struck by our colder and more frosty days during the latter part of the winter. This shock not only checks the growth, but actually kills the tender white jelly-like roots then in the forming. There can be only one result—a plant with stunted growth upon which the foundations of your future tree has to be built. Remember, if these plants are left undisturbed in the nursery they remain dormant.

On the other hand a thoroughly rested and ripened plant, transplanted during late July, August, or September, according to the trend of the season, is ready to break away into full and vigorous growth as the warmth of Spring appears, never to look back.

We readily admit that the rose, being a hardy plant, may even do well when planted early, but after much experience we prefer to pin our faith to late planting, in most parts of Queensland where our winter is so variable. Holding these views, we hope clients will follow our advice and plant late in the season, say, from the middle of July to the middle of September. However, from Rockhampton north, earlier planting may be preferable.

Roses planted during September and even October will do quite well; if planted this late they should, however, be provided with artificial shade and kept well watered until they are established.

It is gratifying to us to know that quite a number of clients, after acting upon our advice, write to say how pleased they are with their experience of late planting; so we reiterate—do not plant or prune roses too early in Queensland, especially along eastern slopes south of Bundaberg.

We must warn people that early planting is the cause of many failures, therefore, do not complain if you ignore our advice.

Selecting Varieties.—When making selections consult our brief descriptions and ascertain the variety's suitableness regarding its growth, style, colour, fragrance, and freedom of bloom. If you are not acquainted with the various varieties listed it will pay you to leave selection to us, mentioning any varieties you may already have. You will find a special list on the inside of the front cover, giving our choice in each colour.

Planting.—Roses should never be planted when the ground is sodden, as the soil glues together and excludes the air so necessary for the future welfare of the plant. Rather delay planting, and in the meantime bury the whole plant lengthwise, cover completely with soil and await more favourable conditions. It is surprising how long plants may be kept by this method.

Although roses do well under almost any condition, it will always repay you to trench and drain the ground. However, should the ground be flat and unsuitable for drainage, it is better to dig it a foot deep and raise the bed. Such beds require hardwood or concrete borders, otherwise the outside plants dry out too easily. Work in a liberal supply of well-rotted cow or stable manure. This work should be done at least four weeks prior to planting. Plant so that the union will be just under the surface of the ground. In the case of light sandy soil it is an advantage to have the union as much as 2 inches below the surface. Never, on any account, place fresh manure or any form of fertilizer near the roots at the time of planting.

The roots should be evenly spread and so arranged as to give them a downward tendency; cover with about 3 inches of fine soil and press down firmly; fill in and give a liberal supply of clean water. Keep the earth away from the graft until the plant strikes; in the meantime, mulch with straw in order to protect union and keep the soil from caking. Cover the outside edges of straw with soil to keep it in position.

The mulch also creates an ideal condition for further waterings. Should the weather continue dry, it will be necessary to water at intervals, according to the conditions. Do not use fresh manure or artificial fertilizer near the roots when planting. Should the sun's rays become hot after planting, it is advisable to provide the plant with artificial shade.

Suckers.—Always keep a sharp lookout for brier suckers, which may from time to time sprout from below the graft. These are readily detected by their foliage, and if not removed they will in time kill the rose tree. *However, on no account must any new rose growth from the base be interfered with.*

Manuring.—Roses should be heavily manured at least once a year, well-rotted animal manure being the best. It should be spread over the bed and lightly forked in. Bone dust and other suitable fertilizers are also beneficial. Established rose trees are greedy feeders, and periodical light dressings of fertilizer, applied during damp weather, will give good results. Heavy soil needs occasional dressings of lime, which, however, should not be used within a month or so of fertilizers.

Pruning.—There is no phase of rose culture more difficult to impart than that of pruning. After accepting the broad principles generally laid down, make a close study of the habits and peculiarities of the various types of roses. Apply commonsense methods and observe and profit by the results obtained. We are opposed to early pruning in this State for similar reasons to those advanced against early planting. However, varieties with H.P. strain may, if the canes are sufficiently ripened, be shortened during March or April to from 3 to 5 feet from the ground—the weaker the shorter. This will ensure a wealth of bloom in the late autumn. For the annual overhaul the end of July and August is the best time. Hard pruning, as practised in cold countries, must not be generally applied here. The reason is not far to seek, as the periods of inactivity are short and uncertain. Make the prevailing conditions your guide as to how and when to prune. Assist the pruning problem by observing the following golden rules during the entire season:—

(1) Cut away dead, spindle wood; (2) always cut blooms and stems that have bloomed well back to a strong eye; (3) never allow seed pods to form on the bush. By these means you will encourage correct growth and freedom of bloom. There are odd varieties which resent the knife, Penelope for instance.

It is most important that plants be kept free from scale and other diseases, otherwise valuable portions have to be prematurely removed to the detriment of the plant. Exhibitors should prune harder than those growing for general purposes. Tea roses require lighter treatment than H.T.'s and H.P.'s.

To prune, cut away all dead, diseased, and spindling wood; thin out anything that is liable to crowd; cut back shoots to a strong eye, pointing outward in the case of uprights and inward on those of spreading habits; preserve any new strong shoots coming from the base (often misnamed water shoots) that may serve to replace any worn-out stems that should be renewed every three years or so.

As soon as the new growth appears, carefully rub off any shoot that is likely to overcrowd or grow in a wrong direction.

Climbers should be allowed their fling during the time they are establishing themselves. Train the strongest canes horizontally, about 24 inches apart, shorten the ends, and cut away all other wood. Provide for the renewal of these trailers every few years.

Aphis.—Nicotine sprays, such as Black Leaf Forty, are most effective. They may be kept in check by applying the hose freely.

Scale.—Spray with either red oil, kerosene emulsion, or any lime-sulphur mixture. Many roses are lost annually through scale.

Grubs, &c.—For all leaf, plant, and flower eating insects, spray with arsenate of lead as directed.

Mildew.—This is a stubborn fungus disease that has for many years past baffled our scientists. The rose, like all other life, no doubt requires a properly balanced food, and as analyses show that our soils are often deficient in potash and lime, it is not altogether surprising to find that, where good dressings of wood ashes have been applied, appreciable improvement in reducing the mildew scourge is apparent. Experiments are being conducted all over the world in search for a cure for mildew, and reports to hand show that potash used in its various forms gives results which are at least reassuring. For our part we can say that we have found the use of wood ashes, also spent carbide, beneficial. If these are not available, try giving each established tree say 4 to 6 oz. of sulphate of potash, in addition to lime, and observe the result.

Regular sprayings with liver of sulphur (1 oz. to 2 gallons of water), or 1 oz. bicarbonate of soda to 1 gallon of water, or Bordeaux will ward off attacks. Remedies: Flowers of sulphur, 9 parts; arsenate of lead, 1 part; well mixed; applied with a bellows when the dew is on the foliage. Sprays: Sulphuric acid, 1 part to 800 parts of rain water, 1 oz. bicarbonate of soda to 1 gallon of rain water is a helpful spray. A drastic remedy is 2 tablespoonfuls of lysol to 1 gallon of water. Spraying should be done before noon. Always treat the underneath as well as the top of the foliage.

Failures.—Failures are generally attributable to one or more of the following causes:—

Having used fresh manures or fertilizer at time of planting. Allowing roots to be exposed after unwrapping. Lack of drainage or planting in soggy ground through excessive wet weather. Planting too near the edge of raised beds, too near shrubs, trees, and/or hedges; also in shady positions. Allowing plants to dry out after westerlies. Giving too much water during first fourteen days in cold weather. Heavy frosts just after planting or even when the plant is established. Planting too deep, planting too shallow, or planting too loose. Acidity in damp or poorly prepared soils. Chemical reactions from fertilizers previously applied to the soil. Plants being knocked by children or the thoughtless gardener. Dogs and cats are often the cause of plants dying or being damaged. The use of strong soap suds, &c. Planting too early or too late. Planting in same spot where a rose has been growing unless soil has been replaced.

QUEENSLAND SHOW DATES.

June.

Childers, 1 and 2.
Bundaberg, 4 to 6.
Lowood, 5 and 6.
Boonah, 10 and 11.
Gladstone, 10 and 11.
Esk, 12 and 13.
Rockhampton, 23 to 27.
Laidley, 24 and 25.
Marburg, 27 to 29.
Mackay, 30 June and 1 and 2 July.

July.

Proserpine, 3 and 4.
Kilcoy, 2 and 3.
Bowen, 8 and 9.
Townsville, 14 to 16.
Cleveland, 10 and 11.
Ayr, 10 and 11.
Rosewood, 10 and 11.
Nambour, 16 to 18.
Charters Towers, 21 and 23.
Cairns, 21 to 23.
Maleny, 23 and 24.
Atherton, 28 and 29.
Gatton, 29 and 30.
Caboolture 31 July and 1 August.

August.

Barcaldine, 4 and 5.
Pine Rivers, 7 and 8.
Royal National, 17 to 22.
Home Hill, 28 and 29.

September.

Tully, 11 and 12.
Innisfail, 18 and 19.
Malanda, 30 September and 1 October.
Southport, 26.
Imbil, 4 and 5.
Pomona, 11 and 12.
Beenleigh, 18 and 19.

Orchard Notes

JULY.

THE COASTAL DISTRICTS.

THE marketing of citrus fruits will continue to occupy the attention of growers. The same care in the handling, grading, and packing of the fruit that has been so strongly insisted upon in these monthly notes must be continued if satisfactory returns are to be expected. Despite the advice that has been given over and over again, some growers still fail to grasp the importance of placing their fruit on the market in the best possible condition, and persist in marketing it ungraded; good, blemished, and inferior fruit being met with in the same case. This, to say the least, is very bad business, and as some growers will not take the necessary trouble to grade and pack properly, there is only one thing to do, and that is to insist on the observance of standards of quality and see that the fruit offered for sale complies with the standards perscribed, and that cases are marked accordingly.

Where the crop has been gathered, the trees may be given such winter pruning as may be necessary, such as the removal of broken or diseased limbs or branches, and the pruning of any superfluous wood from the centre of the tree. Where gumming of any kind is seen it should be at once attended to. If at the collar of the tree and attacking the main roots, the earth should be removed from around the trunk and main roots—all diseased wood, bark, and roots should be cut away, and the whole of the exposed parts painted with Bordeaux paste.

When treated, do not fill in the soil around the main roots, but allow them to be exposed to the air for some time, as this tends to check any further gumming. When the gum is on the trunk or main limbs of the tree cut away all diseased bark and wood till a healthy growth is met with, and cover the wounds with Bordeaux paste.

Towards the end of the month all young trees should be carefully examined for the presence of elephant beetles, which, in addition to eating the leaves and young bark, lay their eggs in the fork of the tree. When the young hatch out they eat their way through to the wood and then work between the wood and the bark, eventually ringbarking one or more of the main limbs, or even the trunk. A dressing of strong lime sulphur to the trunk and fork of the tree, if applied before the beetles lay their eggs, will act as a preventive. In the warmer localities a careful watch should also be kept for the first appearance of any sucking bugs, and to destroy any that may be found. If this is done systematically by all growers the damage done by this pest will be very much reduced.

Citrus trees may be planted throughout the month. Take care to see that the work is done in accordance with the instructions given in the June notes. All worn-out trees should be taken out, provided the root system is too far gone to be renovated; but when the root system is still good the top of the tree should be removed till sound, healthy wood is met with, and the portion left should be painted with a strong solution of lime sulphur. If this is done the tree will make a clean, healthy growth in spring.

The inclusion of a wide range of varieties in citrus orchards—and which has been the general practice—is to be deprecated. Even in new plantations there is a tendency to follow the same unprofitable lines. Far too much consideration is given to the vendor's description for the purchaser's appreciation of a particular variety or varieties. Individual tastes must be subordinated to market requirements, and the selection of varieties to the best available kind of early, medium, and late fruits. Amongst oranges Joppa should be placed first, Sabina for early fruit, and Valencia or Loon Giru Gong for late markets.

In mandarins local conditions influence several varieties, and since the introduction of the fungus known as "scab" the inclusion, particularly on volcanic soil, of the Glen Retreat and Emperor types is risky. In alluvial lands, Emperor and Sovereign (an improved Glen Retreat) are the most profitable, though Scarlet in many places is worth including, with King of Siam as a late fruit.

Land intended for bananas and pineapples may be got ready, and existing plantations should be kept in a well-cultivated condition so as to retain moisture in the soil.

Bananas intended for Southern markets may be allowed to become fully developed, but not coloured, as they carry well during the colder months of the year, unless they meet with a very cold spell when passing through the New England district of New South Wales.

The winter crop of smoothleaf pines will commence to ripen towards the end of the month, and when free from blackheart (the result of a cold winter) or from fruitlet core rot, they are good for canning, as they are of firm texture and stand handling. Where there is any danger of frost or even of cold winds, it pays to cover pines and also the bunches of bananas. Bush hay is used for the former and sacking for the latter.

Strawberries should be plentyful during the month, provided the weather is suitable to their development, but if there is an insufficient rainfall, then irrigation is required to produce a crop. Strawberries, like all other fruits, pay well for careful handling, grading, and packing, well-packed boxes always realising a much higher price than indifferently packed ones on the local market.

When custard apples fail to ripen when gathered, try the effect of placing them in the banana-ripening rooms, and they will soon soften instead of turning black.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

JULY is a busy month for the growers of deciduous fruits, as the important work of winter pruning should, if possible, be completed before the end of the month, so as to give plenty of time for spraying and getting the orchard into proper trim before the spring growth starts.

In pruning, follow the advice given in the May number; and if you are not thoroughly conversant with the work, get the advice of one of the Departmental officers stationed in the district.

Pruning is one of the most important orchard operations, as the following and succeeding seasons' crops depend very largely on the manner in which it is carried out. It regulates the growth as well as the number and size of the fruit, as if too much bearing wood is left there is a chance of the tree setting many more fruits than it can properly mature, with a result that unless it is rigorously thinned out it is under-sized and unsaleable. On the other hand, it is not advisable to unduly reduce the quantity of bearing wood, or a small crop of overgrown fruit may be the result.

Apples, pears, and European varieties of plums produce their fruits on spurs that are formed on wood of two years' growth or more; apricots and Japanese plums on new growth and on spurs; but peaches and nectarines always on wood of the previous season's growth. Once peachwood has fruited it will not produce any more from the same season's wood, though it may develop spurs having a new growth or new laterals which will produce fruit.

The pruning of the peaches and nectarines, therefore, necessitates the leaving of sufficient new wood on the tree each season to carry a full crop, as well as the leaving of buds from which to grow new wood for the succeeding year's crop. In other words, one not only prunes for the immediately succeeding crop, but also for that of the following season.

All prunings should be gathered and burnt, as any disease that may be on the wood is thoroughly destroyed. When pruned, the trees are ready for their winter spraying.

All kinds of deciduous trees may be planted during the month provided the ground is in a proper state to plant them. If not, it is better to delay planting until August, and carry out the necessary work in the interval. The preparation of new land for planting may be continued, although it is somewhat late in the season, as new land is always the better for being given a chance to mellow and sweeten before being planted. Do not prune vines yet on the Granite Belt; they can, however, be pruned on the Downs and in the western districts.

Trees of all kinds, including citrus, can also be planted in suitable situations on the Downs and western districts, and the pruning of deciduous trees should be concluded there. If the winter has been very dry, and the soil is badly in need of moisture, all orchards in the western districts, after being pruned and ploughed, should receive a thorough irrigation (where water is available) about the end of the month, so as to provide moisture for the use of the trees when they start growth. Irrigation should be followed by a thorough cultivation of the land to conserve the water so applied. As frequently mentioned in these notes, irrigation and cultivation must go hand in hand if the best results are to be obtained, especially in our hot and dry districts.

Farm Notes

JULY.

FIELD.—Practically the whole of the work on the land for this month will be confined to the cultivation of winter crops, which should be now making good growth, and to the preparation of land for the large variety of crops which can be sown next month. Early-maturing varieties of wheat may be sown this month. The harvesting of late-sown maize will be nearing completion, and all old stalks should be ploughed in and allowed to rot. Clean up all headlands of weeds and rubbish, and for this purpose nothing equals a good fire. Mangels, swedes, and other root crops should be now well away, and should be ready for thinning out. Frosts, which can be expected almost for a certainty this month, will do much towards ridding the land of insect pests and checking weed growth. Cotton-picking should be now practically finished and the land under preparation for the next crop. The young lucerne should be becoming well established; the first cutting should be made before the plants flower—in fact, as soon as they are strong enough to stand the mowing machine—and the cutting of subsequent crops should be as frequent as the growth and development of the lucerne plants permit. Ordinary cuttings should be regulated to fit in with the early-flowering period—i.e., when about one-third of the plants in the crop are in flower.

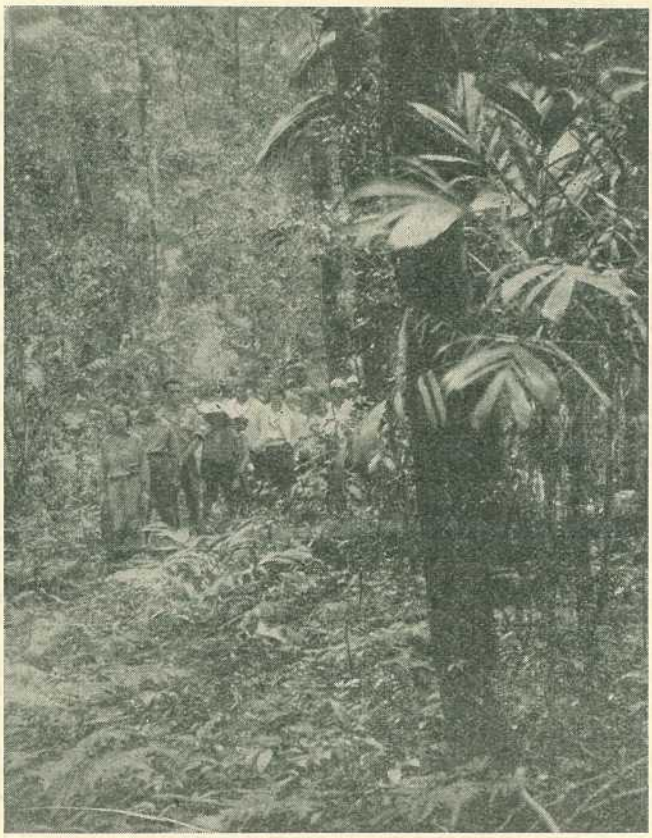

PLATE 261.
Rain forest, Lower Coomera, below the big falls.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1935 AND 1936, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.		Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Apr.	No. of Years' Records.	Apr., 1936.	Apr., 1935.		Apr.	No. of Years' Records.	Apr., 1936.	Apr., 1935.
North Coast.	In.		In.	In.	*Central Highlands.*	In.		In.	In.
Atherton	4·31	35	4·55	3·23	Clermont	1·61	65	..	..
Cairns	11·40	54	9·15	3·41	Glndie	1·22	36	..	..
Cardwell	8·83	64	11·06	4·37	Springsure	1·57	67	..	..
Cooktown	8·72	60	18·66	2·45					
Herberton	3·86	50	2·67	2·00					
Ingham	7·65	44	7·02	3·99					
Innisfail	20·10	55	19·10	9·47					
Mossman Mill ..	8·57	22	5·54	4·68	*Darling Downs.*				
Townsville	3·40	65	2·16	0·47					
					Dalby	1·42	66	0·13	1·16
Central Coast.					Emu Vale	1·44	40	0·42	0·76
					Hermitage	1·50	29	..	0·68
Ayr	2·49	49	2·52	1·05	Jimbour	1·42	48	0·05	1·32
Bowen	2·73	65	0·26	1·73	Miles	1·49	51	0·26	0·22
Charters Towers ..	1·51	54	1·70	..	Stanthorpe	1·79	63	0·64	1·06
Mackay	6·27	65	0·65	3·17	Toowoomba ..	2·68	64	0·68	3·86
Proserpine	5·91	33	2·04	7·76	Warwick	1·68	71	0·47	1·77
St. Lawrence ..	2·80	65	..	0·43					
South Coast.									
Biggenden	2·23	37	0·84	1·31	*Maranoa.*				
Bundaberg	3·36	53	0·93	7·04					
Brisbane	3·81	85	0·21	3·62	Roma	1·33	62	0·02	0·01
Caboolture	4·65	49	0·58	4·23					
Childers	2·92	41	1·20	2·77					
Crohamhurst	6·95	42	2·64	4·82					
Esk	3·10	49	0·31	2·22					
Gayndah	1·48	65	0·25	0·74					
Gympie	3·53	66	1·14	4·30	*State Farms, &c.*				
Kilkivan	2·32	57	0·18	2·03					
Maryborough ..	3·92	65	1·42	6·35	Bungeworgoral ..	1·25	21	..	0·09
Nambour	6·41	40	2·66	6·12	Gatton College ..	1·97	36	0·34	1·64
Nanango	2·01	54	0·32	1·61	Kairi	4·31	21	..	1·40
Rockhampton ..	2·58	65	0·20	0·75	Mackay Sugar Experiment Station	4·88	38	0·21	2·80
Woodford	4·79	49	0·64	3·99					

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1936.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Means Atmospheric Pressure at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·85	83	69	86	9	61	18	1,866	17
Herberton	..	73	61	80	19	51	19, 20	267	13
Rockhampton	30·04	83	62	89	18	52	22, 23	20	3
Brisbane	30·10	78	59	84	26	50	20	21	6
Darling Downs.									
Dalby	30·08	79	51	86	4	37	20	13	2
Stanthorpe	..	71	45	82	4	27	20	64	4
Toowoomba	..	74	51	80	17	37	22	68	4
Mid-Interior.									
Georgetown	29·90	88	67	92	25	59	17, 20	156	4
Longreach	30·03	85	56	91	18	45	21	48	2
Mitchell	30·08	80	45	85	1, 18, 7	34	20	2	1
Western									
Burketown	29·90	89	69	94	26	62	16	45	2
Boulia	30·02	85	60	94	1	50	21	..	..
Thargomindah	30·09	80	55	94	1, 3	43	20	..	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	June 1936.		July. 1936.		June, 1936.	July. 1936.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	6·37	5·2	6·45	5·7	2·7	2·1
2	6·37	5·2	6·45	5·7	2·45	2·49
3	6·38	5·2	6·45	5·7	3·23	3·43
4	6·38	5·2	6·45	5·8	4·8	4·40
5	6·39	5·2	6·45	5·8	4·58	5·40
6	6·39	5·2	6·45	5·8	5·52	6·43
7	6·39	5·2	6·45	5·9	6·49	7·45
8	6·40	5·2	6·45	5·9	7·51	8·47
9	6·40	5·3	6·44	5·9	8·51	9·50
10	6·40	5·3	6·44	5·10	9·54	10·53
11	6·41	5·3	6·44	5·10	10·55	11·57
12	6·41	5·3	6·44	5·11	11·57	a.m.
13	6·41	5·3	6·43	5·11	..	1·3
					a.m.	..
14	6·42	5·3	6·43	5·12	12·57	2·8
15	6·42	5·3	6·43	5·12	2·4	3·12
16	6·42	5·3	6·43	5·13	3·12	4·13
17	6·43	5·4	6·42	5·13	4·10	5·11
18	6·43	5·4	6·42	5·14	5·27	6·6
19	6·43	5·4	6·42	5·14	6·25	6·48
20	6·43	5·4	6·41	5·15	7·22	7·31
21	6·44	5·4	6·41	5·15	8·11	8·1
22	6·44	5·4	6·41	5·16	8·54	8·34
23	6·44	5·4	6·40	5·16	9·31	9·6
24	6·44	5·4	6·40	5·17	10·5	9·36
25	6·44	5·5	6·39	5·17	10·35	10·7
26	6·45	5·5	6·38	5·18	11·6	10.40
27	6·45	5·5	6·38	5·18	11·36	11.17
					p.m.	
28	6·45	5·5	6·37	5·19	12·7	11·55
						p.m.
29	6·45	5·5	6·36	5·19	12·42	12·41
30	6·45	5·5	6·36	5·20	1·19	1·32
31			6·35	5·21		2·27

Phases of the Moon, Occultations, &c.

5 June,	○	Full Moon	3 22	p.m.
12 ,,	☽	Last Quarter	10 5	p.m.
7 ,,	●	New Moon	3 14	p.m.
19 ,,	☾	First Quarter	5 22	a m.

Perigee, 16th June, at 7 a.m.
Apogee, 28th June, at 6.36 a.m.

On the 19th at 3 o'clock in the afternoon the Sun will be undergoing an eclipse which will be total in Asia and the most southern part of Europe. In Hongkong it will be almost total, but only about half its face will be covered by the Moon in the British Isles, where, however, a very fine sight will be afforded if the sky is clear. The eclipse will be in progress about 2 hours before sunset at Brisbane, where it will be entirely invisible. Throughout India the eclipse will end about 3 o'clock. The nearest place to Australia at which a glimpse of it will be seen is in the Philippine Islands.

On the 20th at 2 p.m. Venus will be within half a degree (only the diameter of the Moon) from Mars. Venus in its more rapid motion will overtake Mars and pass to the eastward of it.

At midday on the 22nd the Sun will reach its furthest declination northward, and the phenomenon of the summer solstice will take place in the northern hemisphere. After this the Sun will begin to return southwards.

On the 25th Mercury will reach its greatest declination, 22 degrees westward of the Sun, and set 1 hour 24 minutes before it, and rise 1 hour 44 minutes before the Sun.

On the 29th Venus will be in superior conjunction with the Sun and therefore unobservable, being almost in a straight line from the Earth beyond the Sun.

Mercury sets at 5.5 p.m., 3 minutes after the Sun, on the 1st; on the 15th it rises at 5.14 a.m., 1 hour 28 minutes before the Sun, and sets at 4.1, 1 hour 2 minutes before it.

Venus rises at 6 a.m., 37 minutes before the Sun, on the 1st, and at 6.24 a.m., 18 minutes before the Sun, on the 15th.

Mars rises at 6.50 a.m., 23 minutes after the Sun, on the 1st, and at 6.8 a.m., 34 minutes before the Sun, on the 15th.

Jupiter rises at 5.40 p.m. and sets at 7.29 a.m. on the 1st; on the 15th it rises at 4.38 p.m. and sets at 6.25 a.m.

Saturn rises at 12.34 a.m. and sets at 12.59 p.m. on the 1st; on the 15th it rises at 11.52 a.m. and sets at 12.7 p.m.

The Southern Cross will be at its highest position XII. about 8 p.m. on the 1st and 6 p.m. on the 30th, when it will be 27½ degrees above the horizon at Brisbane, but only 19 degrees at Townsville.

5 July -	○	Full Moon	3 22	p.m.
12 ,,	☽	Last Quarter	10 5	p.m.
19 ,,	●	New Moon	3 14	p.m.
27 ,,	☾	First Quarter	5 22	a.m.

Perigee, 16th July, at 7 a.m.
Apogee, 28th July, at 6·36 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.