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FARM FORESTRY.

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ADEQUATE shelter, shade, and timber plantations are extremely valuable on a farm. Shelter is necessary on a farm for the protection of stock, pastures, and crops. Perhaps the most important point in this connection is the protection of the surface of the ground from the effects of harsh, drying winds. This is particularly noticeable on western and southern slopes in early spring. Grass pastures are to a large extent dependent on the moisture held in the surface layers of the soil, and well-sheltered fields do not lose as much moisture by evaporation as ones exposed to the full force of the wind. Shelter is also very necessary for live-stock during cold and wet weather. Less food is required by stock to maintain their body temperature when sheltered than when exposed to cold winds. Shelter is also required for ewes lambing where the spring weather is apt to be cold.

Shade for stock is very desirable during the hot summer weather. Dairy cows especially benefit from shade, and milk better where shade is provided. Sheep and lambs revel in shade, and lambs being raised for export come to maturity much quicker. Shade is also essential for successful pig-raising, a phase of pig-farming that many farmers do not appear to have realized when laying out their yards.

Good fencing posts, battens, and rails are becoming, in most places, very expensive. Waste parts of the farm can be very profitably planted in quickly growing timber-trees that will yield quite good returns.

Plantations and hedges add immensely to the appearance of the farm and the countryside. Indeed the value and beauty of the farm can be increased by an inestimable amount by well-organized and judicious shelter-planting.

No hard and fast rule can be laid down in respect to the varieties of trees to plant for shelter. This is a purely local matter and must be governed by information gained through observing the varieties that do well in any particular district. Consideration must also be given at the outset to the result required—whether shelter only, or both shelter and timber. The practice of planting trees in single lines, with few exceptions, is ineffective unless the farmer is prepared to maintain them by systematic topping and trimming of the sides.

FIG. 1. A CLUMP OF CUPRESSUS TOROLOSA PLANTED IN THE CORNER OF A FIELD.
Lambs on the sheltered side.

FIG. 2. A CLUMP OF EUCALYPTS (MACARTHURI) IN THE CORNER OF A FIELD PROVIDING SHADE AND USEFUL FARM TIMBER.

Unless topped and trimmed many single rows of trees such as *Pinus radiata, Cupressus macrocarpa,* &c., become bare about their trunks, and heavily side-branched above. Shelter such as this cannot stop the ground wind, but causes draughts, and stock are better in the open than

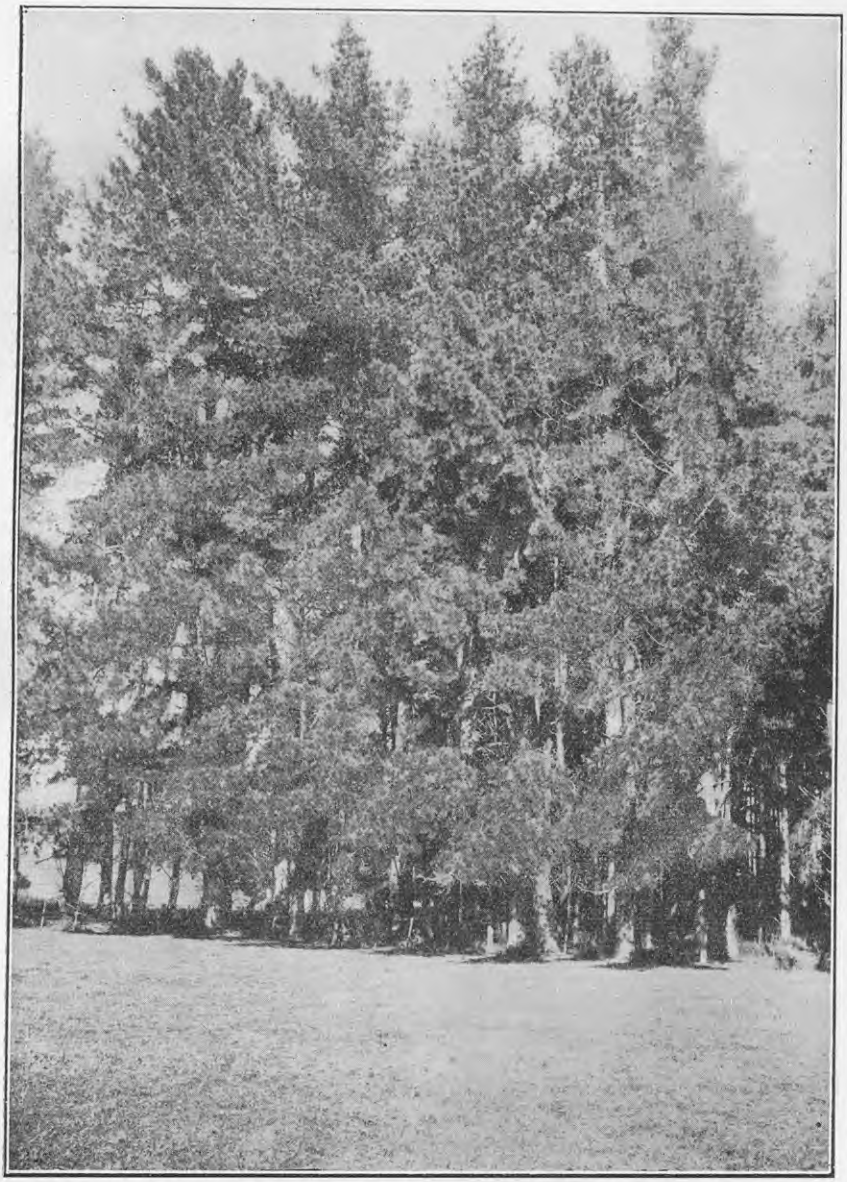

FIG. 3. PINUS RADIATA GROWING IN A ROUGH CORNER OF A FIELD.

Many of the trees have reached the stage when they should be cut out for milling.

near such belts. Excellent trees for single-row planting, provided they are protected from stock, are *Cupressus Lawsoniana*, *Cupressus Benthamii*, *Hakea saligna*, and *Pinus radiata*. These trees are all the better if they are topped when they reach a height of 12 ft., and cut back every year or every second year thereafter. It is also better to shorten side branches. This topping and trimming takes time, but it is time well spent.

General Notes on Shelter-plants.

The following notes give brief information about well-known shelter-plants :—

Cupressus Lawsoniana, recommended for soils of a free nature and well-drained alluvial land. Does not flourish in heavy water-logged land or clay land that is inclined to be wet during the winter. For hedges (intended to be trimmed) plant 3 ft. apart. For tall break-winds plant 6 ft. to 7 ft. apart. Plant two-year-old trees.

Cupressus Benthamii.—A much faster-growing tree than *Lawsoniana*. Will grow in all soils where *Lawsonianas* thrive, and will stand moister soil conditions. Not quite so good as *Lawsoniana* for the production of a closely trimmed hedge. For tall shelter plant 6 ft. to 7 ft. apart.

Pinus radiata.—One of the fastest-growing trees. Will grow in most soils and situations. If desired for a tall hedge, must be trimmed annually.

Hakea saligna.—Does well in heavy clay lands, particularly the gum lands that lie wet in winter. Recommended for such places as the clay lands around Auckland, North Auckland, Te Kauwhata, &c. Also does well on the Waihi Plains. Apparently does not do really well on limestone country. Plant 3 ft. apart. Requires rough trimming once a year to keep it in order.

Acacia verticillata.—Will do well in clay country and especially that overlying limestone. Plant 1 ft. 6 in. apart in late August or September so as to escape any frost for the first year. Keep well trimmed after the first season's growth. This hedge will attain a height of 4 ft. 6 in. in two years. It makes a good cattle hedge, but is not recommended for sheep-farms owing to the spines or prickles becoming embedded in the sheep's wool.

Barberry (Seedless Variety).—Makes a good hedge on almost any soil and in most situations. Must be trimmed annually to keep it in order. Plant 1 ft. 6 in. apart.

African Boxthorn.—Recommended for planting as a stock-hedge near the coast where other hedge-plants will not grow. Trim annually, and be careful to burn all trimmings to minimize the danger of injury to the feet of cattle.

The planting of main shelter-belts to arrest bad winds is a totally different matter, and requires more consideration on the part of the planter. In this case single-row planting is never altogether satisfactory. At least four rows of mixed trees are recommended. A first-class belt can be made up as follows :—

Two rows of *Pinus muricata* planted 4 ft. apart each way on the windward side,
Two rows of *Pinus radiata*, 6 ft. apart each way,
One inner row of *Cupressus Lawsoniana* or *Cupressus Benthamii*

according to soil, planted 12 ft. from the *radiata* and 3 ft. apart in the row. The row of *Cupressus* to be kept trimmed. On land not suitable for *Cupressus*, *Hakea saligna* or barberry may be planted instead. The *Pinus radiata* being of quickest growth soon reaches a fair height, and should be topped at 20 ft. Attention should be given to topping every second year thereafter.

For coastal districts subject to salt-sprays, provided the land is not wet, the following planting is recommended, grown as a tall belt :—

One or two rows of *Pinus pinaster* fronting the sea, 4 ft. apart each way.
One or two rows of *Pinus muricata*, 4 ft. apart each way.
Four rows of *Pinus radiata*, 6 ft. apart each way.
Two rows of *Cupressus macrocarpa*, 6 ft. apart.
One row of *Cupressus Lawsoniana*, *Hakea saligna*, or barberry planted as a hedge, 15 ft. from the macrocarpa. This inner hedge to be kept trimmed.

In districts not affected with salt-sprays another effective break-wind that will provide both shade and shelter is a single row of either macrocarpa or eucalypts, with a hedge of barberry planted on the eastern side in the case of the former and the western side in the case of the latter. With the macrocarpa the barberry should be planted not less than 15 ft. away, and about 9 ft. from the gums. Even then the macrocarpa should be kept well cut back on the side next to the barberry, or it will overshadow it, making it thin and weak in the foliage, and so spoiling its purpose as a draught-arrester. Eucalypts can safely be planted closer to the barberry, owing to their more open and upright growth. A good gum for this type of shelter is *Eucoxylon* (var. *rosea*) Campbell's gum. It is a fairly quick grower, fairly bushy, and does not grow too tall, and stands cutting back.

In wet situations where other trees do not grow satisfactorily, the Lombardy poplar provides quite a good shelter. Four rows should be planted, allowing 4 ft. between the rows and 4 ft. between the plants or cuttings. When the trees have attained a fair height, a good plan to keep the belt furnished at the base is to cut one of the side rows down during early spring. This will cause a dense bottom growth the following summer. During the next year the other outside row may be treated likewise. The resulting growth then provides an impenetrable wind barrier. The Lombardy poplar may also be used successfully in semi-dry areas where the soil is of a fair depth and somewhat loose nature.

The storm which was experienced in this province during February, 1936, revealed many weaknesses in shelter-planting. Trees which were considered resistant to salt-spray were badly blasted, even miles inland. Remarkable instances of this can be seen on both coast-lines to-day. Even in the Bay of Plenty eucalypts and many other varieties of trees were badly blasted. *Pinus radiata* in many localities is very sickly, whilst right alongside can be seen *Pinus muricata* absolutely unaffected.

The cyclonic force of the wind uprooted many shelter-trees, especially tall single- and double-row plantings of timber gums alongside drains. This is particularly noticeable in districts where the permanent water-level is from 4 ft. 6 in. to 6 ft. from the surface. Eucalypts planted for shelter and timber purposes and grown to a height of 50 ft. to 60 ft. in twelve to fifteen years have suffered badly.

Farmers having extremely tall trees on drain-banks in exposed situations on such country are advised to fall every alternate tree, and allow the young growths from the stumps to develop. When such growths are 10 ft. to 12 ft. high, thin by cutting out a number, and the balance top down to 8 ft., and then maintain them at a height of 12 ft. to 15 ft. by topping annually. This practice provides excellent ground shelter for stock for a long distance out into the fields. Two years after falling the first half of the trees, the balance of the large trees should be cut down and the young growths from the stumps allowed to come away and be

FIG. 4. PINUS MURICATA (DOUBLE ROW) PLANTED ON COUNTRY THAT HAS PROVED UNSUITABLE.

Note how bare the trees have become in the base, and how a large number have died out. Planted too closely together when set out.

thinned and topped when ready. By adopting this plan very efficient shelter is obtained and the risk of having many chains of tall trees uprooted during some future violent gale greatly minimized.

On the average farm there are to be found odd corners and rough hillsides which it is impossible to crop or maintain in profitable pasture. Such areas should be planted with a suitable kind of tree to provide timber and wood later on. For rapid growth two trees are outstanding—viz.: *Pinus radiata* and macrocarpa; possibly macrocarpa is the more useful. In wet sodden soils it does not succeed. If planted for timber purposes in fairly large areas, the plants should be set 6 ft. apart on the square or quincunx system, and after a few years every other tree should be cut out. This treatment causes the trees to grow up straight with clean barrels which provide timber for all classes of farm jobs. Consideration should also be given to planting a certain number of eucalypts. They grow in soils where macrocarpa fail. Varieties such as *Eugenioides, Viminalis, MacArthuri, Obliqua, Pilularis,* and *Leucoxylon* are recommended.

Nothing looks more effective on a farm than small clumps of trees, especially if planted on hill-tops. Even single specimens planted in large fields add to the beauty of the landscape, and provide shade for stock in hot weather.

Fencing will have to be provided in all instances where shelter is planted. This is, of course, the heaviest expense in any planting-scheme, but must be faced if success is to be assured.

Shelter around the Homestead and Outbuildings.

It is advisable to plant shelter around the homestead to check cold bleak winds, but care must be taken not to plant large trees too near

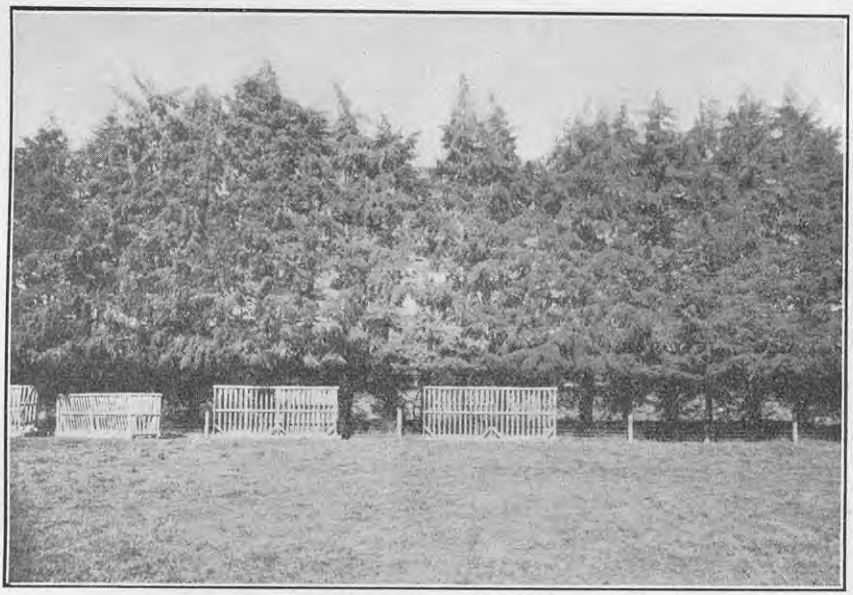

FIG. 5. SINGLE ROW OF CUPRESSUS BENTHAMII.

This shelter has been ruined through lack of attention. Note how bare it is at the base. The fence was erected too close to the trees and cattle have destroyed the lower branches. The fence should have been placed farther out and the ends of the side branches suppressed by slashing back. The trees should also have been topped. The taking of 4 ft. or 5 ft. off the top at this stage would improve considerably this single-row shelter.

the buildings and gardens. Whilst they are small they arrest the wind and do no harm, but after a few years their stems become bare, cold draughts drive through them, their large branches cast a shade over the homestead area, while their far-reaching roots invade all garden space. Homesteads so planted are rendered damp, cold, and unhealthy.

In most districts of the Auckland Province where the homestead area is unsheltered some quickly growing shelter is required, and *Pinus radiata* planted at least 1½ chains away on the windward side and kept trimmed is probably as good as any other tree. When planting *Pinus radiata* provision should be made to establish

a slower-growing and better-class hedge on the lea side fully half a chain from the *Pinus radiata*, which can be cut down when the inner hedge is sufficiently high to shelter the homestead. Ornamental trees and choice shrubs of a tender nature can be planted with safety as soon as there is shelter. Extreme care must be taken, however, not to plant anything of a tall nature near the house: low shrubs should be nearest the buildings, and shrubs and trees of greater height near the hedge.

Pinus radiata plants are usually sent out as one-year seedlings in bundles. Other pines, Douglas fir, redwood, and *Cupressus Lawsoniana* are best obtained as two-year-old transplantings. Eucalypts and *Cupressus macrocarpa* are now usually sent out in trays as one-year-old seedlings. The trays are carried out and put near the pits, and the trees balled out from the trays as required.

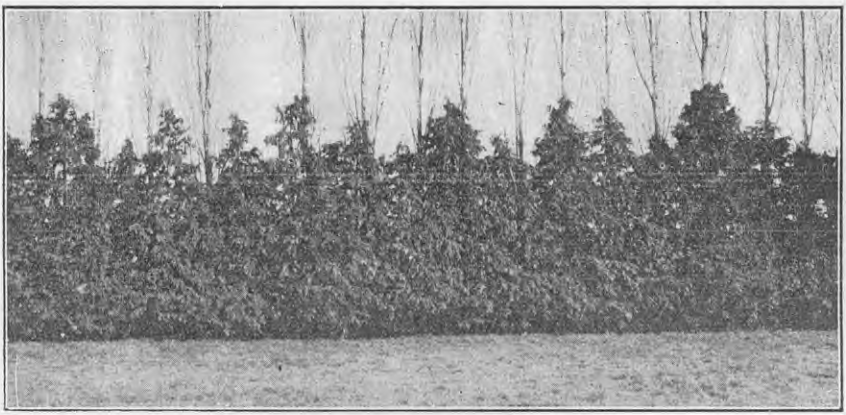

FIG. 6. TWO-ROW SHELTER.

Lombardy poplar 4 ft. apart, and *Cupressus Lawsoniana* planted between and 4 ft. away from the poplars. This shelter has reached the stage when the poplars should be topped at the height indicated in the illustration in which several feet of upper growth are not shown. The *Lawsonianas* would be improved if they were evened up on top and the fence moved farther out into the field. Stock are commencing to destroy the lower branches.

The time of the year to plant trees depends on the climatic conditions chiefly, and to some extent on the variety and age of the young trees. In the Auckland Province planting may be commenced in April, as soon as the soil is moist enough, and should be completed by early September. It has been found that trees planted before the end of May generally give the best results. Planting in mid-winter—June and July—should be done only with the hardy conifers. In districts where severe frosts are experienced, planting must be left until spring, from early August till mid-October.

In planting on the farm the greatest care should be taken in the preparation of the land, and every chance given the young trees to make rapid and early growth. If it is intended to plough the land, the ploughing should be done in summer and should be

followed by the usual horse cultivation to keep weeds in check during the autumn. On unploughable land the pits for the trees should be prepared in autumn. The extent to which the land should be cleared depends on the nature of the weeds or scrub growth present. Most trees are naturally fitted to establish themselves on the forest floor, and so a certain amount of shade is beneficial. Growth such as light bracken-fern should as a rule not be burnt off, but left to provide shade and shelter for the young trees. Strong growing gorse, broom, manuka, &c., should

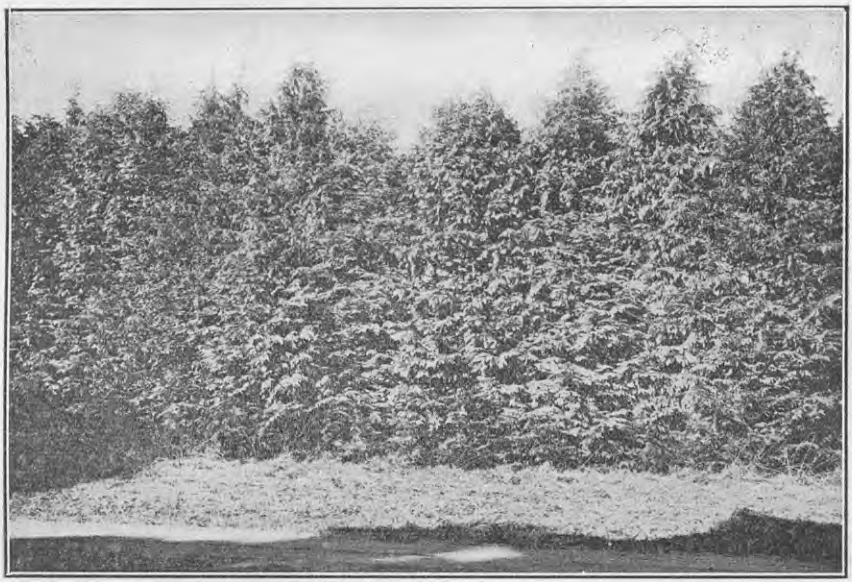

FIG 7. A GOOD ROADSIDE SHELTER OF CUPRESSUS LAWSONIANA..

This shelter has reached the stage when it should have 3 ft. to 4 ft. taken off the top.

be slashed down. On ploughed areas the lines of trees may be marked out with a garden line, while in unploughed and scrub areas the tree-locations may be defined by setting up pole-lines 6 ft. apart and by digging the pits along these lines. These pits are made by skimming off with a sharp mattock the turf or other matter over a circular patch roughly 18 in. in diameter and then loosening the soil as deeply as the mattock can be driven in. If it is intended to plant large-rooted or balled trees, a spadeful of earth should be removed and placed beside the hole. In districts where frosts are experienced early pitting results in having the soil fine and crumbly by planting-time.

Trees should never be planted out into wet, waterlogged soil. Planting in such an area should be delayed until the soil is in a better condition, even if operations are postponed until late in the season.

In planting where open pits have been made, the bottom of each should be firmed and the tree planted in the centre. The fine soil should then be sifted in about the roots and tramped very firmly. The roots must not be bent up or cramped. On a small scale it pays to put a forkful of well-rotted farmyard manure in each pit. If artificial manure is used, blood and bone manure or superphosphate and bone manure in equal parts, allowing two good handfuls a tree, should be applied.

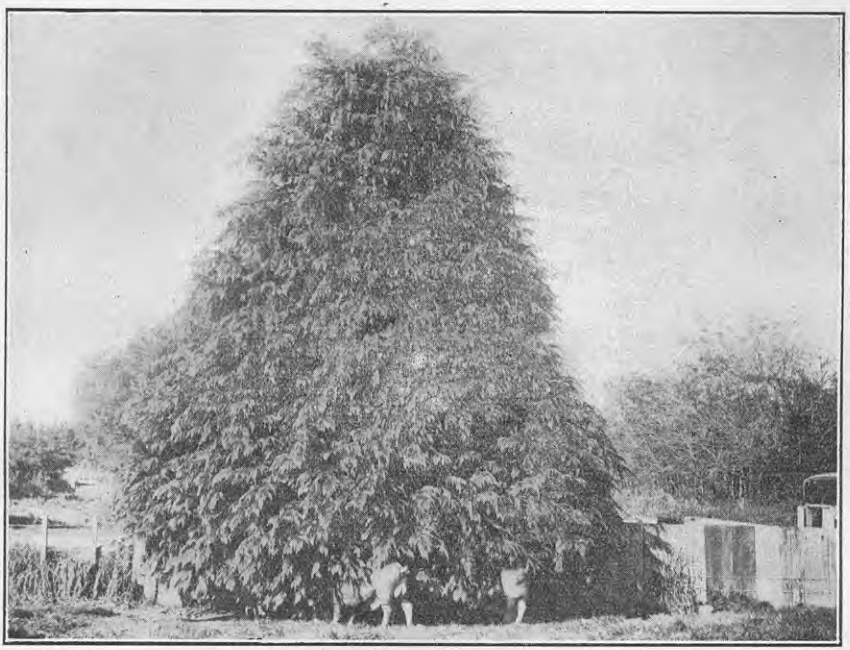

FIG. 8. CUPRESSUS LAWSONIANA USED AS A SHADE TREE IN A PIG-YARD.

PLANTING RULES SUMMARIZED.

(1) A tree should be planted not more deeply than it was planted in the nursery.

(2) Place the tree in the centre of the pit so as to allow even development of the roots. But in very exposed places the plant should be placed against the solid earth on the side of the pit opposite the prevailing wind.

(3) The tree should be planted in an upright position, with tap root going straight down and lateral roots spread out and not bunched together or bent.

(4) Never allow the roots to become dry or even have the appearance of dryness. Carelessness in this direction is probably the most frequent cause of failure.

(5) In the first place work the soil gently in about the roots, then firm it well by tramping.

(6) Do not put grassy sods into the hole. These are liable to cause air spaces and the drying of the roots.

Special care should be taken in planting out eucalypts. A dull day should be chosen, and they should be handled as little as possible. The leaves may wither and fall off after transplanting, but if the plants are strong and properly planted they usually produce new leaves within a few weeks.

MAINTENANCE.

In the first few years of the life of the plantation set out on rough land it pays to clear round each tree a patch the size of the original pit and to replace any failures. Trees that have not been well firmed may be seen to have "worked" at ground-level through swaying, and such trees should be properly firmed. When the trees are from six years to seven years old, some thinning is usually required. Trees that have become crooked, badly balanced, or that have developed double leaders should be cut out, as also should any that are being dwarfed by their neighbours. On workable areas of plantation and alongside hedgerows it pays to keep the land cultivated with a horse hoe for a season or so.

Protection of the plantation against fire can be effected by keeping firebreaks ploughed or disked on ploughable land, and by keeping scrub and rubbish cut and burned on rough country.

METHOD FOR JUDGING PORK AND BACON CARCASSES.

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THE initial development of the export trade of frozen porkers and baconers from New Zealand and Australia was comparatively slow up to 1932, but when it was found that high-quality bacon could be made from suitable frozen carcasses this gave the necessary stimulus to increased production. Development at first was haphazard, and little attention was paid to the vital necessity for selection of the most suitable breeds and strains to give the type of carcass demanded by the consumer. The organization of the New Zealand Pig Marketing Association and the development of the Waikato and Manawatu-Oroua Pig Recording Societies, which were financially assisted by the New Zealand Meat Producers Board, provided the machinery necessary for the organizing of breed and feed trials out of which emerged the material selected for examination in England.

The writers were asked from 1931 onwards to report on the suitability of overseas pig carcasses for the British pork and bacon markets. It became clear that, though there were different ways of submitting the data, it would become increasingly necessary to join forces in investigating the methods so as to present observations and measurements in an agreed and standardized form, such as is now put forward.

Although the scheme described below has been worked out on frozen carcasses, considerable use has been made of the data which have emerged from efforts to supply a similar method of judging in the case

of bacon and pork carcasses exhibited at the London Dairy Show and the National Pig Breeders Association's carcass competition at Peterborough. In our view there is no reason why the method should not be applied, modified as to marks for softness of fat and quality and texture of flesh, to fresh carcasses.

During the last five years we have accordingly been engaged not only in devising the best possible proportion of marks from different observations, but in investigating optimum measurements for the different weight classes of frozen pig carcasses. The New Zealand Department of Scientific and Industrial Research initiated regular shipments of recorded pigs, and during the last five years we have examined a large number of carcasses of various weights, breeds, and crosses of pigs, all carefully recorded as to breed and feed. This valuable material, together with competition carcasses from New Zealand and Australian Agricultural Shows, has enabled us to focus attention on the desirable and undesirable characteristics of the individual pigs and at the same time to evolve the scheme herein described which was designed to define and measure quality.

Since the experiments in judging and describing the carcasses were first started we have tried many different methods. Throughout our object has been to build up a system which could be carried out by any one (not necessarily an expert) and at any time, with a reasonable certainty that the results would be on the same standard in every case. For this reason we have, whenever possible, tried to obtain a *measurement* to express the point rather than to rely on visual judgment, into which the personal element enters. As regards three points, however (hams, shoulders, and streaks), we have not yet been able to arrive at a satisfactory measurement. For the streak several methods have been tried and discarded as imperfect; further work on these points is required before judgment by measurement is applied. Therefore, for the judgment of hams, shoulders, and streaks by the visual method we have constructed photographic standards covering the allotted range of marks, so that the personal element can be reduced to a minimum.

In view of the present considerable variation in the methods of judging at carcass competitions we consider that a stage has now been reached when the publication of the method will prove useful both for competitions and for those supplying the British market. We hope that it will prove useful in helping to standardize judging, and, while we do not suggest that it is yet perfect, its publication may give a chance to others to make improvements.

Description of Method.

General.—In many cases our terms of reference have been to report generally on "the suitability of carcasses for the British market." Whether carcasses will meet the requirements of any given market depends on several different factors, including the carcass weights, appearance, conformation, and texture. In the case of frozen carcasses it is not possible to judge texture, in which softness of fat is an important factor. If it is required to judge this point the best test is the chemical one of "iodine number" of the fat.

Once the requirements of the market regarding carcass weight, quality of butchering, and dressing are known, there remains the important matter of determining whether the breeding and feeding of the pig is giving the conformation required.

We have accordingly devised a scale of points in which 100 marks are awarded for those points which deal with breeding and feeding. Marks for appearance, marketing, and for the suitability of weight classes are given over and above this total.

Marks for suitability of carcass weight have been given by us only for bacon carcasses, in which the matter is more important than in the case of pork.

In carcass competitions it is usual to specify the weight limits within which carcasses must fall. When, however, experiments are being made to test out the effect of breed or feed factors as they affect the quality of the carcass it has sometimes happened that all the pigs in the experiment have been killed on the same day and the carcasses sent for inspection at rather widely divergent weights. It is, however, advisable to kill the pigs as they come to the weight required, say about 100 lb. live-weight for pork and 200 lb. live-weight for bacon, and store the carcasses until the lots are complete. This is much better than killing all at one time whatever their weights, for the proportions of fat, muscle, and bone vary with the weight, and what may be a lean carcass at 50 lb. or 120 lb. may be a fat one at 100 lb. or 180 lb. For experimental purposes the time the pigs take to reach this live-weight can always be used as a measure of the efficiency of the breed or the ration.

The scale of points drawn up for judging the carcasses comprises two sets of marks—(1) Marketing Points, which, for the most part, consist of defects which may occur in the industrialization, dressing, or transport of the carcass, and which affect the price realized by affecting its appearance when exposed for sale; (2) Breeders' Points, which consist of defects caused by the breeding or methods of feeding and management adopted on the farm. These two have been kept separate so that, in cases where one or other only is required, they can be used independently. The Breeders' Points have again been subdivided into (*a*) those which are based on visual judgment (Inspection Points) and (*b*) those which are based on measurement (Measurement Points).

The scale of points and marks adopted for both pork and bacon is as follows:—

Table I.

	Marks. Porkers.	Baconers.
(1) Marketing Points—		
Colour—clean, fresh, white	5	5
Skin—smooth and fine	5	
Dressing—freedom from bruises and hair	5	5
(2) Breeders' Points—	15	10
(*a*) By inspection—		
Hams—well filled and fine-boned	8	8
Shoulders—light	7	7
Streak—thick, full of lean meat	12	12
(*b*) By measurement—		
"Eye muscle" of loin—thick	28	28
Back fat thickness—correct proportion	20	20
Body length—in proportion to weight	20	20
Leg length—short	5	5
	100	100
(3) Suitability of carcass weight	..	15
Total marks	115	125

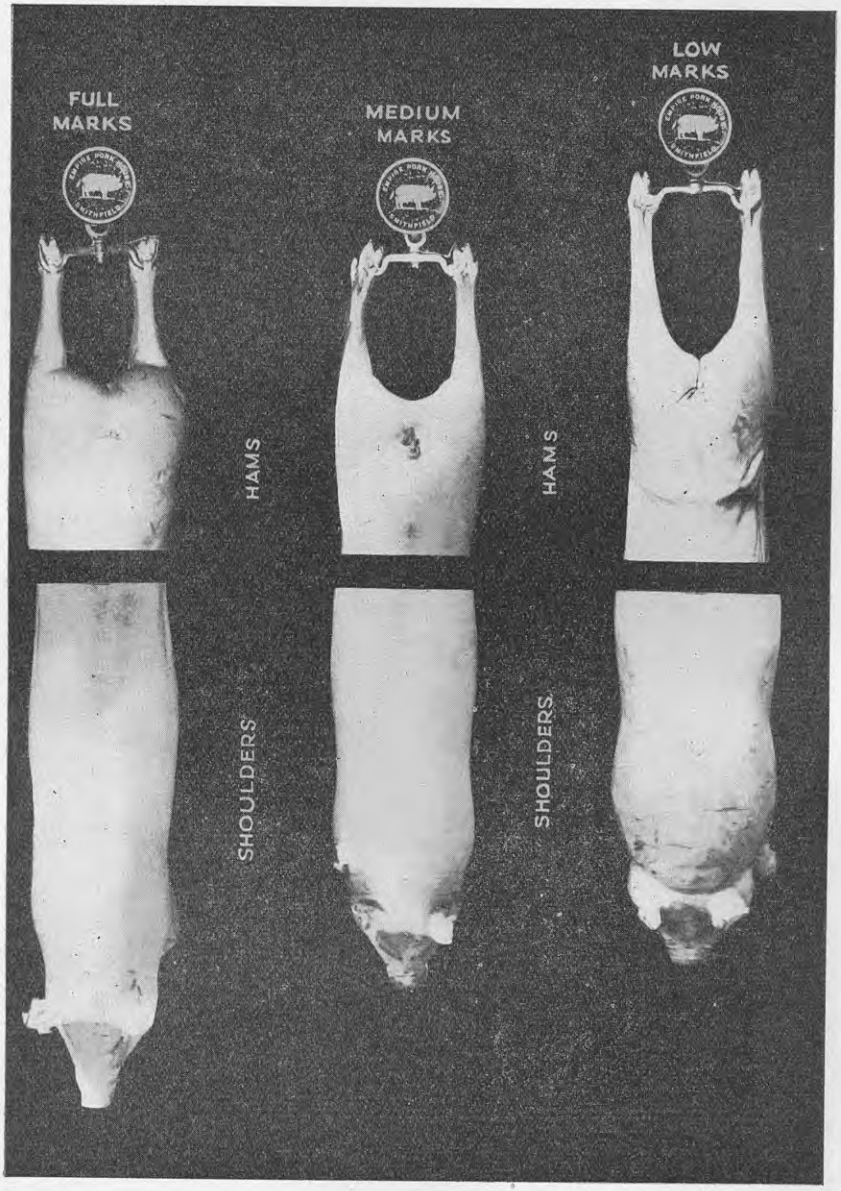

FIG. 1. JUDGING BY EYE-APPRAISAL.
Standards for award of marks.

The relative number of marks given to each point has been carefully considered according to the relative market value of the point. For example, a carcass poor in the "eye muscle," or thickness of lean meat, can drop many more points than one which is thick in the shoulders. The sum total of the points therefore represents the desirability of the carcass from a market point of view. The standard set is a high one, and any carcass which obtains over half marks on any point is a good one in that respect.

Judging in Three Stages.

The judging is carried out in three stages:—

(*a*) The carcasses are weighed and are hung up in a row with their backs to the judge. The Marketing Points (colour, skin, and dressing) and the hams and shoulders of the Breeders' Points are then judged.

(*b*) Each carcass is then sawn down the middle line, and the body length and the leg length are measured with a tape-measure graduated in millimetres.

(*c*) One side of each carcass is then sawn straight through at the level of the last rib, and the hinder ends are laid in a row with the cut surfaces facing the judge. On the exposed cut surface the streak is judged, and the "eye muscle" and back fat are measured by fine pointed callipers and read off on a wooden ruler scale in millimetres.

The level of the last rib has been selected to make this cut, for not only does it expose the most valuable part, but also the latest developing part of the carcass A part which grows late during development of the animal forms the best index of the state of the development of the carcass as a whole.

The Scale of Points explained.

A brief description of the points and the methods used in judging them is as follows:—

MARKETING POINTS.

Colour (5 marks): The colour shall be a clean fresh white. Points should be deducted for dark coloration due to pigmented skin, sunburn before slaughter, or excessive drying in storage, as well as for the dead white blebs found as faults in cold storage.

Skin (5 marks): The skin should be smooth and not too thick or coarse.

Dressing (5 marks): Bruises and weals due to fighting before slaughter should be absent. There should be complete absence of all hair and absence of scraper cuts in the skin. The method of allowing the forelegs to hang naturally is preferable to hooking them back, as the latter makes the shoulders appear heavier than they are.

BREEDERS' POINTS.

(*a*) *By Inspection.*—For these photographic scales are used (see Figs. 1 and 2).

Hams (8 marks): The bone should be fine and the ham well filled out with lean meat, the space between the legs being U- rather than V-shaped. The hams to be judged are compared with the photographic scale of hams (Fig. 1) which shows the shape for maximum (8), minimum (1), and intermediate (4) marks, to be awarded.

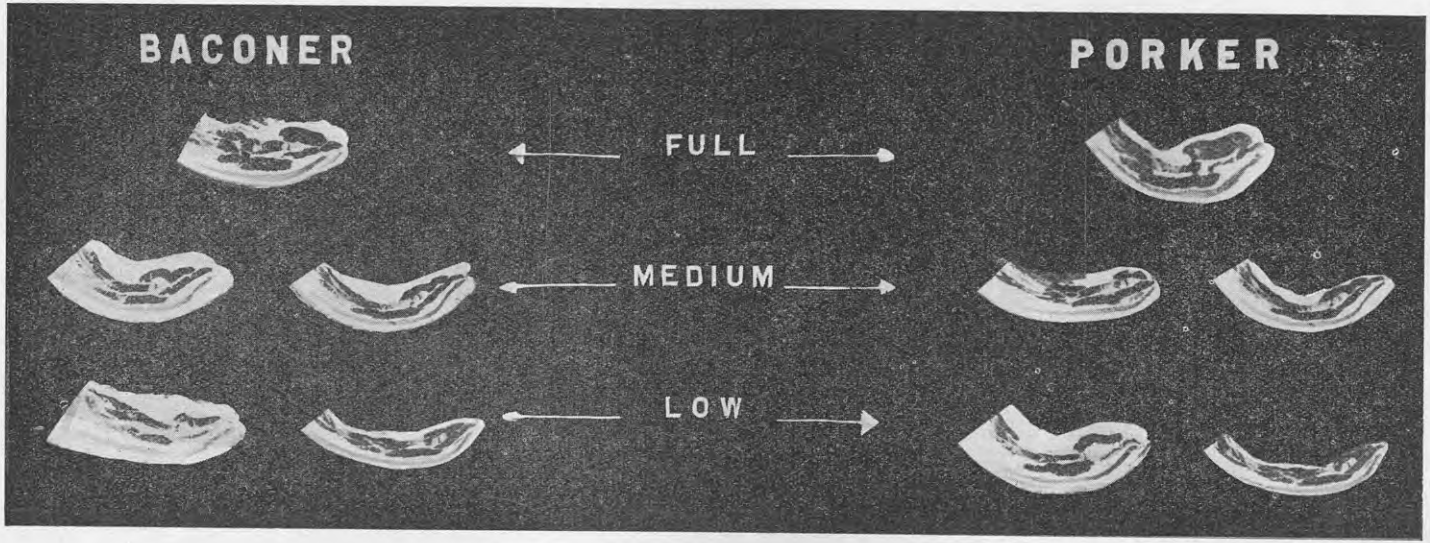

FIG. 2. JUDGING STREAKS BY EYE-APPRAISAL.
Standard for award or marks.

Shoulders (7 marks): These should be light in proportion to the rest of the carcass, for it is a low-priced part. In judging, the shoulders are matched against a photographic scale of the shoulders (Fig. 1) which shows the shape for maximum (7), minimum (1), and intermediate (4) marks, to be awarded.

Streak (12 marks): Not only should the belly be thick, but it should contain a high proportion of lean meat. Comparison with the photographic scale (Fig. 2) is made. The maximum marks (12) are given for a streak which is *both* thick and full of lean meat. The minimum marks (1) are given *either* for one which is thin, *or* for one which is thick but which contains a higher proportion of fat. Illustrations of intermediate marks (6) in each case are also shown.

(*b*) *By Measurement.*—Measurement in millimetres rather than in inches (25 millimetres = 1 inch) has been adopted for the sake of greater accuracy and the avoidance of fractions. Since the actual measurement will vary with the weight of the carcass, Tables II to V have been drawn up for different weight groups. From these tables the marks corresponding to any particular measurement can be read off. In the case of thickness of "eye muscle" and length of body, the highest marks are given for the maximum measurement, and in the case of the length of leg for the minimum measurement. For thickness of fat, on the other hand, as for suitability of carcass weight, the highest marks are awarded for an optimum measurement.

"Eye Muscle" of Loin (28 marks): The thickness is measured halfway along its width (see Fig. 3). This gives the best measure of the thickness of lean meat throughout the carcass. Different carcasses vary much more in the thickness than in the width of the muscle, so the thickness has been selected as the index of lean meat. The scale for converting measurements to marks is given in Table II.

Back Fat Thickness (20 marks): This is measured 1 in. for porkers and 1½ in. for baconers from the middle line, with one point of the callipers at the edge of the "eye muscle" and the other just on the inner layer of the skin (see Fig. 3). This gives a better measure of the amount of fat in the carcass than does the measurement of the fat at the shoulder, for it is the last part of the back fat to develop. Fat differs from all other points for marking, inasmuch as for each weight group of carcass there is an optimum requirement of back fat: there can be too little as well as too much. Consequently the scale for converting measurements to marks (Table III), unlike the others, is extended on both sides of the optimum. In the case of pork, if the carcass is too fat the rind and the fat down to the required thickness has to be removed. It is therefore more profitable to supply this small pork, for which there is a growing demand in industrial areas, with the right amount of fat, so that it can be sold direct to the consumer with the rind on. At one time we considered the measurement of the thickness of the back fat from the point of the "eye muscle" farthest from the backbone to the skin (as shown in Fig. 3), as it is here that the thickness of the fat shows up in the cut. Agreement was good when all measurements were taken by one person, but not when they were taken by different persons, for it is more difficult to judge the exact point

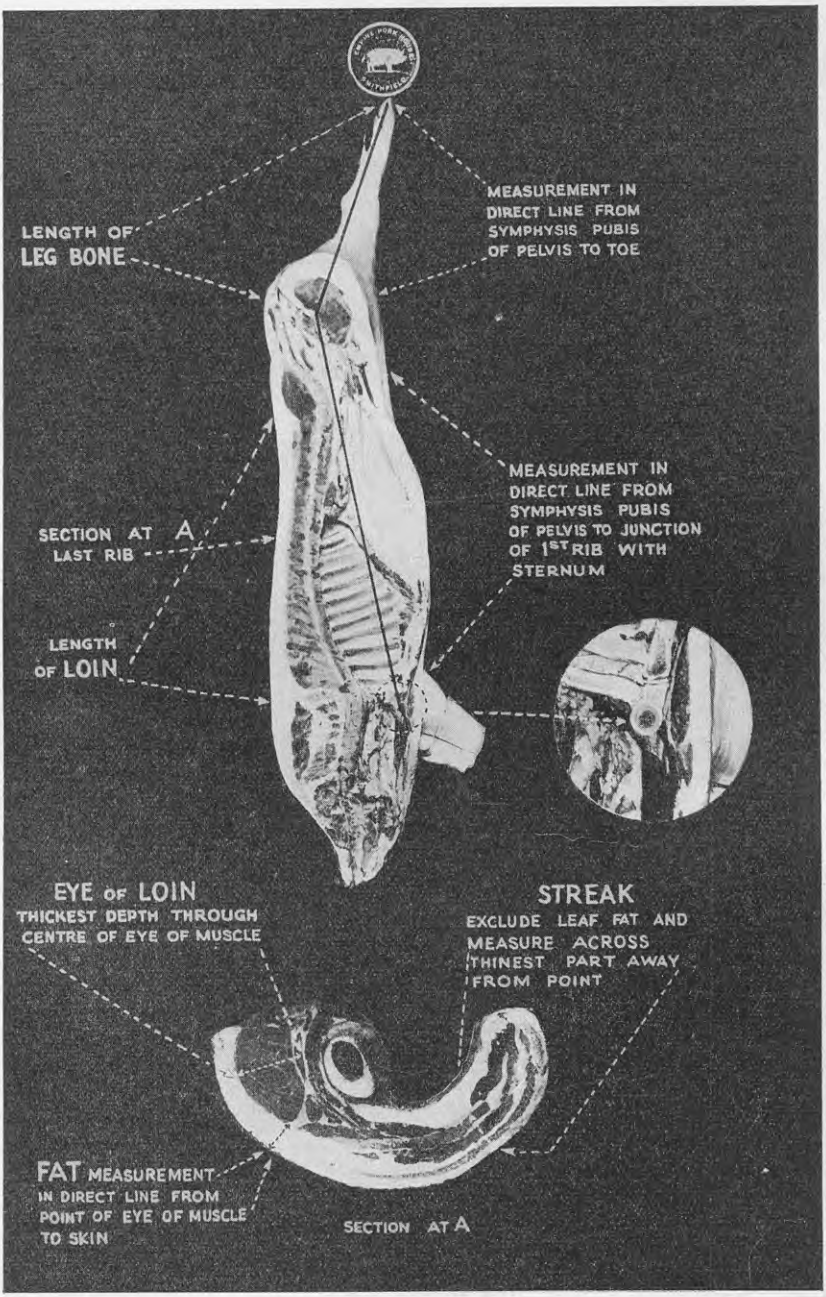

FIG. 3. JUDGING BY AWARD OF MARKS FROM MEASUREMENT.
Measurement with callipers read off on a ruler scale marked in millimetres.

at which the measurement should be taken here than in the place which we have adopted. Fig. 3 shows the discarded method of measurement of back-fat thickness.

Table II.—Marks for Thickness of "Eye Muscle" of Loin.

(Measurements in millimetres.)

Carcass Weight, Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 99.	100 to 109.	110 to 119.	120 to 139.	140 to 159.	160 to 179.	180 to 199.
Marks													
1	23	24	25	26	27	28	29	30	31	32	33	34	35
3	24	25	26	27	28	29	30	31	32	33	34	35	36
5	25	26	27	28	29	30	31	32	33	34	35	36	37
7	26	27	28	29	30	31	32	33	34	35	36	37	38
9	27	28	29	30	31	32	33	34	35	36	37	38	39
11	28	29	30	31	32	33	34	35	36	37	38	39	40
13	29	30	31	32	33	34	35	36	37	38	39	40	41
14	30	31	32	33	34	35	36	37	38	39	40	41	42
15	31	32	33	34	35	36	37	38	39	40	41	42	43
16	32	33	34	35	36	37	38	39	40	41	42	43	44
17	33	34	35	36	37	38	39	40	41	42	43	44	45
18	34	35	36	37	38	39	40	41	42	43	44	45	46
19	35	36	37	38	39	40	41	42	43	44	45	46	47
20	36	37	38	39	40	41	42	43	44	45	46	47	48
21	37	38	39	40	41	42	43	44	45	46	47	48	49
22	38	39	40	41	42	43	44	45	46	47	48	49	50
23	39	40	41	42	43	44	45	46	47	48	49	50	51
24	40	41	42	43	44	45	46	47	48	49	50	51	52
25	41	42	43	44	45	46	47	48	49	50	51	52	53
26	42	43	44	45	46	47	48	49	50	51	52	53	54
27	43	44	45	46	47	48	49	50	51	52	53	54	55
28	44	45	46	47	48	49	50	51	52	53	54	55	56

Table III.—Marks for Thickness of Fat over Loin.

(Measurements in millimetres.)

Carcass Weight, Pounds.	60 to 69.	70 to 79.	80 to 89.	90 to 99.	100 to 109.	110 to 119.	120 to 129.	130 to 139.	140 to 149.	150 to 159.	160 to 169.	170 to 179.	180 to 189.	190 to 199.
Marks														
1 ..	1	1	2	3	4	5	7	8	9	10	11	12	13	14
4 ..	..	2	3	4	5	6	8	9	10	11	12	13	14	15
7 ..	2	3	4	5	6	7	9	10	11	12	13	14	15	16
10 ..	3	4	5	6	7	8	10	11	12	13	14	15	16	17
12 ..	4	5	6	7	8	9	11	12	13	14	15	16	17	18
14 ..	5	6	7	8	9	10	12	13	14	15	16	17	18	19
15 ..	..	..	..	..	..	..	..	14	15	16	17	18	19	20
16 ..	6	7	8	9	10	11	13	15	16	17	18	19	20	21
17 ..	..	..	..	..	..	..	14	16	17	18	19	20	21	22
18 ..	7	8	9	10	11	12	15	17	18	19	20	21	22	23
19 ..	8	9	10	11	12	13	16	18	19	20	21	22	23	24
20 ..	9	10	11	12	13	14	17	19	20	21	22	23	24	25
19 ..	10	11	12	13	14	15	18	20	21	22	23	24	25	26
18 ..	11	12	13	14	15	16	19	21	22	23	24	25	26	27
17 ..	..	..	..	..	..	..	20	22	23	24	25	26	27	28
16 ..	12	13	14	15	16	17	21	23	24	25	26	27	28	29
14 ..	13	14	15	16	17	18	22	24	25	26	27	28	29	30
12 ..	14	15	16	17	18	19	23	25	26	27	28	29	30	31
10 ..	15	16	17	18	19	20	24	26	27	28	29	30	31	32
7 ..	16	17	18	19	20	21	25	27	28	29	30	31	32	33
4 ..	17	18	19	20	21	22	26	28	29	30	31	32	33	34
1 ..	18	19	20	21	22	23	27	29	30	31	32	33	34	35

Table IV.—Marks for Body Length (Symphysis Pubis to First Rib).

(Measurements in millimetres.)

Carcass Weight in Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 94.	95 to 99.	100 to 104.	105 to 109.	110 to 114.	115 to 119.	120 to 124.	125 to 129.	130 to 134.	135 to 139.	140 to 144.	145 to 149.	150 to 154.	155 to 159.	160 to 164.	165 to 169.	170 to 174.	175 to 179.	180 to 184.	185 to 189.	190 to 194.	195 to 199.
Marks																												
1	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820
2	555	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825
3	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830
4	565	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835
5	570	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840
6	575	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845
7	580	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850
8	585	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855
9	590	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860
10	595	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865
11	600	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870
12	605	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875
13	610	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880
14	615	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885
15	620	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890
16	625	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895
17	630	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900
18	635	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905
19	640	650	660	670	680	690	700	710	720	730	740	750	760	770	780	790	800	810	820	830	840	850	860	870	880	890	900	910
20	645	655	665	675	685	695	705	715	725	735	745	755	765	775	785	795	805	815	825	835	845	855	865	875	885	895	905	915

Table V.—Marks for Leg Length (Symphysis Pubis to Toe).

(Measurements in millimetres.)

Carcass Weight in Pounds.	60 to 64.	65 to 69.	70 to 74.	75 to 79.	80 to 84.	85 to 89.	90 to 94.	95 to 99.	100 to 104.	105 to 109.	110 to 114.	115 to 119.	120 to 124.	125 to 129.	130 to 134.	135 to 139.	140 to 144.	145 to 149.	150 to 154.	155 to 159.	160 to 164.	165 to 169.	170 to 174.	175 to 179.	180 to 184.	185 to 189.	190 to 194.	195 to 199.
Marks	——	and	over	—																								
1	450	460	470	480	490	500	510	520	530	540	550	560	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645
2	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625	639 to 630	644 to 635
3	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615	629 to 620	634 to 625
4	429 to 420	439 to 430	449 to 440	459 to 450	469 to 460	479 to 470	489 to 480	499 to 490	509 to 500	519 to 510	529 to 520	539 to 530	549 to 540	554 to 545	559 to 550	564 to 555	569 to 560	574 to 565	579 to 570	584 to 575	589 to 580	594 to 585	599 to 590	604 to 595	609 to 600	614 to 605	619 to 610	624 to 615
5	419	429	439	449	459	469	479	489	499	509	519	529	539	544	549	554	559	564	569	574	579	584	589	594	599	604	609	614
	——	and	under	—																								

Body Length (20 marks) : This is measured with a tape measure from the edge of the symphysis pubis bone to the junction of the sternum with the first rib (see Fig. 3). It gives a measure of the length of the valuable loin joint which can be cut off the carcass. A high proportion of this to the weight of the carcass as a whole increases the value of the carcass for cutting purposes. The scale for converting measurements into marks is given in Table IV.

Leg Length (5 marks) : This is measured with a tape measure in a straight line from the edge of the symphysis pubis bone to the tip of the toe (see Fig. 3). When taken in relation to the weight of the carcass it gives a measure of the amount of bone in the carcass. The scale for converting measurements to marks is given in Table V.

Pork.

The weights of carcasses most in demand for the London Trade are from 60 lb. to 80 lb., although during the summer months and in some other markets there is some demand for rather heavier carcasses for cutting purposes. The latter conveniently fall into two main groups—80 lb. to 100 lb., and 100 lb. to 120 lb. Since the main trend of future trade, on analogy with "Canterbury Lamb," will probably lie with the 60 lb. to 80 lb. group, it is on this group that we have concentrated most. Scales have, however, been prepared for the other groups as well.

(The bacon scheme now operating in Great Britain has caused a considerable amount of variation in the demand for these various porker weights quite out of proportion to the normal, as indicated above.)

Since there was comparatively little detailed published information available to us relating to the most suitable types demanded by the consumer, we were compelled to construct for the first time measurement and inspection standards which we believe accurately reflect consumer preferences.

The scale of marks is the same as for bacon. The standard, however, is in one respect different. In the case of pork, it is important that not only should the belly be thick but that it should contain a higher proportion of lean meat. Comparison with the photographic scale (Fig. 2) is made. As already stated the maximum marks (12) are given for a streak which is *both* thick and full of lean meat. The minimum marks (1) are given *either* for one which is thin, *or* for one which is thick, but which contains a high proportion of fat. Illustrations of intermediate marks (6) in each case are also shown. In the case of the back fat thickness, too, one slight alteration has to be recorded. For pork this measurement is taken 1 in. from the middle line, as compared with $1\frac{1}{2}$ in. on bacon carcasses.

Baconers.

In considering bacon we have taken as our standard a Class I carcass for the Wiltshire trade under the British Bacon Scheme just as we have taken the small 60 lb. to 80 lb. London porker as the ideal standard for pork.

The weights of the carcasses suitable for making bacon will vary slightly with the type of pig used. For Wiltshire sides, made from breeds such as the Large White, the optimum carcass weight is 150 lb., but where, as in most of the material we are dealing with, the breed (Berkshire crosses) is of early-maturing type, as used for the production

of small porkers, a rather lower weight is advisable on account of the tendency of the pig to remain rather short and put on fat at weights above 150 lb. For districts which are beginning for the first time to produce frozen bacon-pig carcasses for this country we have therefore added to our scale of points one for "Suitability of Carcass Weight" (Table VI). To give the optimum carcass weight of 135 lb. to 154 lb. for this type of pig a live-weight of from 180 lb. to 200 lb. is required.

It will be noticed that carcasses falling much under the optimum weights are penalized more than those which are over these weights, for they are less suitable for making into bacon.

Streak (12 marks): For bacon purposes rather more fat is allowable than for pork, and so a different photographic scale is used (see Fig. 2).

Back Fat Thickness (20 marks): This measurement is taken $1\frac{1}{2}$ in. from the middle line. Since the actual thickness of the fat is much greater in a heavy bacon carcass than in a light pork carcass, the latitude (in millimetres) that can be allowed for a reasonably good carcass is larger. In Table III, which gives the scale for converting measurements to marks, therefore, the drop in marks for each millimetre from the optimum measurement is less than for pork carcasses.

Table VI.—Bacon Pigs: Marks for Suitability of Carcass Weight.

Marks.	Carcass Weight. Pounds.
1	110–114
4	115–119
7	120–124
10	125–129
13	130–134
15	135–154
14	155–159
13	160–164
12	165–169
11	170–174
9	175–179
7	180–184
5	185–189
3	190–194
1	195–199

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CHRONIC ZINC-POISONING OF PIGS.

RESULTS OF EXPERIMENTAL FEEDING OF PURE ZINC LACTATE.

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IN the *New Zealand Journal of Agriculture* for July, 1936, p. 34 (1), attention was drawn to the possibility that unthriftiness, arthritis, and mortality in young pigs may, in some cases, have been connected with the solution, in the skim-milk upon which the pigs were fed, of large amounts of zinc from the galvanized-iron piping used for conveying the milk to the piggeries.

In view of the negative findings of American investigators on the possibility of the existence of chronic zinc-poisoning, and also doubt as to the parts played by biological factors, and chemical substances other than zinc, in the causation of the disease, it was decided to institute experiments at the Wallaceville Veterinary Laboratory.

THE WALLACEVILLE EXPERIMENTS.

To ensure that conditions should approximate as nearly as possible to those obtaining on the farms where trouble among the pigs had been associated with the use of galvanized-iron pipes, and at the same time obviate possible uncertainties due to insolubility of zinc oxide and complicating effects of impurities such as lead, arsenic, or cadmium, it was decided to feed zinc in the form of lactate, prepared and tested in the laboratory for purity. Ten pounds of B.P. zinc oxide was obtained as a bulk supply, and showed on analysis the following results :—

Lead, Cadmium.—No trace of precipitate or darkening on passing H_2S through a solution of 10 gm. dissolved in just sufficient hydrochloric acid to effect complete solution and diluted to about 100 cc. A trace of lead acetate solution when added to this solution gave a pronounced black precipitate. No precipitate or trace of lead chromate on applying the test prescribed by the U.S.P.

Arsenic.—No trace by Marsh test using $4\frac{1}{2}$ gm.

The zinc oxide was dissolved in lactic acid B.P. (tested for heavy metals with negative result) and the precipitated zinc lactate filtered off, dissolved in hot water, and allowed to crystallize on cooling. The snow-white zinc lactate was then filtered on a buchner funnel and tested for acid-insoluble-sulphide metals with entirely negative results.

ZINC LACTATE FEEDING TO PIGS.

Three young healthy weaners were selected from a litter of ten young pigs. The three were fed in a common trough with whole-milk and a little meal to which the zinc lactate previously dissolved in water was added. The milk contained approximately 0·1 per cent. of zinc as lactate.

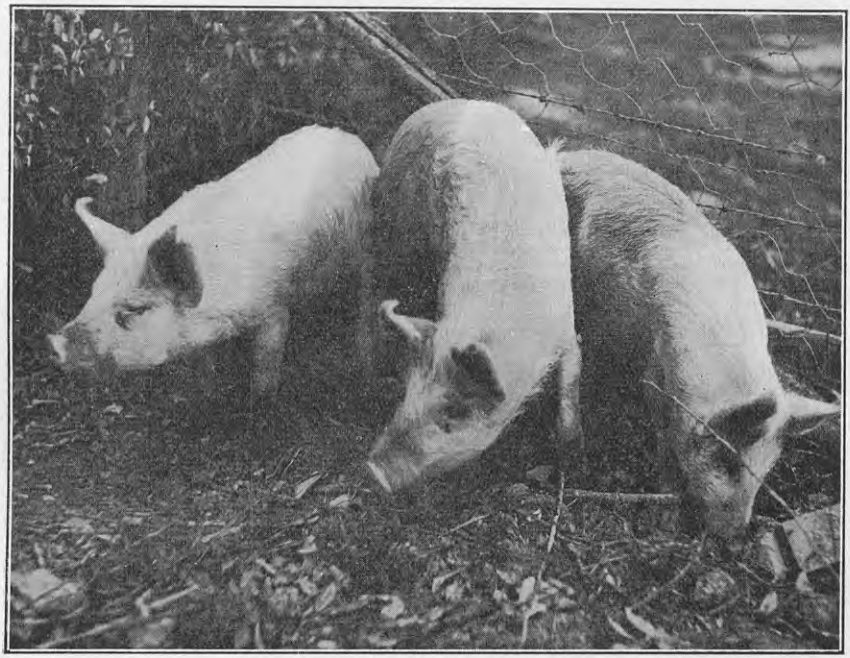

FIG. 1. ZINC-FED GROUP.

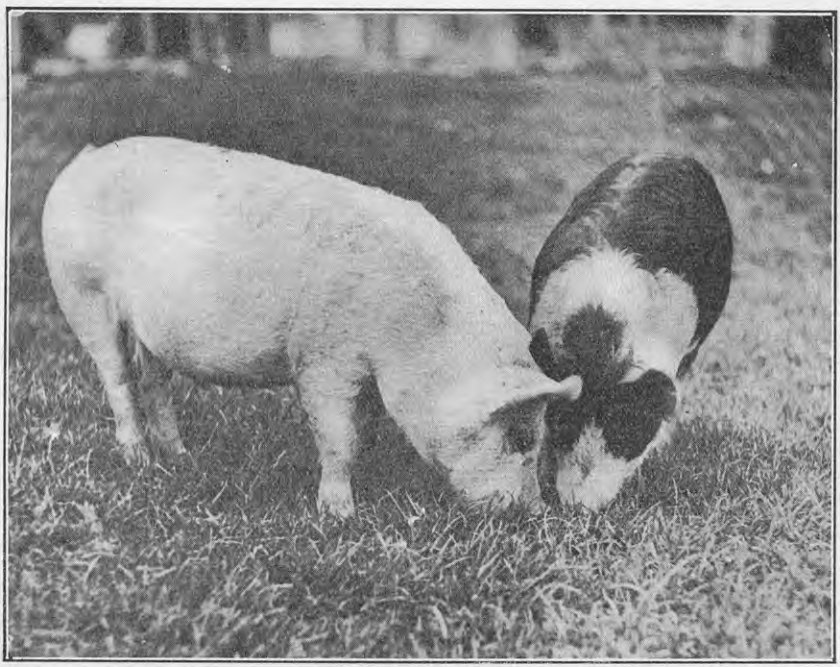

FIG. 2. CONTROL GROUP.

The trial commenced on the 11th August and continued until the last pig was killed on the 4th November. On about the 10th October —two months after the commencement of the feeding experiment— the pigs commenced to leave some of their milk, and the quantity was at once cut down. Just before "going-off" their food the pigs were all noticed to be stiff in action. By the 13th October the pigs were noticeably lame, one much more so than the other two. They also appeared to be rougher in the coat and more flat-sided than their control litter-mates not receiving zinc. On the 23rd October it was decided to kill the pig showing most lameness, while a second pig died on the 24th probably due to the handling of the day before. The third pig, which was killed on the 4th November, was showing similar lameness to that of the others previously killed.

It is estimated that the three pigs received the following amounts of zinc lactate, assuming that each had drunk a similar amount of milk :—

No. 1 pig, which died 23rd October, 1936, 804 gm. zinc lactate = 181 gm. zinc.

No. 2 pig, which died 24th October, 1936, 824 gm. zinc lactate = 185 gm. zinc.

No. 3 pig, which died 4th November, 1936, 1,055 gm. zinc lactate = 237 gm. zinc.

Post-mortem Examination of Pigs.

No. 1.—This was definitely the worst case, but no scouring had been observed. The blood had a thin watery appearance, but clotted exceedingly quickly. Heart, lungs, and pancreas appeared normal. There was no congestion of the alimentary tract and no evidence of scouring. The liver showed an obvious central necrosis of lobules, and was of a pale-brown colour. The kidney was rather too brown in the cortex, and urine was tinged with bile.

The chief changes, however, were noticeable in the ends of the humerus. The head of the humerus in both legs showed a collapse of the bony structure beneath the overlying cartilage. In one case there was erosion of the cartilage as well, and a definite lifting of that cartilage from the bone beneath. The ends of the bones were weak and cancellous and suggestive of serious mineral deficiency. The synovial fluid was slightly blood-stained, and gave a growth of Streptococci and Staphylococci. No noticeable changes were to be seen at the ends of other long bones.

Pig No. 2.—Found dead 24th October. Had been noticeably lame on the left foreleg but had not scoured. The heart, lungs, pancreas, liver, and bladder appeared normal. The kidney was pale and contained a gelatinous fluid in the pelvis. There was slight catarrh and congestion of the mucosa of the stomach, otherwise the alimentary canal appeared normal. Brain appeared congested.

The long bones were examined, and the only one noticeably bad was the head of the left humerus, which was similar to that of No. 1. The joint fluid gave no growth of organisms on culture.

Pig No. 3.—Post-mortem examination was made on 4th November, 1936. This was the largest of the three pigs, but was very lame in the

front legs. There had been no scouring, but the pig appeared unthrifty. All organs appeared normal, and no changes were observed in the alimentary canal.

Analysis of blood for calcium and P_2O_5 gave normal results, and blood histology showed no changes. Examination of the long bones revealed changes in the humerus in both forelegs and at the proximal and distal ends. The cartilage of the head of the humerus had lifted, and in places showed definite erosion, while the bone was spongy. There was some erosion, and considerable fluid was present in the humero-radial joints. No organisms were recovered from the synovial fluid on culture. There was also in this pig a similar lesion on the head of a femur.

Microscopical Examination of Organs.

Liver.—In pig No. 1 a wide zone of cellular necrosis appeared round the central vein of the lobule, but in pigs Nos. 2 and 3 no changes could be observed.

Pancreas.—In all three cases the pancreas was considered normal. The suggestion that a fibrous condition existed could not be confirmed when one considered the fibrous condition of the organs of normal pigs.

Kidney.—No. 1 pig showed definite glomerulo-nephritis, but the other two pigs showed only comparatively slight changes.

Eosinophilic droplets were found to be present in the glomerular sacs in numbers, and passing through to the convoluted tubules. Lining-cells of the convoluted tubules appeared to be secreting excessively, so that long processes of the cells jutted out into the lumen and appeared to deposit irregular droplets which took the haematoxylin stain. In parts there had been an accumulation of debris forming blockages of the tubules. Where such casts had formed, erosion of the cells had taken place, and occasionally the basement membrane had ruptured. A cystic condition of a few of the tubules had resulted.

Summary.

Zinc lactate feeding of pigs resulted in lameness and unthriftiness.

Damage occurred in one case in the liver and to some extent in kidneys of experimental pigs.

The humerus was badly damaged in each case, the cartilage having lifted off a soft spongy underlying bone. This non-specific arthritis was the cause of the lameness, and was produced apparently by an upset of mineral metabolism resulting from prolonged zinc feeding.

Analytical Results on Biological Material from Wallaceville Pig-feeding Experiments.

A representative series of samples was collected from each pig as soon as it was dead, with special precautions to avoid contamination with zinc. The samples were immediately weighed and the analysis commenced on the fresh material. Unfortunately the control littermate pigs were not available for killing at the time, so that to secure a basis for comparison the blood and organs of an ordinary pig killed at the abattoirs were secured and analysed.

Data on the zinc content of pig-organs was lacking in the available literature, but comparison could be made with the figures for other

mammals, including man, cattle, dog, cat, horse, rabbit, and rat. The results of analysis of the pig-organs are given in the accompanying table :—

Table showing Zinc-content Determinations in Wallaceville Pig Experiments.

—	Pig No. 1.	Pig No. 2.	Pig No. 3.	Normal Pig. J/943.
Mg. in 1 kg. of wet weight—				
Blood	12·0* (22nd Sept.)	6·5 (22nd Sept.)	8·1 (22nd Sept.)	4·49
	8·3 (23rd Oct.)	20·5 (24th Oct.)	12·3 (23rd Oct.)	4·9
			13·3 (4th Nov.)	..
Heart	6·8	9·4	6·7	..
Spleen	23·5	113·6	24·6	19·5
Brain	12·0	14·3	12·9	..
Lung	12·7	14·2	..	..
Pancreas	190·0	610·0	187·8	51·0
Bile	51·5	..	55·9	6·0
Joint fluid	11·0	..	18·0*	..
Ovaries	19·3	..	..	..
Muscle	32·0	29·0	29·0	..
Kidney	1,000·0	1,570·0†	610·0	27·0
Liver	1,020·0	730·0	1,140·0	155·0
Mg. in 100 cc. urine	0·17 (26th Sept.)	0·9 (26th Sept.)	0·55 (26th Sept.)	0·15
	0·35 (20th Oct.)	0·45 (20th Oct.)	0·27 (19th Oct.)	..
	0·6 (23rd Oct.)	2·17 (24th Oct.)	0·27 (20th Oct.)	..
			0·33 (4th Nov.)	..
Mg. in 1 kg. of ash—				
Bones	..	..	..	..
Humerus (lower end)	2,276	1,844	1,102	251
Femur (lower end)	1,202	1,330	906	..
Humerus (shank)	597	828	623	193
Femur (shank)	260	720	486	..

* Doubtful; amount of material available insufficient for accurate determination. † Exact figure somewhat doubtful; material all used.

Notes on the Toxicity of Zinc.

The toxicology of zinc may be considered under three headings :—

(1) Acute poisoning due to the caustic or corrosive action of certain soluble zinc salts, especially the chloride and sulphate, on the alimentary canal. This local action is well authenticated, and is not due to a general or systemic toxic effect of the metal or metallic ion.

(2) Brass founders' ague or metal fume sickness is an acute febrile condition resulting from the breathing of very finely dispersed particles of metal or oxide in the form of fume. Though generally associated with zinc it has been produced experimentally with other metal fumes, and is believed to be due to the local action of metallic particles of colloidal dimensions on the lung tissues causing denaturation of protein, which is absorbed, giving rise to a kind of anaphylactic shock.

(3) Chronic or occupational zinc poisoning.

On this aspect there has always been the greatest degree of controversy. Most of the experimental work has been carried out with zinc oxide. The majority of investigators assume that zinc oxide is converted to zinc chloride, lactate, or albuminate in the stomach or other parts of the alimentary canal, but several, such as Heller, consider that it is mostly passed through the intestine unchanged.

The toxic effects obtained by certain investigators who have fed zinc oxide is attributed by later workers to impurities, especially lead, arsenic, and cadmium. Others have fed considerable quantities without appreciable effect. Occupational disease is also generally assumed, and, in some cases, proved to be due to these impurities, particularly lead. Dr. H. Engel(2) (Berlin) reviews this aspect in the publication on "Occupation and Health, No. 353," published by the International

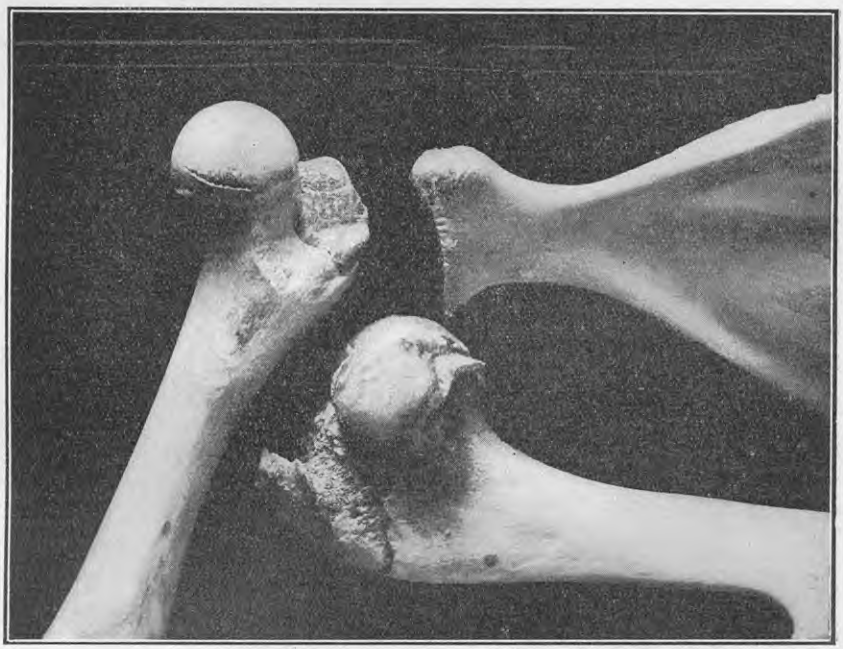

FIG. 3. BONE LESIONS, ZINC-FED PIG.

Labour Office (1931). He considers that pure zinc has a toxicity, if any, similar to copper, and states that zinc ought not to be considered as an industrial poison exerting a general effect due to its absorption. On the other hand, he notes that Kunkel found 28 mg. per kilogram of zinc albuminate given by the alimentary canal to be fatal to the rabbit, and that J. Macht in 1931, by giving 0·5 gm. zinc oxide per kilogram to dogs and cats, caused repeated vomiting, wasting, and shivering, while on the rabbit 1 gm. of zinc oxide was fatal, and 20 mg. caused renal changes. In 1925 Mallory and Parker caused acute glomerulonephritis by injecting 0·5–1 gm. of powdered zinc (metal) under the skin. Kolbert found that non-caustic zinc salts on injection cause paralysis of the central nervous system and vascular system and muscles.

Batchelor, Fehnel, Thomson, and Drinker(3) carried out a comprehensive clinical and laboratory study of the health of workmen in a zinc-smelting works at Palmerton, Pennsylvania. The New Jersey ore used in this works was very low in lead, cadmium, and arsenic. It was found that fifty-one zinc smelters in perfect health excreted each up to 3·9 mg. of zinc per 100 cc. in the urine and up to 133 mg. in the total fæces daily. The amount involved was thus not of an excessively high order, although continuing over a long time. There were no pathological findings.

Drinker, Thompson, and Marsh(4) in 1926 fed cats and dogs with daily doses of zinc oxide of 0·175 gm. to 1 gm. for periods of from three to fifty-three weeks. All three cats on the highest dose (1 gm.) exhibited at autopsy gross hardening and nodular development of the pancreas, which was overgrown with fibrous tissue partially eliminating the islets. The authors did not attach any significance to these findings, as they considered this dosage greatly in excess of any likely to occur in practice. The animals on all other dosages remained healthy, and showed no damage to any organs on autopsy. The evidence submitted does not indicate that more than a very small fraction of the zinc oxide fed was assimilated.

Similarly, Heller and Burke(5) fed rats with amounts of zinc salts of 0·25 per cent. and 0·5 per cent. of zinc in the diet. It is stated that no toxic effect was observed over several generations. The figures appear to indicate, however, a higher mortality of young in the group on the higher zinc ration. The analytical results showed that no increase of zinc in the organs had taken place, and no evidence was presented indicating that absorption of zinc had taken place from the zinc oxide in the alimentary canal.

Discussion.

The results of the present experiment are clearly at variance with those performed elsewhere, and on which the opinion has been expressed that zinc, apart from the local caustic action of certain zinc salts, is a non-toxic metal, or has a toxicity of an extremely low order. To account for the differing results the following points may be considered :—

(1) In the majority of experiments where zinc has been fed to animals over long periods the zinc has been in the form of the oxide. There is no evidence that other than a small fraction of this insoluble compound when fed to animals is rendered soluble by the digestive juices and absorbed. In the few cases where the soluble mineral salts have been fed, it is possible that their local action on the absorbing surfaces of the alimentary canal has tended to hinder absorption and to promote expulsion.

(2) The pig may be an animal peculiarly susceptible to zinc poisoning. It is well known that animals vary in their reaction to various poisons.

(3) The amounts of zinc fed have been comparatively large, although within the range of possibility for animals under farm conditions, as demonstrated by numerous analyses of milk which have been collected from installations where lengthy galvanized-iron pipes are used.

(4) The effects—at least so far as the bone lesions are concerned—may be principally due as suggested to an upset of mineral metabolism.

Further experiments are in progress using half and quarter the amount of zinc to determine at what level demonstrable effects appear in the pigs. A recent report indicates that no further trouble has been experienced on the farm at Atiamuri, where the first case occurred, subsequent to the removal of the zinc from the pipes, although conditions are otherwise unaltered.

ACKNOWLEDGMENT.

The authors wish to thank Mr. D. H. Le Souef, Veterinarian, Wellington, for assistance in obtaining normal pig-organs. The illustrations are from photographs taken by Mr. A. L. Bryant.

REFERENCES.

(1) GRIMMETT, R. E. R., and MCINTOSH, I. G.: Suspected Zinc Poisoning in Pigs. *N.Z. Jour. Agric.*, 1936, *53*, 34.
(2) ENGEL, H.: Zinc. *Occupation and Health*, No. 353, 1931(?). International Labour Office.
(3) BATCHELOR, R. P., FEHNEL, J. W., THOMSON, R. M., and DRINKER, KATHERINE R.: A Clinical and Laboratory Investigation of the Effect of Metallic Zinc, of Zinc Oxide, and of Zinc Sulphide upon the Health of Workmen. *Jour. Industrial Hygiene*, 1926, *8*, 322.
(4) DRINKER, KATHERINE R., THOMPSON, PHEBE K., and MARSH, MARION: An Investigation of the Effect of Long-continued Ingestion of Zinc, in the Form of Zinc Oxide, by Cats and Dogs, together with Observations upon the Excretion and the Storage of Zinc. *Amer. Jour. Physiology*, 1927, *80*. 31.
(5) HELLER, V. G., and BURKE, A. D.: Toxicity of Zinc. *Jour. Biolog. Chem.*, 1927, *74*, 85.

CARCASS-QUALITY IN BACON PIGS.

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PART II.—THE INFLUENCE OF SUPPLEMENTARY CONCENTRATES ON CARCASS-QUALITY.

BOTH in New Zealand and in the United Kingdom critics of the New Zealand methods of raising and fattening pigs practically exclusively on dairy by-products—separated milk, buttermilk, and whey—have frequently expressed the opinion that this method of feeding injuriously affects the quality of the bacon produced from such pigs. Their opinion is undoubtedly influenced by practices that prevail in European countries, and that are not necessarily applicable under New Zealand conditions. In particular, it has been suggested that the feeding of large volumes of separated milk causes thin bellies, and gives rise to the condition described by the trade as "paper flanks."

Accordingly a series of experiments was designed to investigate thoroughly these assertions by comparing the quality of carcasses of pigs fattened exclusively on factory buttermilk with those of others fattened on varying quantities of concentrate meals in addition to buttermilk.

Experimental Technique.

Three series of group-feeding trials involving 106 Tamworth-Berkshire cross pigs were conducted over a period of three years. Detailed description of the technique, feeding, and economy aspects of these trials have already been reported in this journal(9).

Briefly, the appetite of the pigs governed the quantity of buttermilk fed to all groups. With the supplemented groups a grain-meal mixture was fed on a per 100 lb. live-weight per day basis, the actual quantity varying between the different groups. Thus in Series A and B the control group received buttermilk only, and the respective supplemented groups an addition to the daily ration of from ¾ lb. to 2 lb. of meal per 100 lb. live-weight. In each case in these series, supplementing extended over the whole fattening-period. (Table VII.)

On the other hand, Series C was designed to fill in the experimental gaps in A and B by studying in particular the stage of growth at which —if at all—it is beneficial from both the quality and economy viewpoints to supplement buttermilk with concentrate feeds. Accordingly, meal was fed with buttermilk at varying rates and over different growth stages during the fattening-period, which extended from weaning to bacon weights. Thus meal was fed during the early stages from weaning to pork weights, during the late stages from pork to bacon weights, throughout the whole fattening-period, and at a heavier rate during the early stage than during the late. The pigs received buttermilk only during the non-supplemented stages. (See Table VII and Reference 9.)

All pigs were slaughtered as they reached 200 lb. live-weight, and were handled at and after slaughter as described in Part I of this paper, being shipped to London for examination after examination as carcasses at the New Zealand end. For special reasons a few carcasses were not exported, but the data relating to these was recorded in New Zealand.

The results reported are based largely upon the measurements taken by and the opinions of the New Zealand Pig Carcass Evaluation Committee, and the author takes this opportunity of thanking Messrs. H. R. Davidson, John Hammond, J. B. Swain, and N. L. Wright for their careful and detailed work.

Influence of Diet on Thickness and Quality of Streak and Thickness of Bellies.

Data based upon actual measurements only are reported, partly for reasons of space and partly because effects were noticeable only in respect to "internal" quality characters.

A convenient summary of the group results is obtained by examining the average value obtained for each character, expressed on a percentage basis, the standard of comparison being that of the Committee(1).

The general picture presented by these results (Table VII) clearly indicates that the addition of concentrate supplements to the buttermilk ration produced no measureable improvement in the bellies of bacon pigs. Within Series A and B, where the quality of the streak was assessed by measurement on the loin-cut (at last rib) the respective groups are equally efficient. In Series C where evaluation was made by comparison with standard photographs, the efficiency differences existing are in favour of the groups receiving little or no meal.

Table VII.—Summary of Carcass-quality Results.

(Percentage Efficiency.)

—	Series A.			Series B.			Series C.				
	Group 1.	Group 2.	Group 3.	Group 1.	Group 2.	Group 3.	Group 1.	Group 2.	Group 3.	Group 4.	Group 5.
Rate of meal-supplementing per 100 lb. live-weight per day	Nil whole period	1 lb. whole period	2 lb. whole period	Nil whole period	¾ lb. whole period	1½ lb. whole period	Nil whole period	1 lb. whole period(1)	1 lb. early, nil late(2)	2 lb. early, 1 lb. late(1),(3)	Nil early, 1 lb. late(3)
Meal used per 100 lb. dressed-weight gain	..	140 lb.	260 lb.	..	130 lb.	200 lb.	..	120 lb.	40 lb.	160 lb.	85 lb.
Weight range increase covered (dressed weight)	40 lb.–140 lb.			80 lb.–140 lb.			..		35 lb.–140 lb.		..
Number of pigs ..	10	10	10	12	12	12	8	8	8	8	8
Carcass Efficiency.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.	Percentage.
*Streak	94	95	93	87	94	87	51	45	54	44	55
Eye of loin	51	52	54	60	60	60	46	46	51	51	47
Proportion of fat ..	86	73	57	90	80	75	40	34	65	50	69
Length of loin ..	29	19	18	39	33	32	4	0	7	3	3

(1) Whole period: 50 lb. – 200 lb. live-weight. (2) Early period: 50 lb. – 120 lb. live-weight. (3) Late period: 120 lb. – 200 lb. live-weight.

* Series A and B; Evaluation by measurement. Series C: Evaluation by standard photographs.

From the quality angle the belly region should not only be thick but should also contain a high proportion of lean meat. Since the latter is not shown up by a thickness measurement, the method of evaluation by standard photographs is considered the more satisfactory index of belly or streak quality(1). Detailed results by both methods are set out in Table VIII, which also shows the thickness of bellies measured on the uncut carcass as in commercial grading practice.

Table VIII.—Effect on Thickness and Quality of Streak, and on Belly Measurements.

Series and Group Number.	Supplementing-rate.	Streak Thickness and Quality (London). (Frozen Carcass.)			Belly Measurements (New Zealand). *	
		Thickness.	Marks(1).	Marks(2).	Middle.	Flank..
		SERIES A.				
	Lb.	Millimetres.	Percentage.	Percentage.	Inches.	Inches.
1	Nil	52	94	54	1·5	1·1
2	1	50	95	40	1·4	1·1
3	2	50	93	47	1·5	1·1
		SERIES B.				
1	Nil	45	87	65	1·4	1·1
2	¾	47	94	68	1·3	1·0
3	1½	46	87	63	1·4	1·1
		SERIES C.				
1	Nil	Not taken.		51	1·25	1·2
2	120	Comparison		45	1·20	1·2
3	40	standard photo-		54	1·23	1·2
4	160	graphs more		44	1·25	1·2
5	85	satisfactory.		55	1·20	1·2
		Index.				

(1) Marks on measurement. (2) Marks on eye appraisal—standard photographs.

* Measurements as available for commercial grading—uncut side.

The average measurements both on the loin-cut and on the uncut carcass clearly illustrate the failure to influence the thickness of the streak by increasing the dry-matter content of the ration, even though the rate of supplementing was raised as high as 4 lb. of meal per pig daily during the later stages of fattening in Group 3 (Series A). Factory buttermilk as a sole source of diet not only produced bellies as thick as those from pigs receiving more concentrated diets, but the results recorded reach a high standard of efficiency.

The results throw considerable doubt on the theory that bulky diets are necessarily associated with thin bellies. With types of pigs similar to those used in these experiments, the author has not obtained significantly thicker bellies from pigs fattened on a completely meal diet.*

Neither rate of supplementing nor stage of growth of supplementing produced any effect on measurements.

On the other hand, though the results are not strictly uniform, the evaluation of streak on a basis of the proportion of fat to lean as well as on thickness (Marks 2, Table VIII) suggests that the use of meal

* Unpublished data.

has tended to increase the proportion of fat in the belly region. See also Plate II. This effect is in keeping with the increase in proportion of fat as measured in other parts of the carcass.

The thickness results are in agreement with recent work in England(10), where reduction in the water content of the ration failed to effect any significant improvement in bellies. In view of further work(11) which substantiates the practical farmers' belief that a fasting-period before slaughter improves the belly thickness, it must be noted that the pigs in these series were killed after a uniform fasting-period of twelve to sixteen hours. Incidentally the latter offers a more practical method of improving belly thickness by ensuring such a fasting-period than does the provision of special rations. Further, as pointed out in Part I of this paper, the slaughter of pigs at carcass weights of 140 lb. and over rather than at lighter weights can be of material assistance in avoiding excessively thin bellies.

If thinness of belly is associated with belly distension resulting from bulky diets, it is suggested that the negative results from these investigations are due to the fact that the use of supplements even at relatively high levels does not materially reduce the appetite of pigs for milk. This is a regular feature in New Zealand experience.

Influence of Diet on Proportion of Fat to Lean in Different Parts of the Carcass.

The use of meal with buttermilk increased the proportion of fat in the carcass, and the higher the proportion of meal fed the greater was the deposition of fat. This effect is clear from the efficiency awards summarized in Table VII. Details of group fat-measurements in the loin-cut are set out in Table IX.

Table IX.—Effect on Proportion of Fat: Measurements on Loin-cut.

(Frozen Carcass.)

Group and Series Number.	Average Carcass Weight.	Fat Thickness (average).	Range in Fat Measurements.	Average Marks awarded.	Percentage possible.
		Series A.			
	Lb.	Millimetres.	Millimetres.		
1	137	25·4	20–32	17·0	86
2	138	27·4	24–34	14·5	73
3	140	31·0	29–36	11·5	57
		Series B.			
1	136	23·7	20–29	18·0	90
2	138	25·7	22–34	16·0	80
3	139	27·0	23–42	15·0	75
		Series C.			
1	146	29·0	25–37	8·0	40
2	146	29·6	24–36	7·0	35
3	146	26·0	22–29	12·5	65
4	142	28·0	23–38	10·0	50
5	147	25·75	21–27	14·0	70

Note.—Fat measurements taken on loin-cut at last rib, Series A and B at point of eye, and Series C at point 1½ in. in from middle line. Reference(1).

The extent of the increase in fat measurements was not great, but so undesirable is even a slight excess of fat in the commercial bacon carcass that the small increase recorded in the heavy-meal-fed groups was sufficient to produce significantly lower efficiency awards from the Committee. The uniformity of the effect may be judged from the photograph of the loin-cuts of the series showing the greatest effect.

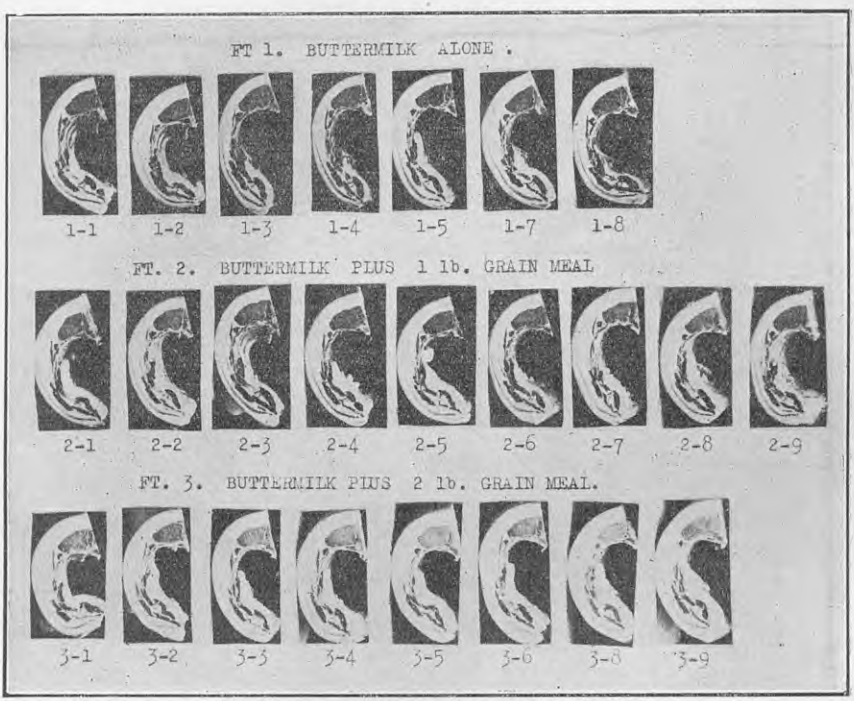

PLATE II.

Within each series the heaviest supplemented groups had a higher proportion of fat as indicated by the measurements on the loin-cut than both the light supplemented groups and the buttermilk-only groups, with one exception. The somewhat anomalous result of Goup 1 of Series C, the fat measurements of which are not in agreement with the tendency of the figures of the comparable groups of the series, nor with the results of the other two series, is rather difficult in interpret. Two points may be noted. A greater individuality effect was recorded in the pigs of each group of Series C than was the case with Series A and B, where the results were more uniform. This was specially marked in Group 1, and suggests that a more sensitive technique than the group-feeding system may be necessary to provide a conclusive finding on the point at issue.

Further, on theoretical grounds, and on the basis of a certain amount of evidence on the point(7, 12), the higher fat measurements of Group 1 might be attributed in part at least to a possible effect of very slow rate of fattening in the early stages, and rapid growth in the later stages(9) upon deposition of fat in the carcass—*i.e.*, accelerated weight-increase resulting from unlimited feeding in the final stages, following a long period of slow growth, might be mostly fat.

The results from Series C do not show any advantage from supplementing at any particular stage of growth, but rather indicate that the important factor so far as fat is concerned is the quantity of meal fed. Proportion of fat was also assessed by fat measurements along the back-line at the thickest point of the shoulder and the thinnest point over the loin. The carcasses were graded on a basis of these measurements according to the New Zealand official grading-scheme.

Table X.—Effect on Shoulder-fat Thickness and Commercial Grading Quality.

Group and Series Number.	Meal-supplementing Rate.*	Back-fat Thickness at		Grading Quality.†	
		Shoulder.	Loin.	First Grade.	Second Grade.
		SERIES A.			
	Lb.	Inches.	Inches.	Percentage.	Percentage.
1	Nil	1·65	1·05	60·0	40·0
2	140	1·70	1·10	40·0	60·0
3	260	1·90	1·20	..	100·0
		SERIES B.			
1	Nil	1·60	1·38	58·0	42·0
2	130	1·65	1·30	42·0	58·0
3	200	1·75	1·37	34·0	66·0
		SERIES C.			
1	Nil	1·76	1·10	37·5	62·5
2	120	2·00	1·20	..	100·0
3	40	1·75	1·00	62·5	37·5
4	160	1·90	1·00	..	100·0
5	85	1·75	1·00	62·5	37·5

* Per 100 lb. weight-gain—dressed carcass. † N.Z. Official standards—grading on fat measurements only, taken on cold dressed carcass (N.Z.).

These results are in agreement with those taken on the loin-cut, a greater thickness of back-fat being associated with heavy rates of meal-supplementing, and the best measurements being shown by the pigs fed buttermilk alone. Little variation in fat over the loin existed. The variations in shoulder fat were responsible for a higher proportion of first-grade carcasses from groups fed buttermilk alone or supplemented at the lower rates. It is to be noted that the shoulder-fat measurements and grading results of Group 1, Series C, bring this group more in line with the related results.

In respect to this tendency for meal-supplementing to produce an increased proportion of fat in the carcass, several points of practical significance arise. The inherent tendency of New Zealand bacon pigs to carry too high a proportion of fat has been demonstrated in Part I. Any system of feeding which may accentuate this tendency is potentially dangerous on economic grounds. Yet other economic advantages of meal-feeding makes the limited use of supplements with by-products highly desirable. Rather than these investigations, therefore, suggesting the abandonment of a system of feeding with many husbandry and financial advantages(4, 9, 13), they point to the necessity for improvement in the type of pig in New Zealand to one capable of producing carcasses with the correct proportion of fat at bacon weights.

In view of the findings of Hammond(2, 5, 6, 12) on growth in pigs, it is not surprising that by accelerating growth with the early-maturing types of pigs used in these experiments the additional energy supplied by the meal was deposited largely as fat. The greater proportion of fat in all groups of Series C as compared with those of A and B was undoubtedly due to the excessively short pork-type pigs used in the former.

Finally, it is suggested that the results brought forward herein demonstrate clearly that the feeding of buttermilk improves the quality of bacon carcasses and that the excessive fat in New Zealand baconers is due more to the use of rapid-maturing pork-type strains than, as is commonly believed, to the feeding of pigs exclusively or almost exclusively upon dairy by-products.

Influence of Diet on Firmness of Fat.

The quality of the fat as well as its quantity is a factor of considerable importance in the carcass-quality of bacon pigs. The fat should be as hard as possible because soft fat readily becomes rancid. A hard fat is particularly essential in carcasses which have to withstand the strain of long periods of freezing and storage(3) as do pigs from New Zealand destined for the United Kingdom market. The following table gives details of the iodine values obtained in England from the pigs of Series C.

Table XI.—Quality of Fat Hardness.

Series C Group.	* Iodine Numbers of		Meal fed per 100 lb. Carcasses.
	Frozen Carcasses.	Cured Bacon: Fat.	
			Lb.
1	57·5	55·2	Nil
2	57·3	58·6	120
3	57·7	55·6	40
4	57·4	56·7	160
5	57·0	56·9	85

* Composite group samples.

These iodine values are in all cases markedly lower than those quoted elsewhere for pigs fattened in other countries. They show that buttermilk produces a firm fat, and that the firmness is not reduced when the milk is supplemented with meal up to 2 lb. per 100 lb. live-weight daily. They also clearly demonstrate that New Zealand pigs have definite advantages for storage in case of necessity.

Summary.

Experiments carried out with over a hundred pigs divided into groups and fed, in addition to unlimited supplies of factory buttermilk, quantities of meal varying from nil to 2 lb. per 100 lb. live-weight daily, show that—

(*a*) The addition of meal to a buttermilk diet does not increase the thickness of belly:

(*b*) There is no evidence that thinness of belly is attributable to feeding unlimited supplies of buttermilk:

(*c*) Buttermilk produces carcasses with a lesser proportion of fat than buttermilk supplemented with meal, but this feature is not marked when the meal fed does not exceed a rate of 1 lb. per 100 lb. live-weight daily :

(*d*) The type of pig exerts a greater influence than the type of diet on the proportion of fat to lean in bacon carcasses :

(*e*) The fat of pigs fed on buttermilk and buttermilk plus meals is particularly hard.

ACKNOWLEDGMENTS.

In a project of this magnitude it is impossible to acknowledge adequately all those who necessarily played an essential part in the work. Particular thanks are due to Mr. W. J. Croucher, Recording Officer, Manawatu-Oroua Pig Development and Recording Club, for most valuable and extensive assistance, mention of which was made in Part I, and to the members of the New Zealand Pig Carcass Evaluation Committee, Messrs. Hammond, Davidson, Swain, and Wright, for their invaluable co-operation and assistance at the London end. The work would also have been impossible without the active support of the following organizations : Kiwi Bacon Co., Longburn ; N.Z. Co-operative Pig Marketing Association ; Cheltenham Dairy Co. ; H. R. Lane and Co. ; Jos. B. Swain and Co. ; Smithfield, Empire Bacon Co., Newcastle ; N.Z. Department of Scientific and Industrial Research. Special thanks are due to farmers who supplied pigs and necessary information, and to Mr. A. Webb, of the Kiwi Bacon Co., Mr. H. E. Thurston, of the Cheltenham Dairy Co., and to Professor W. Riddet, all of whom were of material assistance in planning and organizing the work.

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REFERENCES.

(9) McMEEKAN : N.Z. Jour. Agr., Dec., 1936.
(10) Annual Report West Scot. Agr. Coll. Pig Breeders Ann., 1936–37.
(11) CALLOW, *et al.*, Report Food Investigation Board, 1935.
(12) HAMMOND. Unpublished data.
(13) McMEEKAN and CROUCHER : N.Z. Jour. Agr., *53*, 1, 1936.

GRADING OF MALTING BARLEY IN NEW ZEALAND.

Fields Division.

GROWERS of barley in New Zealand have long desired the setting-up of definite standards as a basis of barley sales, but until 1936 little or no concerted effort on their part was made to bring this system about. However, following the 1936 harvest, a definite move in this direction eventuated which resulted in a meeting of representative growers in Christchurch in June, 1936, urging Government fixation of prices and official grading.

It is obvious that, unless there is very keen competition between maltsters for the produce of any district and the absence of any alternative source of supply, a basis of sale in which the buyer is the sole judge of quality falls far short of the ideal. For some years past this element of competition has become a diminishing factor by reason of amalgamation of brewing interests. The proximity of the South Australian market, from which very large quantities of malting barley have been imported of recent years, has further restricted competition. In Table A a statement of the importations during the past six years shows clearly the growing tendency on the part of maltsters to rely on this source for their requirements.

Table A.

Calendar Year.	Imports of Malting Barley.
	Bushels.
1931	11,992
1932	20,814
1933	81,060
1934	88,184
1935	161,628
1936	265,638

Action taken by the Government to curtail imports and the introduction of the compulsory contract system, whereby maltsters are required to arrange contracts to cover their requirements, will do a great deal towards altering matters in this respect.

While the curtailment of imports and the contract system will improve the position for barley-growers, it has been the policy of the Government to explore the possibilities of grading to defined standards. This problem is, however, one of some magnitude, and it may be well to survey the position in other countries.

In a report submitted in 1936 by the Standards Association of Australia to the Commonwealth Council for Scientific and Industrial Research on the subject of Standardized Grading of Primary Products the barley-grading practice in several countries is briefly reviewed.

United States of America.—The grade requirements are based upon weights and percentages of sound barley, heat-damaged kernels, foreign matter, broken kernels, black barley, and wild oats.

Canada.—The grades (3) for malting barley cover minimum weight per bushel, minimum percentage of varieties or type, "sound" quality and maximum limits of seeds, wild oats and other grains.

Germany.—Groups (3). Set percentages of foreign bodies (including weeds), other grains, broken and crushed grain, sprouted grains, moisture content, and germination capacity.

U.S.S.R.—Grading is based on external characteristics and analysis. External characteristics take cognizance of smell, taste, and insect-infestation. Analytical characteristics cover uniformity of size (Fogel apparatus), farinaceous and half-glassy grains, weight per 1,000 grains, sprouted grains, germination energy, moisture content, and albuminous content.

Argentine.—Grading is based on condition of grain, minimum weight, percentage of "feed" barley, wild oats, foreign matter, stained, skinned and broken, heat-damaged, sprouted, smutty, and weevil-infested grains.

Great Britain.—The position in Great Britain is somewhat obscure. Apparently buyers have quite definite standards, based upon external characteristics such as feel, smell, &c., upon which they work. No allowances are fixed for such analytical points as purity, germination, moisture, &c., though probably these points are taken into consideration. Information is not available as to the extent, if any, to which analytical standards could be applied to barley-grading as the result of work which has been carried out by the Institute of Brewing during the past eleven years. There is evidence, however, of a tendency to attach a good deal of significance to nitrogen content, although admittedly this factor is still (as for the past thirty years) too complicated to be yet adopted as a sole indicator of suitability. From a knowledge of the nitrogen content of a sample of barley it appears to be possible to forecast with reasonable accuracy the potential yield of extract from the line. This information is very important to the maltster, especially when he is dealing with barley which he knows to be of a suitable type. Where the nitrogen test seems to fail is that it gives no indication of the quality of the malt which will result.

The difficulties confronting the English worker are perhaps somewhat modified in New Zealand, as we have for all practical purposes only two varieties of malting barley, and the differences of soil and climate and the reaction of these factors on the quality of the grain are not pronounced as in Great Britain, where barley is received from such widely divergent sources as California, Northern Africa, Persia, Czechoslovakia, and India, in addition to their home-grown barley. Work along the lines of nitrogen percentages and based on British findings to date should be well worth while in New Zealand.

Australia.—Reference has previously been made to the report of the Standards Association of Australia. This report, after considering the arguments for and against standard grading, reviews the Australian position as follows:—

"It is quite apparent that in the opinion of the majority of those consulted there would be problems to be encountered which would make the institution of a system of standard grading of malting barley a most difficult, if not an impossible, undertaking. The impracticability of defining accurately and adequately in a

written description those qualities which would be regarded as the criterion for approval for a grade classification is by no means an unusual difficulty in standardization experience.

" In some instances it is possible to prepare a standard of grading which, while requiring some supplementary means of quality determination such as actual tests in use, are nevertheless of unquestionable benefit and assistance. The standard grading may provide the preliminary determination for approval, and, by doing so, eliminate a large proportion of the sub-grade samples. In other words, all those samples which fail to pass the tests and visual examination provided in the standard would be unsuitable for acceptance, but some of those which pass the standard requirements would not be suitable and would require to be eliminated subsequently by a supplementary means of determination.

" Sometimes this supplementary check is in the form of a standard sample, and the product is required to be similar to or of quality equal to the standard sample in respect of features not specifically recorded in the standard specification.

" A standard which is dependent upon accessory determinations would indicate but would not specify in detail the supplementary approval that would be necessary. Whether such a type of standard is likely to be of any value depends upon the conditions relating to the product under consideration.

" In other instances the only specific requirements that it is practicable to record in a written specification are so limited in extent and of such restricted value that it is definitely not worth while endeavouring to apply a standardized grading until human knowledge on the subject in question has been greatly extended. It is wiser in such cases to defer attempts at standardization and to encourage research with a view to the desired extension of knowledge.

" It is a matter for careful judgment as to the practicability of drafting a grading standard for malting barley which would be of value either as a partial or a complete guide for determination of quality.

" Much has been said regarding the impossibility of applying a standard grading because of the diverse requirements of various users. Again quoting from standardization experience this may or may not be a valid objection. A standard grading may fix the requirements for a single grade of approved quality, or it may determine a range of grades suitable for a variety of purposes in use. The range of grades may be unlimited in extent, and it is common practice with regard to grading either of primary or manufactured products to provide for multiple grades. Obviously, however, if the number of grades be extended too greatly, the advantages of standardization are largely forfeited and the system may become cumbersome and economically unsound.

" In the case of malting barley, therefore, the question to be answered is whether the number of grades customarily required by the user is small enough, or could be sufficiently curtailed without detriment, to permit the adoption of a reasonable range of standard grades.

" The argument that the present practice is so firmly established that a drastic change of practice would be vigorously opposed is a difficult one to combat. It is the problem of overcoming the inertia of conservatism. If the proposed change of practice would definitely be advantageous it is necessary to consider whether the inertia may not be overcome, either by the gradual penetration of new ideas or by a measure of control in the public interest. Before such steps are taken, however, there should be very real conviction that the benefits to be derived warrant the effort.

" An important feature of the discussions on this problem is the distinction between the conditions governing purchase for the Home market and conditions of oversea trading. A standard grading might conceivably be justified for one and not for the other.

" Perhaps the most significant of all the features of this inquiry is the conflict between the claims as to impracticability of standard grading and the fact of the existence of systems of standard grading, not only in other countries, but also in Tasmania. This contrast appears worthy of careful consideration as to whether the practice of standardized grading as recorded is found satisfactory, and, if so, whether equal satisfaction could be assured in the application of a standard to the marketing of all barley produced in Australia or possibly to the export only of barley from Australia."

Table B.—Grades of Malting Barley.

	No. 1 Grade Superior shall be dry, plump, bright, sound, clean, and free from other Grains.	No. 1 Grade shall be dry, plump, bright, sound, clean, and free from other Grains.	No. 2 Grade shall be dry, plump, sound, reasonably bright but not stained, reasonably clean, and free from other Grains.	No. 3 Grade shall be dry, plump, slightly stained and reasonably free from other Grains.	No. 4 Grade must be reasonably dry, plump, and reasonably free from other Grains; may be stained and weathered.
The maximum allowance permitted in each grade shall be as under (all percentages being in terms of weight) :—					
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Flinty grain	0·5	0·5	0·5	0·5	0·5
Foreign matter (weeds, chaff, straw, &c.) ..	0·5	0·5	1·0	2·0	2·0
Wild oats	0·5	0·5	1·0	2·0	2·0
Skinned and broken grains	2·0	3·0	4·0	5·0	5·0
Tares and other round seeds	5·0	5·0	5·0	5·0	5·0
Sprouted grains	Nil	Nil	Nil	Nil	3·0
Moisture	15·0	15·0	15·5	16·0	16·0
Bushel weight	52 lb.	52 lb.	51 lb.	50 lb.	50 lb.
Disease	Trace	Trace	Trace	Trace	Trace

Prior to grading all barley shall be screened through a 6A screen. The maximum amount of screenings permitted for malting barley shall be 20 per cent. Screenings under 20 per cent. shall be subject to dockage at the rate of ½d. per bushel for every 2 per cent. over 5 per cent. On tares and round seeds left in the screened sample there shall be a dockage deduction on a weight-percentage basis at the rate of ½d. per 1 per cent.

The maximum district price is payable in respect of No. 1 Grade Superior only. The price for No. 1 Grade is 1d. per bushel lower, the price for No. 2 Grade is 3d. per bushel lower, the price for No. 3 Grade is 6d. per bushel lower, and the price for No. 4 Grade is 9d. per bushel lower than the maximum district price in each case.

New Zealand.—Under no misapprehension of the difficulties of the problem and conscious of their limited knowledge of the subject, officers of the Department tentatively explored the possibilities of establishing standard grading for New Zealand. They were encouraged by the fact that the bulk of malting barley was purchased by two firms and that there was reasonable conformity in the whole of the malting barley produced in the Dominion. It was finally decided that there was a reasonable chance of setting up successfully standard grades, based partly on appearance and partly on physical determinations. The Government decided that barley grading *for those lines in dispute as to quality between buyer and seller* was practicable, and a Committee was set up to formulate mutually acceptable standards for adoption as official standards in such cases. To this extent only have malting-barley standards been adopted in New Zealand. It is hoped during the coming year to secure evidence as to the efficacy of the standards set up.

The Committee was as follows:—

A. Anderson, Leeston	Representing growers.
J. H. Gordon, Garston	
J. H. Hewlett	Representing maltsters.
A. B. Duncan	
R. B. Tennent (Chairman)	Representing Department of Agriculture.
J. M. Smith	
F. E. Cameron	Committee Secretary.

The standards are given in Table B. It should be pointed out, however, that while No. 1 Grade Superior is the objective towards which the grower should aim, we have no knowledge that such barley is the most suitable for *all* malting purposes.

Research Work.—Much work can be done by way of manurial trials in relation to soil types and climatic conditions, investigating the disparity in yields in the various growing districts, and kindred matters. If this work could be supplemented by or co-ordinated with analytical and bio-chemical work there is no doubt that considerable improvement could be effected. The work would perhaps not bring about immediate results, but in the long run—especially if close contact with overseas institutes were maintained—there appears no reason to doubt that it would prove its value to the industry. The initial expense would be heavy—it would probably be necessary to construct and equip a small malthouse and laboratory, &c.—but the problems confronting the industry are many and our present knowledge meagre. How could it be otherwise? Workers in Great Britain after years of specialized research are still far from understanding the full significance of many factors.

—*F. E. Cameron, Secretary, Barley Advisory Committee.*

Check-testing Suppliers' Milk and Cream Samples at Dairy Factories.—During the year check tests numbering 440 were carried out by Divisional officers. A pleasing feature of the testing as carried out by the dairy companies is the very few variations found between the factory results and the check tests. It is now the exception for the Division to receive samples of milk or cream from suppliers for check-testing, which is an indication that the factory testing is being carried out on approved lines and that suppliers generally are satisfied with the general accuracy of the factory tests.—*Annual Report, Director of the Dairy Division.*

DESTRUCTION OF ANT-NESTS IN BOWLING-GREENS.

ANTS are common in soil throughout the Dominion, and are quite frequently found in lawns. The treatment recommended is the use of carbon disulphide or of calcium cyanide in the dust form. To apply carbon disulphide, punch holes in the soil about the nest to a depth of 8 in. to 12 in., depending on the size of the nest. Into each of these holes pour about one tablespoonful of carbon disulphide and cover the top of the hole with moist earth. It is a good plan to cover the top of the treated nest with wet sacking. It must be remembered that carbon disulphide is poisonous and inflammable, and the fumes must not be breathed or a light of any kind allowed near: even smoking must not be allowed near the scene of operations.

Calcium cyanide, in the dust form, may also be used for destroying ant-nests. This is best applied to holes made in the soil in and around the nest. Several holes should be made 2 in. or 3 in. apart. The cyanide should be applied with a funnel, a teaspoonful to a hole, putting it only in the bottom of the holes. Fill the holes with earth immediately after application of the cyanide, which, if scattered over the surface of the ground, is likely to kill the grass or other plants. Calcium cyanide and the gas from it are very poisonous, and care must be used in handling it.

—*Horticulture Division.*

In general, New Zealand farming has to face steadily increasing competition from other agricultural countries upon our export markets. One of the most effective means of meeting this competition is improvement not only in the quality of our export products, but in the quality of all those other farm-products upon which the quality of our export products at times depends. There is scope also for improvement in the handling of our products.—*Annual Report, Minister of Agriculture.*

SEASONAL NOTES.

THE FARM.

Provision of Reserves of Feed.

THE report of the Dairy Industry Commission, 1934, contains the following statement: "It can be fairly stated that the quality of our dairy cows at the present time is, on the average, better than the efficiency displayed in their management and feeding." In practice this statement has been given much less attention than it warrants. It enunciates a truth which much evidence from the field shows is applicable equally to our sows and to our breeding-ewes. This truth provides important guidance in the drawing-up of a programme of the work of the coming year in respect to the provision of special feed. At this season with distinct advantage such a programme may be drawn up tentatively; although it is likely to be advisable to modify such a programme later because of developments which could not have been foreseen, it may be expected to be of service in the meantime in the making of decisions about such matters as the location of fences and of silage pits or trenches and the arranging of cultivation work, all of which should be planned as soon as possible so that labour may be provided for them from now onwards as opportunity offers.

Useful guidance in drafting a programme of special feed provision lies in the fact that in the past provision as a rule has been distinctly inadequate. Inadequate supplies of feed to supplement that available directly from pastures in winter and early spring usually lead to two distinctly undesirable results, one of which, while much less obvious than the other, is probably more serious. The more obvious of these results is a poorer return from live-stock, frequently due in part at least to greater incidence of disease. Important aspects of this relative to sheep-farming were discussed in this column in February last, while in regard to dairying it must suffice now to state that there is a general agreement that losses from a wide range of troubles are magnified as the result of poor feeding in winter and early spring—*e.g.*, losses due to udder troubles and to internal animal parasites.

Poor Feed-reserves inseparable from Poor Utilization.

The other serious though generally not so apparent result originates in the fact that inadequate provision of reserves of feed for use in the winter and early spring is inseparable from poor utilization of that grassland: if such reserves are too meagre the farmer is forced either to overstock his pastures in winter and early spring or to understock them in summer or, what is more common, both to overstock and to understock them at the respective seasons specified. In all three cases poor utilization is an inescapable result. To understand the full bearing of this it is necessary to recall that recent important advances in our knowledge of grass-farming relate to the basic importance of utilization of feed from grassland as a factor governing the returns from that grassland. Hanley, of the School of Agriculture of Cambridge University, touches on one aspect of this matter in the January, 1937, *Journal of the Ministry of Agriculture*, England, in stating:—

"Though fertilizer applications can do much to ensure a satisfactory amount of good-quality herbage, other points in management, especially the density and periods of stocking, have frequently a much more immediate and pronounced effect on the productivity of a pasture."

Outstanding Importance of Utilization.

In New Zealand farming the concept involved in the statement is a momentous one, which already has been confirmed fully in New Zealand experience. It is momentous because it calls for the development in many of us, and maybe in the majority of us, of a changed outlook. This changed outlook would lead firstly to our not concentrating attention so completely upon what may be termed "direct" means of increasing the productivity of grassland—*e.g.*, top-dressing, the use of better strains of pasture species, &c., and secondly to our giving greater attention to the method of utilizing the growth of grassland with the dual objective not only of making most effective use of current growth but also of fostering future growth as fully as possible.

And this brings us back again to the fact that, if the reserves of feed for winter and early spring are inadequate, it is possible neither to make the best use of current growth throughout the year nor to foster the fullest future growth. Inadequate reserves of winter feed lead to overstocking or understocking as already indicated: overstocking at best means that too large a proportion of feed is used solely for maintenance; understocking means wastage.

There remains for consideration the effect upon the pastures themselves. The joint influence of overstocking and of understocking at the respective periods mentioned is weakening of a species which grows when the grazing is severe and strengthening of a species which grows when the grazing is lenient. In practice over wide areas the result is a weakening of the early developing rye-grass and strengthening of the late brown-top and sweet vernal. Unfortunately, examples are altogether too readily available.

Measures to improve Reserve-feed Position.

A most valuable and effective means of improving the feed position is conserving the surplus of summer feed in the form of silage or hay. In some cases, however, there has been a tendency to place too much dependence upon the reserves of feed that actually are built up in the form of silage. To this matter there are three distinct aspects that require consideration. In the first place, because of weather vagaries from year to year, there is no certainty whatever that in next summer there will be enough surplus grass-growth to give reasonably safe supplies of silage. In the second place, on account of various factors, human and otherwise, assuming an adequate surplus of grass-growth for the purpose under consideration, experience teaches us to expect a marked disparity between the potential reserves of silage and the actual reserves. It may be contended that the disparity is due to faulty management, but for practical purposes the crux of the position lies in the fact that such a disparity is customary and so must be allowed for in any planning that professes to cover the position as it is as distinct from the position as it might be or as it should be. In the third place, ensilage as commonly carried out gives feed that fails in respect to the quality required for certain important purposes in dairying—*e.g.*, the feeding of cows in late summer and the feeding of pigs with farm-grown material when the supply of dairy by-products is inadequate. Because of these and other facts most farms, including those on which ensilage and hay making are given a prominent place, could profitably undertake some special cropping for the purpose of creating reserves of feed.

Judicious top-dressing, which was discussed at some length in these notes last month, is considered briefly below in part of its relation to seasonal supplies of feed.

Special Supplementary Crops.

Of current importance in regard to crops grown specially to supplement pastures during critical feeding periods is the fact that the mangel, which is of especial value, when sown after grass often gives the largest and most profitable crops, and this especially when ploughing about May is practised. Ploughing at this stage assures enough time for the thorough decay of the buried sod, and this decay gives a more fertile and tractable soil. If ploughing at this stage is not practicable it becomes necessary to carry out in the spring a skim-ploughing followed by a deep-ploughing, or, alternatively, a disking of the sod before deep-ploughing.

Late autumn or early winter cultivation, in preparation for such crops as carrots, lucerne, and potatoes, is frequently well justified, especially when these crops follow old pasture. A main objective of such cultivation should be the thorough breaking-up of the sod, and this usually may be effected suitably by skim-ploughing followed by disking, which in turn is followed by a normal deep-ploughing in the spring.

At this stage it pays to base procedure on the well-established fact that a common cause of unprofitable yields of the crops under consideration is inadequate preparatory cultivation. Hence in districts in which the amount of arable cropping carried out is substantial, no opportunity should be missed of cultivating the land in preparation for spring sowing. In this respect it may prove of assistance to bear in mind that old lea land can sometimes be cultivated safely when nearby similar land which has been under the plough recently is too wet for satisfactory results from cultivation.

Pre-winter Top-dressing.

What takes place in the case of good well-top-dressed pasture at Marton does not differ radically from what takes place in the case of similar pastures in much of the North Island. Work done at Marton shows that for several weeks in winter the daily production of pastures probably is not greater than 8 lb. to 10 lb. of green herbage an acre. Merely to maintain herself alive without loss of weight the average dairy cow requires approximately 30 lb. of green grass herbage or its equivalent daily, and if she is producing butterfat she requires an additional 30 lb. to 60 lb. of such feed daily according as her production ranges from 200 lb. to 400 lb. of butterfat a year. These data which enable pasture-production to be compared with feed requirements at the periods mentioned are useful as an indication of the extent to which good, well-manured pastures meet or rather fail to meet the needs of stock during the period of low growth in winter. They are useful also as an indication of the advisability of carrying out pre-winter top-dressing well ahead of the season of low growth so that the fertilizer stimulates the pastures while they are still making growth rapidly enough to give an increase of real practical moment. What seems not to be realized sufficiently is that pre-winter top-dressing carried out close to the period of really low winter growth does not materially affect the winter supply of feed, whereas similar top-dressing carried out some weeks earlier may substantially improve the winter-feed position. From this it follows that where pre-winter top-dressing has not been done already it should be proceeded with as quickly as possible. In short, in our grass-farming we should give greater consideration than generally we seem to give to the really small quantity of herbage actually grown even with the assistance of top-dressing during the winter period during which warmth is the dominant factor determining the rate of growth.

The Cereal Crops.

The guidance relative to cereal crops tendered in these notes last month applies generally to matters calling for attention in April and May. The treatment of the seeds of cereals for the control of certain diseases seems not to keep pace completely with recent advances in such treatment. As these advances beget safety and convenience in the work without making it unduly expensive, those who are not yet putting them into application certainly should consider carefully the advisability of doing so. Full information about such seed treatment is obtainable from officers of the Fields Division.

Autumn Utilization of Crops.

Because of their immaturity, and especially because this year conditions have been favourable to the development of attacks of internal parasites, calves and hoggets are likely to suffer severely and maybe to be permanently stunted unless they receive good treatment from now onwards for some months. Worms are of common occurrence, and are often present in stock without doing any apparent damage, while at other times they do great damage. Hence there must be more than one cause operative before worms cause serious damage. In support of this there is much experience both in New Zealand and overseas which points to the conclusion that worms much more readily cause grave trouble in stock which are not looked after well. Stock should not be allowed to get into a low condition before they are given good treatment. Hence young stock should be trained to eat such material as silage and hay while they are still in good condition and thriving, and before they will be called upon to live almost wholly on these unfamiliar feeds, a gradual introduction to which assists valuably in avoiding the set-back at times suffered by stock subjected to sudden changes in feeding. Hoggets being fed largely on standard special fodder crops such as turnips should as a rule be given a run-off on suitable pasture—one which is short, clean, and fresh.

It is significant that some who consistently have been successful with lucerne adopt the practice of having growth a few inches in height on the lucerne area at the beginning of winter. Such a growth is of value in checking the development of seedlings of those weeds which are capable of outgrowing lucerne when the temperature falls below a certain point: the foliage on the lucerne checks such seedlings to the extent that it deprives them of a supply of direct sunlight. Further, if the growth on lucerne is removed just before winter some fresh growth usually takes place. This is a drain on the crop which weakens it, and this weakening is specially undesirable in those many cases in which lucerne requires its maximum strength to be successful in the competition with invading plants that regularly takes place in the spring. Should a lucerne area be invaded heavily with useful plants such as rye-grass, cocksfoot, and clover, it may quite well be sound practice not to try to free it from such invaders, but to treat it as a pasture from which it may be possible to obtain annually two or three cuts, to some or all of which the lucerne contributes substantially.

Care of Young Pastures.

At this season care should be taken to avoid both too lenient and too severe grazing of young pastures. The most beneficial grazing of young pastures usually results from stocking with a relatively large number of animals for a short time. This avoids the undesirable selective browsing of the more attractive species which may take place under light stocking. Too lenient grazing is likely to be harmful when a quickly developing temporary species such as Italian rye-grass is very

prominent or even fairly prominent in the pasture: such a temporary species is likely to outgrow the valuable slower permanent species and to injure them by shading.

—*R. P. Connell, Fields Division, Palmerston North.*

THE ORCHARD.

Harvesting and Storage of Fruit.

DURING the coming month picking, packing, and marketing of apples and pears will continue to engage the attention of the fruitgrowers. Every care should be exercised in the handling of the fruit so as to avoid the damage and subsequent deterioration which is caused through rough handling and lack of judgment in the picking. At this time of the year the fruit is frequently wet with rain or dews. As far as is practicable the fruit should not be gathered until it is perfectly dry. This point is more important in respect of fruit which it is intended to store for a time. Only sound, mature fruit should be placed in storage. Growers who have mid-season varieties stored in their sheds should examine the fruit at frequent intervals, and immediately it shows indications of "going off" no time should be lost in placing it on the market. Fruit which should be marketed at once is frequently held until it has deteriorated considerably. As a result of its condition of advanced maturity in conjunction with the handling, such fruit invariably arrives at the market in an almost unsaleable condition, which leads also to waste. Such late-maturing varieties as Statesman, Rome Beauty, Tasma, Sturmer, &c., which are firm-fleshed, will, with proper treatment, keep longer than mid-season varieties. In consideration of this, in the main, varieties of this class should be given preference in the matter of cold storage. Delicious, although classed as a mid-season variety, holds well, as a rule, in cold storage. A cool, even temperature should be maintained, moderately dry, but not sufficiently dry to cause the fruit to wilt. In situations at the orchard where the average daily temperature is not low at this time of the year, and when there is considerable fluctuation between the day and night temperature, fruit intended for long storage should be placed in a cool store. It is advisable to repack stored fruit before placing it on the market, as there are usually some fruit affected with storage rots, and these fruit, if not removed, will cause a considerable reduction from the price otherwise obtainable.

Late Spraying.

Following the completion of the harvesting it is advisable to spray stone-fruit at leaf-fall—*i.e.*, when the leaves commence to show autumn tints and to fall—with Bordeaux 5–4–50. For the better control of brown-rot, leaf-curl, die-back, &c., stone-fruit trees should be examined carefully and all cankered and infested shoots, laterals, branches, and mummified fruits removed and destroyed by burning, for in such tree-parts the fungous diseases over-winter.

Drainage.

Good drainage is very important. The drainage of heavy retentive soils should not be neglected. Tile drains, though more expensive, give the best results, and are the most convenient and permanent type of drain for the orchard. Existing open drains should be cleaned and put in order so as to enable the drainage water to pass away freely.

Ploughing and Manuring.

The orchard should be ploughed as early as possible after the fruit crop is harvested, so that the work may be completed before it is too wet for working.

In circumstances where a green crop has been sown and has not reached a sufficient height, it is as well to delay the ploughing for a while, to obtain the benefit of any additional growth the crop may make during late autumn and early winter. The soil is greatly benefited by being exposed to the winter frosts and rains. To facilitate the surface drainage the land should be ploughed with the fall, and not across the slopes. Plough to the trees, leaving an open furrow along the centre of the land between the rows of trees.

It is recommended that deep-ploughing should be done, towards the centre of the rows, in autumn, as the effect of any injury to the feeding roots at this time of the year would be less than when the trees are in growth. When ploughing close to the trees shallow-ploughing is advisable, as otherwise serious damage to the root system may occur, which would result in a considerable check to the growth of the trees.

Applications of phosphatic and potassic manures may be made during the autumn just prior to the ploughing of the land. Soils requiring lime may be top-dressed with approximately 1 ton of carbonate of lime per acre. The application of the quickly acting nitrogenous fertilizer may now be delayed until the spring.

—B. G. Goodwin, Orchard Instructor, Christchurch.

Citrus Culture.

By the time these notes appear in print the month of April will be practically over so that winter weather conditions will be close at hand, if they have not arrived already. In the notes for almost every month mention has been made of the application of sprays—Bordeaux mixture, summer oil, &c.—and it is just possible that critical readers may say that according to the writer one should be spraying almost continuously. This, of course, is exaggerating the case, although it would be safe to say that owing to the unfavourable weather conditions which have prevailed during the past two years, particularly with regard to the incidence of fungous diseases, more than the usual amount of spraying has been necessary. These notes are intended to be a guide and a reminder for the work which may be expected to be necessary under certain conditions. It is for the individual grower to work out and adopt his own programme to suit the particular requirements of his own grove. The local Orchard Instructor is always available to assist with advice if required. Although it is advantageous to exchange views with one's neighbours it does not necessarily follow that the same time-table and spray programme should be carried out unless all conditions are identical. A few basic principles which may be used in determining the disease-control programme are—Prevention is easier and less costly than cure; spray applications if applied at the correct strength and at the right time are good insurance against loss of crop, and thus loss of the whole year's labour; thorough work is absolutely essential, as also is an efficient spraying plant; the trees should be kept in a condition which makes good crops a reasonable certainty, not a doubtful possibility.

Apart from spraying, however, there are often other matters in connection with disease-control which require the careful consideration of the grower. One of these is drainage. Instances have come under notice of patches of orchard containing a few trees which were always infected with fungous disease while the balance of the orchard was clean. Investigation revealed the fact that in these patches the soil was water-logged, and in hot weather the humidity around the trees was excessively high. Improvements in drainage eliminated the trouble. It may be that, in cases where it is particularly difficult to control fungous diseases, the drainage of the whole orchard is poor, in which case extra money spent on improvements in this direction should be well repaid by better fruit and reduced spraying-expenses. Physiological diseases, such as die-back, are often caused by poor soil drainage. Lack of shelter is often the indirect cause of a fungous disease,

wither tip, which does considerable damage to the foliage, twigs, and fruit. The fungus gains entry to trees which have become low in condition. Several instances have occurred of a bad outbreak in young trees which have been exposed to high winds. Attention to the matter of improving shelter is thus an important part of disease-control. However, it is possible for shelter to be overdone, and an endeavour to obtain the happy medium of shelter from damaging high winds while maintaining sufficient air circulation to reduce humidity should be aimed at. From the foregoing it will be seen that, apart from spraying for the control of disease, careful attention must be given to other important factors, and it is suggested that this time of the year, when the pickings are not yet heavy and the soil is still workable, is appropriate for action in this matter.

Frost protection is a problem which must be considered by nearly all citrus growers in this country, since there is not a very great area which is frost-free. Here again the matter must be investigated thoroughly by each individual orchardist, as even adjacent groves vary considerably in their liability to frost. While damage to citrus trees in New Zealand is often measured only by the amount of injury done to the young wood, there is evidence that more serious, though often not so noticeable, harm is done to the crop, particularly in the case of lemons. Severe frosts, of course, cause a dropping of fruits and foliage, but lighter ones cause premature colouring, a slowing of the growth of the fruit, and often extensive blemishes which reduce the grade of the fruit. Through the failure of the fruit to " size up " normally, its natural life has been almost expended before it is picked, with the result that keeping-quality suffers, and this is reflected by the increased amount of decay in curing-rooms at the period when the bulk of the frost-injured fruit has been picked. The avoidance of this trouble may play a definite part in the production of better fruit. Unfortunately, whereas deciduous trees while dormant are able to stand most of the frosts of winter, and require protecting only against one or two which generally come at the critical fruit-set time, citrus trees, provided the frosts are severe enough, are liable to damage over the whole period of winter: this makes the task of protection much more costly and difficult. There are some growers who have successfully carried out orchard-heating, while others who have purchased oil-pots have thrown them aside after a trial or two and given the job up. The nature of frosts varies so much from orchard to orchard and from time to time that even those who are more or less prepared are taken unawares at some period or other, and the expense and hard work of the other occasions are nullified. In places the drift of cold air is so great that it is difficult to keep the heated air over the orchard, but this same drift, provided there is a ravine or gully alongside the grove, is the means of saving the situation, as the cold air is drawn off into these gullies, where it settles and causes there a hard frost, while the orchard escapes with a much lighter visitation. In localities where there are no lateral air currents and the cold air stays close to the ground, thus, while a very low temperature may be recorded on the grass, that of the air up in the trees is several degrees higher and no damage is done. In still other cases the movement of the air is sufficient to bring the cold layer well up into the trees, and damage results. Altogether the difficulties and uncertainty of protecting citrus orchards from frosts are such as to encourage many growers to trust to luck and hope for the best. In spite of the difficulties, however, the benefits to be derived from frost-protected citrus orchards are such that it is to be hoped that some cheap yet efficient method may be evolved in the near future.

Pruning.—The ordinary cutting-back of light spent laterals to more vigorous wood may be continued as opportunity offers, either during picking or in spare time, but as winter is now close at hand no really heavy cutting-back should be done until spring. Skeletonizing citrus trees in the winter-time may cause severe damage.

Brown-rot.—The month of May has often proved to be a time for considerable development of brown-rot, and therefore growers should see that all trees have a good covering of Bordeaux mixture 3–4–50. Spray residue from a previous application, such as the one for the protection of the autumn setting from verrucosis, may still be visible on the trees, but the efficiency of a Bordeaux spray should not be regarded as extending for more than a month at the outside, while under excessively wet conditions it might be reduced to less than half that time. The practice of spraying only half of the tree for protection from brown-rot is not to be recommended, since total coverage may still be necessary against other fungous diseases, and if the 1-per-cent. oil has been added the insecticidal value is also obtained throughout.

Young Trees.—Special attention should be paid to these to see that they face the winter well protected from the elements—cold winds and frosts. If windbreaks are not yet adequate the expense of individual protection of small trees will generally pay well. Scrim, brushwood, or fern can be utilized for this purpose not only for protection from wind, but also from frost. A bad setback may mean an additional year without revenue, and sometimes trees are lost altogether through outbreaks of disease following low condition contracted during the winter.

—A. R. Grainger, Orchard Instructor, Tauranga.

POULTRY-KEEPING.

Management.

As good management is "the skilful or prudent use of means to accomplish a purpose," the main essential of good management in the poultry business is a thorough knowledge of the conditions under which poultry do best.

To the average person poultry-keeping appears to be a more or less simple business, but those of practical experience have long realized that the management of poultry in large numbers is one of the most difficult tasks to carry out profitably.

Success in the poultry business really depends upon attention to detail, and there are very many petty details which, though trifling in themselves, are, when taken together, vitally important, for if these little details are not attended to regularly they will in many cases make the difference between profit and loss. It is only by practical experience that one is likely to know or learn of these numerous details, and, because successful poultry-keeping demands the constant attention of so many little details, that practical experience is so essential, and why so many without that necessary experience and the aptitude for constant attention to petty details have failed at the business.

The chief aim of the poultry-keeper should be the production of eggs, and as eggs are produced by so many units of the flock, all of which have to be fed, it requires special supervision and very close attention to every detail of management always to keep enough units of the flock producing in order that sufficient eggs are produced to pay for the flock's keep and give their owner a surplus sufficient to compensate him for his outlay and labour. On all poultry plants much the same daily routine work, such as feeding, watering, cleaning, collecting and packing of eggs, &c., has to be done, yet some have the knack of going about their work in such a methodical manner that these essential routine jobs take up much less time.

It is interesting to watch the successful manager going about his work, and at times surprising to see how much more some are able to achieve than others without much apparent effort. They never seem

to get bustled or in a muddle, and their plants are always neat and tidy. This is usually the result of a good practical training, coupled with those gifts of health, energy, and forethought.

Poultry-house Management.

The importance of comfortable, well-ventilated houses and good house-management is not always fully appreciated. The requirements of good housing are plenty of room, fresh air, dryness, and sunlight, and, if there is a lack of any of these, poor production, colds, roup, digestive disorders, and other diseases may be the direct result. Owing to the fact that the normal temperature of a fowl ranges from 106° to 107·5° F., the hens require even more fresh air than is considered adequate for human beings, and, as the air they exhale is saturated with moisture, good ventilation is necessary to remove this from the house as soon as possible, for dampness in poultry-houses is often the result of condensation.

The need for more ventilation is now generally recognized, and up-to-date houses usually are provided with more back ventilation than was the case a few years ago.

Some houses in sheltered positions are provided with as much as 3 in. of an opening right along the back, between the top wall-plate and the roof. However, care must be taken to see that no draughts are created near the perches, and it will be found that less ventilation is required during the cold winter months. It is well, therefore, that arrangements be made so that these openings may be adjusted according to the weather.

The Floors.

The floor of the house should be a few inches higher than the surrounding ground, and proper drainage provided. Concrete floors are recommended. In some localities material for concrete floors is too expensive, and in such cases a good well-rammed clay floor gives good results. At times board floors are used, and if built above the ground so as to allow a circulation of air beneath they prove quite satisfactory.

Litter.

All fowlhouse floors should be covered with 3 in. or 4 in. of good dry straw. This not only provides a necessary means of exercise for the birds, but makes the house warm and comfortable. The litter should receive regular attention, and at least two or three times a week it should be forked up and levelled. As the birds usually face the light when feeding, it will be found that the litter is scratched to the back of the house, and it is advisable to see that it is forked forward regularly.

If the litter remains dry it is an indication that conditions in the house are correct, but if it becomes damp and heavy it should be removed, and the cause, if possible, corrected. Overcrowding, want of ventilation, and low floors are the chief causes of damp litter; in fact, very often a few too many birds in a house will make a great deal of difference between damp and dry litter, especially during the winter months. It is much the wiser plan to cull out a few of the poorer birds than to have damp litter in the houses. Good dry litter soon gets broken up into almost dust, and as this occurs it is a good idea to add an armful of fresh straw about every week, for the birds often eat a good deal of the new straw, especially if they are being fed a concentrated mash, and this weekly addition of a little fresh straw will assist in keeping the flock in the best condition.

If the litter remains dry it will last for months, but if it gets damp and gives off an odour it should be renewed at once. Any material such as vegetable stalks, &c., which are likely to check the birds from

scratching should be regularly removed. These little details, such as the regular forking-up and levelling of the litter and the addition of a little fresh material regularly, do not take up a great deal of time, but they all assist in keeping the birds interested and contented, which in turn means better results.

Nests and their Care.

The nests should be arranged in as convenient a way as possible, for they must be visited at least once or twice each of the 365 days during the year. In fact, the time involved in attending to the birds should be reduced where possible, and this can often be done when erecting the houses by placing doors, gates, and nest-boxes in the most convenient places.

The nests should be placed high enough from the ground that all the floor-space may be utilized as a scratching-ground, and it is advisable to see that they are deep enough that other birds cannot see those that are laying. Attention to this detail has a tendency to prevent vent-picking and cannibalism.

Though many hens like to lay in the same nests, it is advisable to provide one nest for each four or five birds, and plenty of clean dry nesting-material should be kept in each nest. Amongst the most popular nesting-materials are straw, straw chaff, shavings, sawdust, especially *Pinus radiata*, and sand, while quite a few poultry-keepers use shell grit. However, whatever material is used an ample supply should be provided, for much loss is occasioned each year from a lack of suitable nests and nesting-material.

Grit and Oyster-shell Grit.

A supply of oyster-shell and metal grit should always be within reach of the birds. It is well to provide separate boxes for each material, and so place them in the house that the grit will not get covered over with litter when the birds are scratching. By placing these boxes in the houses the grit is protected from the weather, for if grit, and especially oyster-shell grit, is allowed to get wet it is likely to get caked, and in such a state is not liked by the birds. Some poultry-keepers fail to appreciate the full value of a constant supply of fresh oyster-shell grit, but most successful poultry-farmers have found that it has paid them to keep this material always before their birds.

Insect Pests.

One of the chief essentials in good poultry management is to keep the house free of insects. When it is remembered that the third generation of one pair of red mite may amount to 120,000, and all this can happen in eight weeks, it is not difficult to realize how a few weeks' neglect could upset one's plans for a whole year.

For this reason every precaution should be taken to keep the perches, nests, and houses free of insects. The perches, nests, and, in fact, everything in the fowlhouse should be movable in order to guard against the ravages of insects. Once each week during the warm weather and once each two or three weeks during the winter months the perches should be painted with a good strong disinfectant. In addition, at least once each year the whole house should be thoroughly cleaned, washed, and disinfected.

Dust Baths.

As the natural way for fowls to keep themselves clean of insects is to dust in the soil, provision should be made for a dust-bath in all houses. A box about 3 ft. square and 1 ft. deep should be sufficient for fifty birds. Dry earth of a sandy nature is suitable for the purpose. It is well to renew this material regularly.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Uniting Colonies.

THE presence of weak hives in the apiary must be avoided as far as possible. During warm autumn days weak colonies rarely escape the attention of robber bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is far the better plan to unite the bees with a stronger colony than to run the risk of unsettling them in the dormant season through the encouragement of wholesale robbing.

Covers.

With the approach of the rainy season it is advisable to make a complete examination of the hive-covers in use. Altogether too little attention is paid to making the covers watertight, and neglect in this direction leads to winter losses. No amount of labour should be spared in saving the bees from exposure and dampness, and by so doing warding off the large annual losses that occur through neglect. There is no excuse for the beekeeper neglecting to protect his bees, and in the long-run a small expenditure on some suitable waterproof roofing-material doubly repays for itself, and is the means of saving colonies that would otherwise be lost. Bees must be kept dry. An examination made of colonies where proper protection is not provided reveals the presence of large quantities of propolis. Usually this is collected to prevent the penetration of external moisture, and it is noticeable that it is gathered freely in the autumn months. Where adequate protection is provided the bees are to a large extent saved the labour of collecting the propolis, and by providing dry roofs the beekeeper is assisting them. In the case of roofs that are cracked, do not attempt to tinker with them, but cover them entirely with some waterproof material. In the long-run metal coverings are the cheapest and the best. Good zinc or galvanized iron makes ideal covering, and lasts for years.

Spare Supers.

Where extracted combs have been placed on the hives for the bees to clean these should be removed and the bees confined to as small a space as possible consistent with the size of the colony. It may be necessary to leave some of the supers on during the winter months, and these can be dealt with in the spring. Do not leave the bees more space than they require, as they desert the lower supers and cluster at the top for warmth.

Mats.

It should be seen that each colony is provided with one or two good mats during the winter months, to keep the bees as warm as possible. Mats should be cut to fit exactly on top of the frames, and may be made from clean sacking or canvas. Sugar-bags or cornsacks make excellent mats and are easily procured. Wood mats are adopted by some beekeepers, and, if desired, may be secured at a moderate cost from dealers in beekeeping material. In districts where the bees do not bring in a great deal of propolis wood mats are effectual. On no account use calico mats, as these afford practically no warmth.

Weeds.

The hives should be kept clear of all weeds, so that the flying bees may have free access to the entrances. Many bees are lost by striking growing obstacles on returning to the hives. For the next few months, when the air is charged with moisture, plenty of air and as much sunlight as possible should penetrate beneath the bottom boards. In

damp situations place the hives sufficiently high from the ground to avoid the dampness. Old bricks or concrete blocks make good supports for the bottom-boards. Make sure that the hives have sufficient cant towards the front before the winter rains set in. The presence of much moisture on the bottom-boards is the means of loss to the beekeeper, and, in addition, causes the hives to become sour and foul-smelling.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Planting Season.

THE months of May to September inclusive are known as "the planting season"—the period during which hard-wooded plants may be set out to best advantage: hedge-plants, shelter-belts, fruit-trees, bushes, and ornamental shrubs. Where the requirements have been carefully studied and planned and the land thoroughly prepared, the work is best done without delay when the ground is free from frost and not too wet. Considerable root-growth is made during the winter, which greatly facilitates establishment. Only in cold exposed conditions is there any advantage in delaying the planting of less hardy plants until the end of the planting-season.

It is best to take delivery of plants of this class so soon as they are ready, and heel them in in a piece of friable ground. They will then be quite secure for the whole of the planting season, if necessary, and may be planted out as weather conditions and other circumstances permit.

Advice on planting is often somewhat laboured, but if the plants are suited to the conditions of soil and climate and the ground has been prepared as advised it is only necessary to observe a few precautions. Straggling and damaged roots should be pruned back, and the plant set in a hole sufficiently big to accommodate the roots without crowding and of a depth which will allow the plant to be set at the same level as in the nursery. In filling, the soil should be broken fine and distributed evenly, and when the roots are covered it should be trodden thoroughly firm, and the filling then completed. Loose planting is the commonest and most serious fault. Plants with a long stem, such as standard roses, &c., require staking. For these a hardwood stake of suitable length should be driven when the hole is opened; the plant is then firmly planted beside it and made secure by tying it to the stake with strong tarred string. A piece of canvas or other material round the stem of the tree under the tie will prevent it from injuring the bark.

Plants which have had their roots considerably shortened when lifting in the nursery will require to be pruned. This operation will require careful consideration—more than it usually receives. Those which make young growth subject to damage by frost, such as roses, are pruned only lightly when planting, the pruning being completed just before, or shortly after, growth commences in the spring—at the later period in the colder districts. Shrubs having more than one stem, or which branch low down, should have the branches thinned to three or four well-distributed growths so that crowding will not take place as they get older. They should be removed completely, close up to the point of origin, cutting them off flush. The remaining growths should then be shortened, cutting just beyond a good bud pointing in an outward direction. The plant will then make well-spaced bushy growth. Plants which it is desired to grow on a main central stem, pyramid fashion, should have any vigorous growth likely to compete with the central leader removed completely. Many specimens that are otherwise admirable have this double leader, which is not only disfiguring by spoiling the balance of the tree but frequently causes serious injury. The remaining branches may then be thinned out where there is any sign of crowding, and

the leader and branches left should then be shortened moderately. By careful training in this manner young plants not only make vigorous growth but also shapely trees, which will best attain the main object, whether it be shelter or any other purpose. Plants with fine roots, such as heaths, rhododendrons, and most conifers, require little or no pruning when planting out.

To enable them to make satisfactory growth, most plants require light and air, as well as the soil and water in which they are planted. For this reason grass and weeds should be suppressed when they make their appearance in the vicinity of young trees. Clean culture is most desirable, at least for a few years until the plants are thoroughly established and cease to be in danger of being overgrown by such wild growth. In the case of hedge-plants such growth should never be allowed to attain any considerable height close to the base of the hedge, or much of the foliage there will be destroyed ; this will cause great disfigurement as well as reduce the efficiency of the hedge. It is a disfigurement which it is very difficult to adjust. In the case of plantation-trees, spot-planted in grass, the grass should be mown at least once a year, about the month of December before it seeds ; it can then be allowed to lie as a mulch, where it quickly decays, and among other useful purposes assists in retaining moisture, especially during the summer months, when young plants are inclined to suffer from a shortage.

Breaking in Grass Land for Cropping.

Land suitable for intensive cropping is a good deep loam on a well-drained subsoil ; such soil usually carries a heavy turf, which is best broken in with some care, especially when infested with couch-grass or any other bad weed. In such extreme cases cultivation should be commenced in summer, when the land should be fallowed and cleaned during the dry weather, as has been previously recommended. In an opposite extreme case where the turf is thin and free from serious weeds, ploughing and subsoiling may proceed in the usual way ; but where the turf is heavier it usually is best to skim-plough now, and some weeks later when the grass is dead cross-plough, burying the turf deeply, and at the same time using a subsoiling attachment, or a second plough, to break up the bottom of the furrow.

On a new site, water-supply, drainage, and wind-shelter will each require consideration. The difficulties which arise are very frequently due to inadequate attention being given to one or the other of these fundamental requirements. Land suitable for early crops—that is, land with rather sharp drainage and consistently warm temperatures—is most likely to require a well-arranged irrigation system. Fortunately, in most cases of this kind artesian water is easily available, and sprinkler irrigation can be arranged which uses the water with economy and best effect. Apparatus of this class has been much improved during the last few years ; sprinklers with wide coverage, even distribution, and instantaneous couplings, for sections where movable piping is used, are now available. Drainage is of greatest importance where the land is heavy, especially where water is received from adjacent higher ground. During the busy periods in autumn and spring it is difficult to " catch " this land in suitable condition for working unless ample drainage is provided. Where the frequent cultivation necessary to intensive cropping has to be done, drainage improvement is essential. On new sites shelter from prevailing winds is often deficient for horticultural crops ; in most localities an ample provision of intersecting hedges is required. These should be planted now and given all the attention due to their importance.

Vegetable Crops.

The growth on asparagus crops should now be mown, raked, and burnt ; the land should be lightly disked, and a low ridge should be thrown up over the stubble to rot it. Special attention should be given

to land being prepared for planting out permanent crops such as asparagus and rhubarb. It should be clean, rich, and deeply worked; a good dressing of kainit for the asparagus and superphosphate for the rhubarb should be included.

When the foliage has died down on rhubarb that is to be replanted, spare roots may be lifted and forced in a dark shed maintained at a temperature of 55° F. to 65° F. Place the roots close together with a little light soil between and maintain a humid atmosphere by means of tepid water.

In frost-free localities peas and potatoes are planted now for harvesting in early spring. For this purpose a variety of main-crop pea is chosen; a good strain of Stratagem is popular.

Small and Sundry Fruits, &c.

The unusually high price of shelled sweet almonds at the present time has drawn attention to the production of these and other nuts. From the little experience we have had of almond-growing in the Dominion the indications are that they thrive best in the drier districts where late spring frosts are not severe. Isolated trees are usually barren, as they are generally self-sterile, and to obtain a crop at least two varieties must be planted. The soft-shell varieties are preferable, such as I.X.L., Ne Plus Ultra, and Hatch's Nonpareil. These are also suitable for cross-pollination, which will be most effective if bees are kept in the vicinity. An average crop is 5 lb. or 6 lb. of nuts per tree; but twice that weight may be obtained from the above-mentioned varieties under good conditions. The kernels weigh rather more than half the weight of the nuts. Bordeaux sprays in spring and autumn are required to control shot-hole and other fungi. A good soil that is light and well drained suits them best.

Sweet chestnuts (*Castanea vesca*, syn. *Castanea sativa*) are from the mountain forests of Southern Europe and Western Asia. They are handsome deciduous trees with useful timber. Baked or boiled the nuts make a wholesome dish, and are usually popular where they are plentiful. There is ample evidence here that the trees will crop well on good warm hilly country. A group of these trees looks well and provides useful shade, as well as a crop of nuts. Like other nuts, when properly cured, they have good keeping-qualities and may be used at any season.

Filberts, hazels, and cob-nuts are popular names given to varieties of *Corylus colurna* and *C. avellana*. Our supplies have chiefly come from Spain, where these trees are grown extensively, especially in the Province of Tarragona. The most suitable soils there are said to be light, cool, and deep, well aerated, and with a fair supply of moisture. Planting-distances there are 8 metres between rows, and 4 to 5 metres between trees in the row, say, 26 ft. between rows and 13 ft. between trees. In cool districts in the Dominion there a few groves planted, and they are cropping well. There appears to be no reason why they should not be extended. When planted in rich, moist soil the trees run to wood and are not profitable. Trees grown with an open centre, on a light well-drained loam, and the suckers suppressed, crop best. Fertilization of the "flowers" is by wind-blown pollen from catkins. For heavy cropping the question of pollination demands careful consideration, but until further variety tests have been carried out here mixed varieties should be planted. An average yield generally is about 1,000 lb. of nuts per acre.

Walnut-culture has been somewhat checked by the prevalence of bacterial blight, but trees vary widely in their susceptibility to this disease. The trouble also is less prevalent in the drier districts.

Selected trees planted in groups, or as single shade trees, or as an avenue, will often serve a useful purpose in addition to supplying a crop of nuts. They should be planted in good well-drained alluvial land in a district with a comparatively low rainfall.

The Homestead Garden.

The planting-season provides the necessary opportunity for planting up shelter-belts and shrubberies in the new garden. Distances between shrubs and trees are usually 3 ft. to 6 ft. or 10 ft., according to the adult size of the subject or the purpose in view. On the windward side a shrubbery at maturity should present to the eye a comparatively close wall of foliage of various shades and shapes; inside are taller trees with an undergrowth of shade-loving shrubs and ferns; on the leeward margin the choicer shrubs and trees are placed, often in rather more open order, the more attractive features being set out in comparatively large groups. While the plants are small and of a similar size, planting should be done with the greatest care to obtain the best effect, for as the plants mature and reveal their character any defects in arrangement will be revealed. The art is best acquired by studying the native bush and public and private gardens and plantations in the vicinity, and noting the results of the various arrangements under the local conditions of soil and climate.

The established garden also usually receives great benefit from some consideration during the planting-season, for, as in the natural bush, there is no finality to the operations of sowing and reaping. With shade and shelter established, many climbers, ferns, palms, and shade-loving shrubs will find a congenial environment and grow away quickly with best results if planted now. And, as ripe pine and gum timber is removed for use, the vacant areas should be replanted where second growth is not expected. Not a garden has been planted but what improvement may now be made as a result of new experience which has been gained. In mild, moist western districts where rhododendron, azalea, camellia, hibiscus, hydrangea, palms, and tree-ferns flourish these should more usually provide the materials for some of the more outstanding features in the gardens. Most of the kinds of plants mentioned have a wide variety that provides for almost any effect which may be desired. In the drier atmosphere of eastern districts the rose, carnation, wattle, bignonia, bougainvillea, syringa, tamrix, magnolia, oleander, banksia, phœnix, and fan-palms are among those plants which readily make a good display under the conditions there: also most bulbs of African origin, and tubers and bulbs, such as irises, anemones, &c., from the Near East, if comparatively dry sites are chosen. The present season presents an opportunity of extending the more desirable features in garden-planting in the place of those less suitable.

In new gardens where the preparation of the land has not reached the planting-stage, the work should be continued when the land is sufficiently dry, with a view to sowing down lawns about the month of August and completing the planting of hard-wooded subjects by the end of September—especially in the drier localities.

—W. C. Hyde, Horticulturist, Wellington.

Parasitic disease is responsible for considerable loss in young cattle. Many calves die or have their constitutions undermined by the action of internal parasites. In combating the trouble, the importance of the provision of extra nutritious feed in assisting the young animal to overcome the effects of the parasites cannot be overestimated. In this respect chaff, oats, and good hay will do far more good than drenching with worm medicine.—*Annual Report, Director, Live-stock Division.*

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed, and the sacks suitably sealed and tagged. (A previous list, to which those interested are referred, appeared in the March *Journal*) :—

Variety.	Grower.	Acreage.
Cross 7	Allan, A. T., Scargill	64
	Amyes, C. G., Fernside, Rangiora R.D. ..	14
	Brown, I., Grovetown, Blenheim	7
	Calder Bros., Cave—	
	Line A	18
	Line B	9
	Canterbury Seed Co., Leeston	10
	Davies Bros., Waiau	25
	Gardiner Bros., Waitohi, Temuka	35
	Gartery, F. W., Springbank, Rangiora R.D. ..	28
	Hall, K. W. J., Hororata	42
	Jones, C. H., Winchmore R.D.	7
	Kennedy, T., Greenstreet, Ashburton	10
	Lowe, G. J., Coldstream, Rangiora R.D. ..	11
	Lowery, W. C., Winchmore R.D.	17
	McCaw, J. and F., Hakataramea	20
	McLachlan, W. H., Rangitumau, Masterton ..	8
	Mulligan, W. H., Maronan, Ashburton	8
	Nutt, H. A., Motukarara—	
	Line A	16
	Line B	8
	Turner, C. W., Halkett	23
	Waddell, R., Chertsey	10
Dreadnought ..	Canterbury Seed Co., Leeston—	
	Line A	12
	Line B	10
	Coughlan, M., Kingsdown, Timaru	10
	Dempsey, J., Hook—	
	Line A	35
	Line C	20
	Saunders, F. L., Studholme	6
	Stewart, J. L., Hook, Waimate	10
	Wilkinson, T., Section 3, Cormacks R.D. ..	10
	Williams, J. C., Section 4, Kokoamo R.D. ..	10
Hunter's II ..	Calder Bros., Cave	13
	Campbell, D. A., care of P. G. Ellis and Co., Rangiora	7
	Evans, H., Upper Plain, Masterton	12
	Muirhead, J. H., Lagmor, Ashburton	40
	Reeve, E. J., Coups Road, Kaiapoi	16
	Royds, R. S., 412 Burnside Road, Fendalton ..	4
Jumbuck ..	Canterbury Seed Co., Leeston	6
	Steven, G. H., Rosewill, Timaru	7
Solid Straw Tuscan	Hille, W. G., West Melton	26
	Johnston, R. H., Dunsandel	100
	Kinnimont, J., Section 7, Cormacks R.D. ..	10
	McCarthy, E., Prebbleton	17
	Miller, D., Leeston	10
	Muirhead, J. H., Laghmor, Ashburton ..	31
	Rathgen, Mrs. I. E., Leeston	14

—*Fields Division.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WILT IN TOMATOES, VERBENA, AND LARKSPUR.

C. T. B., Timaru :—

Has the growing of blue lupin caused verticillium wilt in my tomatoes this season ?

Last year I sowed blue lupins in February for green manure ; they grew to about 12 in. and then were dug in for green manure, on the same ground. Verbena and larkspur were planted, and long before maturity fully 50 per cent. of the plants withered and died. Tomatoes were similarly affected where planted in the same ground. Only one survived.

The Horticulture Division :—

There is no record or proof of blue lupin being a host of *V. albo-atrum*. The practice of planting the types of plants mentioned by you on top of recently dug-in sappy lupin is to be condemned, as all the conditions are suitable for fungous attack.

Without specimens of affected plants it is impossible to determine the cause of the " wilt " condition, which in your case is probably *Sclerotinia*, but not necessarily the same organism attacking both the larkspurs, &c., and the tomatoes.

ACTION OF BLUESTONE SOLUTION AS DRENCH.

J. B. V., Te Mata :—

I understand that when drenching sheep with bluestone or a combination with bluestone, the bluestone closes up a certain canal or passage and thus allows the solution to go straight to the fourth stomach. If so, how long a time elapses after the first part of the dose (say, ¼ oz.) enters the mouth before that passage is affected and closed.

The Live-stock Division :—

It has been found by Dr. Clunies Ross in Sydney that the action of the bluestone solution commences in the mouth of the animal. It is the chemical reflex action of the copper on the mucous membrane of the mouth which causes the closure of the oesophageal groove. Therefore, any fluid swallowed by the animal should all go into the fourth stomach. Dr. Ross's experiments show that this is the case. It is also possible first of all to give a bluestone solution alone and then follow up within fifteen seconds with a dose of any other medicine which you wish to reach the fourth stomach directly.

WIREWORMS IN POTATOES.

Subscriber, Totara Flat :—

Is there any remedy for the control of wireworms in potatoes, and are certain varieties more susceptible to their ravages than others ?

The Fields Division :—

Beyond thorough cultivation, there is no satisfactory means of dealing with wireworms. Practically all pasture carries a population of wireworms, and when the pasture is broken up and the land sown in such crops as potatoes the wireworms may attack and do considerable damage to the tubers in the first season, but infestation diminishes considerably the longer the land is under cultivation. Soil fumigation may at times do a little good, and the use of calcium cyanide worked into the ground during cultivation, at the rate of 200 lb. to the acre, has been said to have a good effect. The cyanide should be applied not later than fourteen days before a crop is sown. This treatment is only practicable, however, for comparatively small areas. It is not considered that certain varieties of potatoes are more susceptible than others to the ravages of this pest.

WEATHER RECORDS: MARCH, 1937.

Dominion Meteorological Office.

NOTES FOR MARCH.

THE cold conditions of the previous months were continued through the first half of March, but the second half was warm. Though the rainfall was below normal in most places, cloudy and humid conditions prevailed, and few places felt any shortage. Stock are reported to be in good condition, and there is abundance of pasture. Lambs are fattening, on the whole, rather better than earlier in the season, though the feed is generally still rather soft. Harvesting was done in difficult circumstances, and some of the wheat was again damp. The lack of dry, sunny weather has adversely affected the production of grass-seed and some other crops. White butterflies were rather numerous and destructive.

Rainfall.—In the North Island, North Auckland, the Northern Waikato, and the Bay of Plenty areas had considerably more than the average rainfall, but over the remainder only about half of it was recorded. In the South Island there was an excess in North Canterbury, Southern Otago, and Southland, and at a few places in Westland, but a defect elsewhere. South Canterbury, especially, had much less than the average.

Temperature.—Mean temperatures differed little from the normal for March, the warm weather in the latter half of the month compensating for the cold of the first half. Between the 10th and the 13th some rather sharp frosts were recorded, and some damage was done to tender plants. Sunday, the 28th, was, at many places, the warmest day of the season, over 80° being recorded at some North Island stations.

Sunshine.—Slightly more than the average amount of bright sunshine was recorded in the far North, at Auckland, and the far South, at Invercargill, but over most of the country there was a deficit of about twenty to forty hours. Seldom, if ever, indeed, has so sunless a March been experienced.

Pressure Systems.—The only very pronounced storm occurring in the New Zealand area during the month was that which developed as a tropical cyclone in the New Hebrides region at the end of the third week. It was then rather violent and extensive, and heavy rain, accompanied by strong gales, was experienced at Norfolk Island. The most usual procedure is for these storms to begin to take a more easterly course from this stage onward. In this particular case, however, a rather deep westerly depression developed at the critical time over south-eastern Australia, and the cyclone was drawn into its circulation. It continued to move southwards, keeping about 400 miles off the New Zealand coast, and on the 27th began to fill up. North-easterly gales had been caused by it in the northern part of the Auckland Peninsula, but no strong winds elsewhere. On the 28th, merging with the oncoming westerly depression, it reinforced the latter, causing a stormy day with north-westerly gales in many places about and south of Cook Strait. On the next day it had disappeared. During its rather varied history it brought heavy rain to most of the country. Rain during the first four days was heavy in many places.

From the 8th to the 13th south-westerly winds and cold, showery weather prevailed over the Dominion. It was during this period that frosts were experienced, and snowfalls occurred on the mountains. These were unusually heavy for the time of year, particularly on Mount Egmont.

From the 19th to the 22nd some heavy rains fell in the south-western and southern parts of the South Island.

RAINFALLS FOR MARCH, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Fall.	Total Rainfall to Date.	Average Rainfall to Date.
		North Island.				
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	2·24	13	0·96	3·10	14·71	10·54
Russell	6·21	10	2·63	4·09	24·15	12·42
Whangarei	6·05	14	3·11	4·45	18·34	12·25
Auckland	3·52	14	0·97	3·27	8·99	9·81
Hamilton	2·90	12	1·19	3·76	10·00	10·24
Rotorua	5·15	14	3·06	3·48	13·65	11·44
Kawhia	..	..	..	4·21	..	9·83
New Plymouth ..	1·82	13	0·31	3·68	17·30	11·80
Riversdale, Inglewood ..	4·15	16	1·55	7·04	29·13	20·58
Whangamomona ..	4·18	9	1·47	4·98	20·20	14·45
Hawera	1·68	12	0·43	3·01	11·88	8·92
Tairua	5·81	12	2·58	5·21	13·05	13·55
Tauranga	5·94	14	2·61	3·92	12·52	11·73
Maraehako Station, Opotiki	6·08	12	1·35	3·96	17·66	11·69
Gisborne	2·97	8	2·28	4·42	8·85	10·60
Taupo	2·58	12	1·86	3·14	8·48	9·25
Napier	1·21	9	0·78	2·66	6·62	7·62
Hastings	0·86	7	0·49	2·76	3·98	6·94
Whakarara Station ..	1·47	7	0·34	..	8·67	..
Taihape	1·38	12	0·20	2·60	7·94	8·19
Masterton	1·84	9	0·66	2·75	8·74	8·09
Patea	1·83	12	0·34	3·35	12·73	9·34
Wanganui	1·67	10	0·50	2·47	10·13	7·72
Foxton	1·15	10	0·35	1·98	7·17	6·19
Wellington	2·22	13	0·83	3·20	9·62	8·84
		South Island.				
Westport	6·32	17	1·17	7·50	25·97	21·05
Greymouth	9·18	20	1·80	8·80	35·48	24·18
Hokitika	7·74	20	1·62	9·51	35·94	26·83
Ross	8·35	16	1·41	10·73	43·00	32·03
Arthur's Pass ..	6·64	8	3·11	13·19	45·75	37·21
Okuru, South Westland	16·03	10	4·30	14·15	40·74	36·40
Collingwood	4·68	11	1·86	5·81	25·01	17·68
Nelson	2·19	10	1·01	2·92	9·71	8·45
Spring Creek, Blenheim	0·82	9	0·26	1·98	7·85	6·38
Seddon	0·67	7	0·32	2·00	6·36	5·69
Hanmer Springs ..	3·29	12	1·02	3·26	7·96	10·47
Highfield, Waiau ..	1·73	10	0·50	2·84	4·31	8·42
Gore Bay	2·78	11	0·99	2·13	6·34	7·39
Christchurch	1·98	..	0·52	1·84	6·25	5·73
Timaru	1·71	13	0·56	2·16	7·89	6·34
Lambrook Station, Fairlie	1·26	12	0·47	2·34	7·54	6·58
Benmore Station, Clearburn	1·85	13	0·82	2·41	10·08	6·80
Oamaru	1·06	13	0·37	1·78	5·46	5·61
Queenstown	2·19	13	0·67	2·62	9·83	7·46
Clyde	2·03	14	0·66	1·49	6·31	4·40
Dunedin	2·92	19	0·65	2·90	13·38	9·02
Wendon	4·90	16	0·90	2·74	17·36	8·20
Balclutha	3·14	18	0·72	2·31	12·27	6·61
Invercargill	5·41	20	1·56	3·89	15·17	11·07
Puysegur Point ..	8·87	22	1·04	7·97	29·44	21·33
Half-moon Bay ..	7·31	18	2·08	5·37	20·06	14·27