VOL. IV. FEBRUARY, 1893. PART 2.


# AGRICULTURAL GAZETTE OF NEW SOUTH WALES.

SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER.

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[1s. for a Single Number or 10s. per Annum.]

# THE AGRICULTURAL GAZETTE

OF

# NEW SOUTH WALES,

PUBLISHED BY

THE DEPARTMENT OF AGRICULTURE.

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Anthistiria membranacea, Lindl.

"Landsborough Grass."

*Vol. IV, Part 2.* *FEBRUARY.*

# The Grasses of Australia.

(*Continued from Vol. IV, Part I, page* 2.)

By F. TURNER,
Botanist, Department of Agriculture.

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## ANTHISTIRIA MEMBRANACEA, *Lindl.* "Landsborough Grass."

*Flora Austr., Vol. VII, page* 543.

Quite glabrous, sometimes forming dense leafy tufts of 6 inches, the branching stems often elongated to 1 foot or 2 feet. Leaves flat, appearing almost articulate on the short prominently striate sheaths. Floral leaves or bracts with coriaceous sheaths and short lanceolate laminæ. Panicles small, dense, almost cyme-like as in *Apluda*, with very numerous small spikes or clusters, each subtended by a scarcely longer bract. Spikelets scarcely two lines long, glabrous, the four involucral ones pedicellate, the fertile one rather longer than the two pedicellate barren ones beside it. Glumes all thin, the outer one acute with several green nerves, the second with one or three nerves, the awn very fine, scarcely more than as long again as the spikelet. Grain enclosed in the hardened outer glumes, but free from them.

An annual species found in the arid interior of all the Australian Colonies except Victoria. It is fairly plentiful in many parts of the continent, and it is mostly found growing on rich soils. It generally grows in small tufts, but in a favourable season the weak stems lengthen out very much and form an entangled mass often over a foot deep. It is essentially a summer-growing species, and generally it makes most of its growth during the hottest part of the season. I have had this grass under experimental cultivation, and raised an excellent crop of herbage in less than three months from seed. It was grown on a black loamy soil, and during a period of very dry weather, it produced a great amount of rich succulent herbage which horses were very fond of. When cut, just as the flower stems first appeared, it made excellent hay. It is worthy of extensive cultivation in the arid interior either for temporary pasture, or to be cut at the proper time, and turned into hay. It is considered to be a most nutritious grass, and towards autumn it often gets so exceedingly dry and brittle that it breaks up into innumerable pieces, but even then stock of all kinds are said to be so exceedingly fond of it, that they lick the broken stems and leaves from the ground.

There would be no difficulty in bringing this species under systematic cultivation for, under ordinary circumstances, it produces an abundance of seed which usually ripens in November, December, and January. If a large quantity of the seed is required, it would be advisable to fence off a small area where the grass grows plentifully, from which as much seed could be gathered, when ripe, as would sow an immense area.

*Reference to Plate.*—A, compound cluster of spikelets; B, cluster of male or barren spikelets, and the fertile one, opened out to show how they are arranged; C, fertile spikelet, opened out to show the three glumes and awn; D, male spikelet, opened out to show three glumes; E, grain, back and front views, all variously magnified.

ANDROPOGON PERTUSUS, *Willd.* "Pitted Blue Grass."

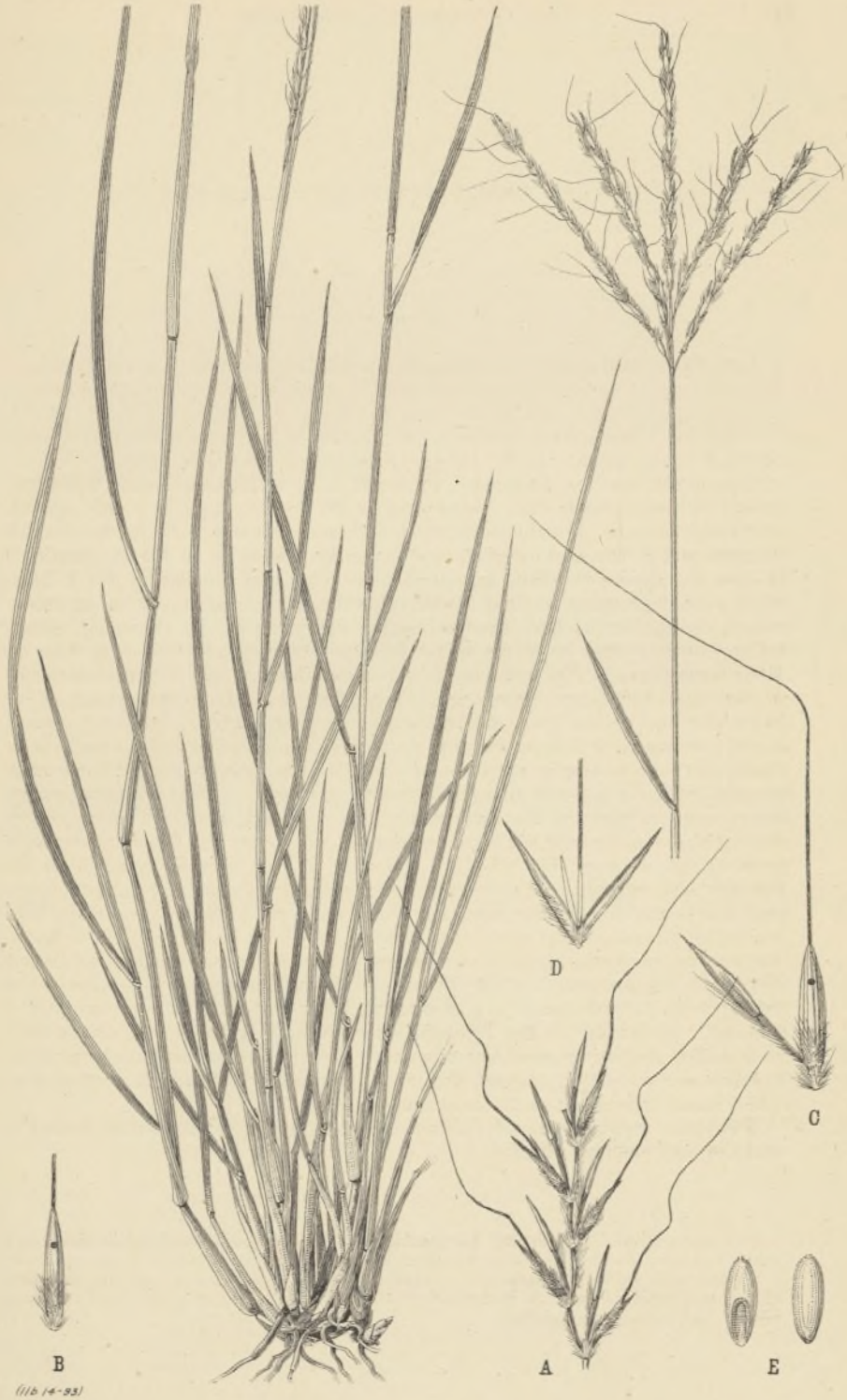
*Flora Austr. Vol. VII, page* 530.

STEMS slender, 1 foot to 2 feet high, the nodes glabrous. Leaves chiefly at the base of the stem, narrow, glabrous. Spikes, two to five, sessile, or nearly so, at the head of the peduncle, without sheathing bracts, 1 inch to 2 inches long; silky-hairy, as in *A. affinis*, with long hairs on the pedicles and at the base of the sessile spikelets. Spikelets fully two lines long; rather obtuse, the outer glume marked above the middle with a small pit, which assumes inside the appearance of a projecting gland. Awn slender, about $\frac{3}{4}$, rarely 1 inch long. Pedicellate spikelet, usually containing a male flower. Grain enclosed in the glumes of the sessile spikelet, but free from them.

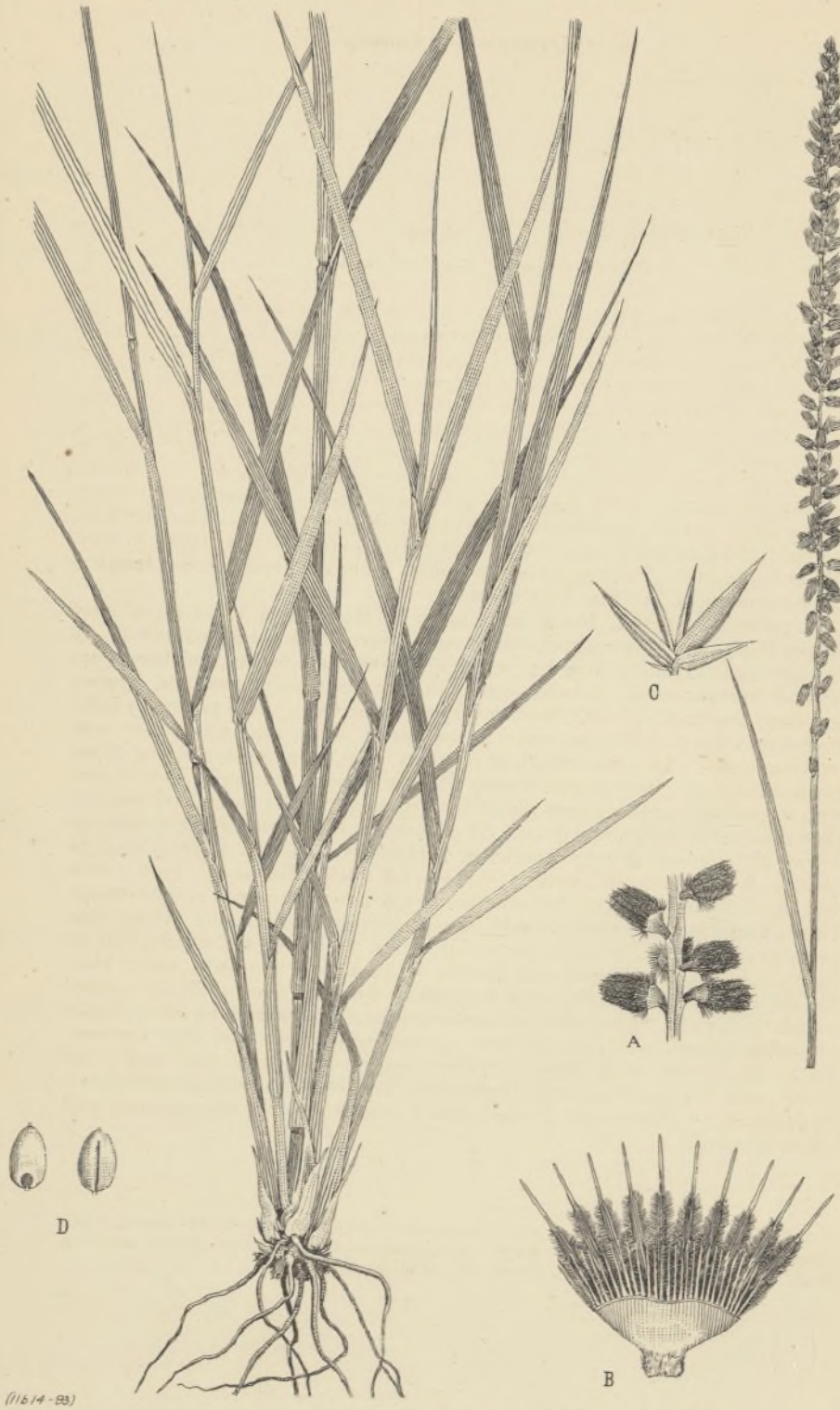
A perennial species, found and recorded from all the Australian Colonies, except Western Australia. According to Mr. Bentham, it is widely spread over tropical Asia. In this country it is found growing both in the coastal districts and in the arid interior, and in many places it is fairly plentiful. It does not appear to affect any particular geological formation, for I have often seen it growing on land overlaying the Wianamatta shales, on stony ridges, on light soils, and also on rather heavy ones. It generally grows taller, however, and produces more herbage on rich alluvial soils than on other formations. The grass is slightly stoloniferous, and it branches freely at the base, but never grows into large tussocks. In consequence of its habit it withstands a great amount of dry weather, and in an ordinary season it will grow more or less all the year round. In sheltered situations and where frosts are not too severe it will make considerable growth during the winter months, which is a great advantage in the pastures of this country, where the greater number of the indigenous species make most of their growth during the summer and autumn months. Some years ago I had this species growing on a lawn, for which I found it a very suitable grass both for summer and winter. After being cut a few times it assumed a dwarf, compact habit, and was easily kept in order with other lawn grasses. I can recommend it as a lawn grass for some of the drier districts in the Colony. As regards the pastoral value of this grass, Baron von Mueller has published the following remarks:—"Mr. Nixon, of Benalla, regards it as one of the best grasses to withstand long droughts, while it will bear any amount of feeding. According to Mr. Bailey's observations it endures cold better than some other *Andropogons* of Queensland. Though not so palatable to pasture animals as some other grasses, this one is important for the summer season, when many others fail in the arid interior."

This grass produces an abundance of seed, which ripens throughout the summer and autumn months.

*Reference to Plate.*—A, showing the arrangement of the spikelets on the rhachis; B, a sessile spikelet, showing the pit in the outer glume; the awn cut off just above the spikelet; C, a sessile and pedicellate spikelet; D, sessile spikelet, opened out, showing the three glumes and terminal awn, the latter cut off above the spikelet; E, grain, back and front views. All variously magnified.




Andropogon pertusus, Willd.




Cenchrus Australis, R. Br.

"Tall Burr Grass."

## CENCHRUS AUSTRALIS, *R. Br.* "Tall Burr Grass."

*Flora Austr., Vol. VII, p. 497.*

A STOUT, glabrous grass, attaining 6 to 9 feet. Leaves long and flat; ligula split into cilia. Spike rather dense, 4 to 8 inches long, the rhachis slightly scabrous-pubescent. Involucres very shortly pedicellate, erect, or at length reflexed, broadly ovoid, under four lines long, the inner bristles or lobes, about ten, flattened and very shortly united at the base, plumose in the lower half, scabrous in the upper part, with reversed asperities; one sometimes, but not frequently longer than the others; outer bristles numerous, unequal, subulate, and scabrous from the base. Spikelets (always ?), solitary in the involucre and shorter than the inner lobes. Outer glume short, obtuse, hyaline, nerveless; second glume acute, three or five-nerved; third rather longer, five-nerved, with a palea and sometimes a male flower in its axil. Fruiting glume as long. Nut enclosed in the fruiting glume and palea, but free from them.

A perennial species, found principally in the coastal districts of New South Wales and Queensland, and in many places it is fairly plentiful. It is much more common, however, in the northern than in the southern portion of the continent. I have never collected, nor have I seen the species growing, any further south than the Illawarra district. It is generally to be found growing on hill sides and on low scrub lands, and sometimes near water-courses. In some situations it grows into large tussocks, the stems from which may often be seen nearly 9 feet in height. As the herbage of this coarse-growing grass becomes old, it is very rough to the touch, and when in that state cattle will never eat it. If the coarse leaves and stems should be burnt off, however, during October or November, the new growth that is made will be tender and succulent for several weeks afterwards, then cattle will eat it readily enough; but whether there is any nutriment in the herbage I am unable to say. Sheep should never be depastured on land where this grass grows plentifully, more especially when the seeds are nearly ripe, as their coverings (involucres) will fasten on to almost anything, and if they should get entangled in the wool it would be found a most difficult matter to get them out. When the burr grass becomes established on river banks or similar situations it protects them against heavy rains and flood waters. Its tough, fibrous roots form a perfect mat in the earth and bind it so firmly, once the plant becomes established, that it is with difficulty dislodged. It produces an abundance of seed, which ripens during the summer and autumn months.

*Reference to Plate.*—(A) Showing the arrangement of the spikelets on the rhachis; (B), involucre flattened out; (C), spikelet opened out to show the four glumes and two paleas; (D), nut, back and front views; all variously magnified.

# Supposed Poisonous Plant.

By F. B. GUTHRIE and FRED. TURNER.

## A Description and Analysis of the "Darling Pea," "Indigo," "Cranky Pea," &c. (*Swainsona galegifolia*, R. Br.)

*Flora Austr., Vol. II, page* 217.

A glabrous perennial or under-shrub, with erect flexuose branches, sometimes under 1 foot, sometimes ascending or even climbing to the height of several feet. Leaflets, eleven to twenty-one, or rarely more, oblong, obtuse, or emarginate, mostly four to eight lines long. Stipules small, reflexed. Racemes pedunculate, exceeding the leaves and sometimes twice as long. Flowers rather large, deep red in the original variety. Pedicels rarely longer than the calyx, with minute bracteoles near the top. Calyx glabrous, two and a half to three lines long, the lobes acute, short or nearly as long as the tube. Standard six to eight lines in diameter, with two oblique or almost longitudinal plate-like prominent callosities above the claw; wings shorter; keel broad, obtuse. Style subulate, acute, not inflexed at the end, bearded longitudinally without any terminal tuft. Pod much inflated, membranous, 1 inch to 2 inches long, on stipes varying from two to six lines. The species varies with light purplish-pink flowers, *S. coronillæfolia*, Salisb, and with white flowers, *S. albiflora*, G. Don. The differences in the length of the stipes of the pod do not, as had been supposed, coincide with the differences in the colour of the flower.

This species is, in one form or another, found in many parts of New South Wales from the coast to the arid interior, and in some districts it is very plentiful. During the past two years many specimens have been forwarded to this Department for identification, and in several instances they were accompanied by letters containing most conflicting statements as regards the effect the plant had on animals eating it, a summary of a few of which appears below. It was thought advisable to publish a figure of the plant, with the description and analysis, so that no possible mistake could occur in correctly identifying the right species. It must be understood that the common names given to this plant are also given to three other species growing in different parts of the Colony, specimens of which have occasionally been received for identification. The three species are—(1) *Swainsona greyana*, Lindl. This plant may be distinguished from the one under notice by its more robust habit, large pea-like pink flowers, and the calyx densely covered with white cottony down. This species is found principally in the interior. (2) *Indigofera australis*, Willd. This is a hard-wooded shrub with pinnate leaves. It often attains a height of 6 to 8 feet, and in one form or another is found nearly all over the Colony. It has


Swainsona galegifolia, R. Br.

"Darling Pea," "Indigo," "Cranky Pea."

small pea-like reddish flowers, which are arranged in axillary racemes. These are succeeded by nearly straight pods, about 1½ inches long. (3) *Lotus australis*, Andr., is a dwarf perennial plant, rarely exceeding 2 feet in height. In some districts on the eastern side of the Dividing Range it is very plentiful, but is more sparingly distributed in the interior. Its leaves are composed of five leaflets, three at the end of the stalk, and a lower pair close to the stem. The flowers are sweet-scented, and are arranged in umbels; the colour is usually pink, but they vary from white to purplish. The pods are cylindrical, and about 1½ inches long.

The complete analysis of the Darling pea plant is as follows:—

| | | |
|---|---|---|
| Water ... ... ... ... ... ... ... | | 47·62 |
| Benzine extract— | | |
| Wax... ... ... ... ... ... ... | 1·05 | |
| Colouring matter ... ... ... ... ... | ·10 | |
| Ash ... ... ... ... ... ... ... | ·11 | |
| Volatile matter ... ... ... ... ... | trace. | |
| | | 1·33 |
| Alcohol extract— | | |
| Oily matter... ... ... ... ... ... | 0·55 | |
| Colour and extractives ... ... ... ... | 1·79 | |
| Ash ... ... ... ... ... ... ... | ·21 | |
| | | 2·55 |
| Water extract— | | |
| Gum... ... ... ... ... ... ... | 4·47 | |
| Ash ... ... ... ... ... ... ... | 1·22 | |
| | | 5·69 |
| Acid extract— | | |
| Starch isomers ... ... ... ... ... | 5·45 | |
| Ash ... ... ... ... ... ... ... | 2·01 | |
| Colours, &c. | | |
| | | 7·52 |
| Alkaline extract— | | |
| Chiefly albuminoids ... ... ... ... ... ... | | 16·12 |
| Woody matter— | | |
| Cellulose ... ... ... ... ... ... | 8·75 | |
| | | 18·14 |
| | | 98·97 |

| | |
|---|---|
| Total ash ... ... ... ... ... | 6·65 |
| Albuminoids ... ... ... ... | 18·83 (from nitrogen). |

In a special examination for alkaloids by Stevenson's method, an oily substance of a burning disagreeable taste was obtained on shaking out the acidified extract with ether, in the process of purifying the alkaloid. We were unable to find any conclusive evidence of the presence of an alkaloid in the plant, and if such be present it is there in exceedingly minute quantities. This oil is identical with the oily matter extracted with alcohol, and we endeavoured to prepare the same in larger quantities with a view to testing its physiological action. This proved a difficult matter, as different specimens gave varying quantities of the extract, and even working with 1 lb. of plant it was only possible to obtain a very small yield.

In fact, owing to the length of time involved in the transit, and the difficulty of packing, the bundles of pea, with few exceptions, arrived here in very bad condition, having become heated in the journey, and mildewed in the centre of the bags. The only specimen which yielded the oily substance in fair quantity was a small one brought by Mr. Cruickshank, M.P., and this was the only specimen received in a perfectly fresh condition. We are of opinion that an analysis should be made on the spot, so as to insure a supply of perfectly fresh plants.

A detailed account of the analysis is appended.

One hundred grammes of leaf, flower, and stalk, brought into as fine a division as possible, were taken.

Water.—This varied with the freshness of the sample, some giving 56 per cent. The bundle to which this analysis refers was forwarded to the Department by Captain Menzies, and was not particularly fresh.

Benzine extract.—Purified benzine was used, boiling at 85 degrees Cent. The principal substance dissolved out was a whitish wax, melting at about 70 degrees Cent.

Alcohol extract.—Eighty per cent. alcohol gave a highly coloured extract, containing a small quantity of an oily substance mixed with colouring matters and extractives, and not easy to purify. This oil hardens on exposure to air, and is soluble in ether with some difficulty. No tannin nor organic acids were found in this extract.

Water extract.—Cold water dissolved out a fairly large quantity of a gum, purified by redissolving in water and precipitation by alcohol. In this state it is a gum of a reddish colour. Reduces Fehling's solution on boiling with acids.

Acid extract.—This extract was made with weak hydrochloric acid, which dissolved out substances, which, on treatment with acids, are converted into glucose. They may be classed as starch-isomers. Starch is, however, absent. This extract may also contain some gum not perfectly removed by cold water.

Alkaline extract.—Treatment with caustic potash yielded a very dark-coloured liquid, which gave an abundant precipitate on the addition of acid, and contained probably the greater part of albuminoid matter in the plant. This was not further examined.

Ash.—The greater portion of the ash has been accounted for under the differents extracts. That which still remains unaccounted for is contained in the alkaline extract and the fibre.

Albuminoids.—These were calculated from the nitrogen obtained by Kjeldahl's method.

The only substance which appears likely to possess poisonous properties is the oily substance extracted by alcohol. We are still engaged in obtaining this extract in a larger quantity, with the object of injecting it into a sheep under conditions which will allow of its action being watched. There is, however, considerable difficulty in obtaining a sufficient supply for this purpose the yield being small under the most favourable circumstances, and from specimens in bad condition it is smaller still. Moreover, the pressure of routine work has prevented our giving undivided attention to the investigation. We hope, however, shortly to have sufficient to examine the physiological action of this oil and of the other constituents. The pods and seeds were not submitted to analysis. The plant appears to be poisonous before the pods are formed, and even previous to flowering. Indeed, it is very doubtful whether the hard seeds are digested at all by the animal.

The "Darling pea" or "Indigo" that the following extracts from letters refer to is the *Swainsona galegifolia*. Messrs. Gleeson, in the Myalla district, writing to the Stock Department in 1888, state that 70 per cent. of their young lambs were affected by it, and in this case the plant was not yet in flower. The greater mortality may be due to the fact that at such time the pea is often practically the only herbage, and is especially green and inviting.

Mr. Jas. B. Bettington, Brindley Park, Merriwa, writes as follows:—"I do not regard the Darling pea such a scourge as some do, and I do not think that healthy sheep ever eat it. Salt is an antidote to it, and so long as plenty of salt is supplied in the paddocks sheep either will not eat it, or if

they do will not suffer any ill effects from it. I have killed many sheep suffering from what is popularly called pea eating, and always found them full of worms, but whether the worms are caused by eating the pea or the worms in the sheep cause them to eat the pea I cannot tell."

Captain A. S. Menzies, Reedy Creek, Inverell, writes as follows:—"I have had twenty years' experience of the 'Darling pea,' or 'Indigo,' and am convinced it is nothing else but poison. When stock eat it they will eat nothing else as long as they can get Indigo. They soon fall away, have a wild, distressed look, an awkward, quivering gait, distorted limbs and features, and die at last in an emaciated state. It appears to me a narcotic poison, acting on the nerves and brain. The losses on stock all through these districts are large from this cause, especially among young sheep, and the plant seems to be increasing. It is worse in sheep country than where cattle are run, probably because the latter country is never so heavily stocked. It should be noted that the poison has a marked effect on the fleece of an 'indigo eater.' The wool is nearly always very clean, peculiarly soft, light in condition, and fine in quality. The growth of the wool, as far as length is concerned, does not seem to be at all checked, but the fleece generally is much lighter. The effects generally of the poison pea through these districts are simply disastrous. It is impossible to properly stock the country, and even with all precautions, and with constant care, the losses are at all times very large."

Mr. W. H. Walker, Tenterfield Station, Tenterfield, writes as follows:—"The 'Darling pea' is very troublesome this year; cattle, horses, and sheep are all suffering."

Mr. G. H. Gordon, Gragin, Inverell, writes as follows:—"In the Darling pea there certainly exists, in a most marked degree, constituents injurious to stock, which causes an annual and heavy loss to the pastoralist."

Dr. T. J. Henry, Government Medical Officer, Warialda District, writes as follows:—"*Re* 'pea-eating' cattle, my opportunities for study of the subject have been limited to observing the appearance and gait of the cattle and sheep affected. They fall off markedly in condition and become miserable and drooping, and, even though removed to good grass country, long, and perhaps permanently, if confirmed pea-eaters, remain poor. Their coats lose the glossiness of health and are rough; indeed the rough coat alone will draw one's attention to an affected beast.

"They have a shuffling unsteady gait, and are prone to run into obstacles—'climb trees,' as the bush people laconically term it. I am under the impression that the iris is unusually dilated, though to what extent and for what period it is difficult to determine, and this causes loss of the power of accommodating the vision to a nicety for light and for distance to some extent. This accounts, I am of opinion, for the running into objects. The cerebellum is probably affected also more or less by the pea, and this disturbs the co-ordinating and equilibration medianisms rendering the gait awkward and staggery in bad cases."

The Rev. Dr. Wm. Woolls, F.L.S., &c., whose attention has been called to this plant for a number of years past, has kindly furnished us with the following information:—"*Swainsona greyana*, Lindl. (the poison pea of the Darling). This plant was found in Victoria by Mitchell and Grey, and was named *greyana* in honor of the latter (Lindl. Bot. Reg., 1846), but its poisonous properties were first recorded by Baron von Mueller in the 'Transactions of the Royal Society of Victoria,' and subsequently in the 'Documents relating to the Intercolonial Exhibition (1866–67),' in which he states that, although such extraordinary effects were attributed to it on

the Darling, yet cultivated plants were innocuous when given to sheep in large quantities. Mrs. E. Forde, whose late husband was engaged in surveying the Lower Darling in 1865–66, sent me specimens of *S. greyana* at that time, accompanied with some notes respecting the effects it produced on horses. The poison, it was supposed, acted on the brain of the animals, as those under its influence obstinately refused to pass over even a small twig lying in their way (supposing probably that it was larger than it really was), whilst in other instances they attempted to climb trees. Mrs. Forde further remarked that, so bad was the reputation of the plant amongst the squatters on the Lower Darling, it was regarded with horror by them. This species extends to Queensland, where, in common with others of the same genus, it is supposed to be poisonous, but it is not so common in that Colony as in Victoria and New South Wales. As the accounts respecting the poison pea of the Darling vary considerably, it seems probable that the effects of the plant is very much modified by the season. In dry seasons, for instance (such as that of 1865, when the grasses and tender plants failed, and the animals fed abundantly on *Swainsona*), more mischief appears to have arisen than in favourable years, when forage plants spring up in profusion, and afford a varied nutriment for sheep and cattle.

"*S. galegifolia*, R. Br., and *S. coronillæfolia*, Salisb., which in the 'Flora Australiensis' are regarded as varieties of one species, are more widely distributed than the preceding, and have been known from the early part of the century. These, next to *S. greyana*, are the principal forms to which deleterious properties have been attributed, and so impressed have some squatters been with the fact, that they have incurred considerable expense in getting their runs cleared of what they considered poisonous. It is highly probable that in some parts of the Colony, these species are not distinguished from the native indigo (*Indigofera australis*), and hence they are freely spoken of as 'indigo.' From statements made by persons in different parts of New South Wales, there can be no doubt that these plants, in certain seasons and under certain conditions, are highly injurious to sheep and cattle, but I have been assured by a gentleman in the neighbourhood of Mudgee, who had had great experience in such matters, that he did not consider *Swainsona* poisonous when eaten with other kinds of herbage. It seems also probable that the bad qualities of this genus, as indeed of other leguminous plants are more fully developed when they come to maturity. *Swainsona* and other injurious plants exercise a greater influence on animals in lands recently occupied and yet in their natural state, than when they have been opened up for cultivation or pasture. This, however, may arise from the gradual destruction of noxious species, or from the fact that animals learn to distinguish in some degree between what is suitable for them and what is not. The great danger seems to be in seasons of drought, when they cannot procure wholesome forage and will eat anything that comes in their way. It is likely that *Swainsona* in a young state has a similar effect to *Medicago denticulata* in the early spring, when cattle get swollen from eating too much of it and die unless relieved. I have seen some in that state on the banks of the Cudgegong."

Bailey and Gordon, "Plants Reputed Poisonous and Injurious to Stock, Queensland," say:—"Although the 'Indigo' plant does not contain an irritant poison, it has undoubtedly occasioned great losses in stock. Its effect on sheep is well known to stock-owners; they single out from the flock and wander about listlessly, and are known to shepherds as 'indigo eaters.' When once a sheep takes to eating this plant it seldom or never fattens, and may be said to be lost to its owner.

"The late Mr. Charles Thorn made, in 1873, an experiment with this plant which is deserving of a place here, as showing its effect on sheep. A lamb that had become an 'indigo eater' was placed in a small paddock near the homestead, where it refused to eat grass. Mr. Thorn collected a quantity of the indigo plant and this it ate greedily, following all over the paddock and eating it out of his hand.

"The Hon. G. King, M.L.C., kindly supplied a bag of the plant to the Chief Inspector of Stock for analysis. Mr. K. T. Staiger experimented on several animals, with the result of showing that it was possessed of very powerful sudorific properties, its effect on frogs, for instance, being to reduce them in a few hours to mere skeletons. Further experiments pointed to the probability of its being a most active poison when administered in a volatile state.

"Of the Darling pea, Mr. Wm. Nepean Hutchison says that stock readily devour it, and it takes little to drive them perfectly silly. On one occasion a mob of travelling sheep camped no distance from the town of Taroom. Quantities of the pea were growing about where the horses were hobbled for the night. The following morning it was noticed how strange the animals appeared. They had been on the road some nine weeks, and were up to this date caught without any trouble, but on this particular occasion it took several of the men to do so. Their eyes were staring out of their heads, and they were prancing against trees and stumps. The second day two out of the nine died, and five others had to be left at the camp. When driven they would suddenly stop, turn round and round, and keep throwing up their heads as if they had been hit under the jaw; they would then fall, lie down for a while, and would go through the same agonising performance when they once more attempted to stand. On one station in the course of a few weeks eight head were shot, having injured themselves past all hope of recovery.

"The specimens which have usually been forwarded to us as the 'indigo' have been one or other form of *Swainsona galegifolia*."

*Reference to Plate.*—A, raceme of seed pods; B, seed pod with one of the valves removed to show the arrangement of the seeds; C, stamens and pistil; D, pistil; E, sheath of stamens, the upper portion flattened out; F, seed; G, upper petal or standard; H, wing or lateral petal, side view; I, lower petals or keel, side view, C, D, E, F, H, and I magnified.

# Plants Visited by Bees.

In reply to the series of questions asked by this Department, relating to the plants most visited by bees, a large number of reports were furnished from the several districts of the Colony from which the following has been compiled.

Reports were received from thirty-eight apiarists in the county Cumberland, Messrs. Archibald, Aubin, Ayling, Bailey, Bolus, Bennett, Braithwait, Brown, Cadden, Daley, Davidson, Edmonds, Gambling, Gray, Gardner, Hodgkins, Hinsch, Hensley, Hambley, Hill, Hall, Henderson, James, Littlejohn, M'Hale, M'Lean, M'Farlane, Porter, Prosser, Pemberton, Riddel, Rigg, Sadler, Stokes, Turner, J. L. Thompson, Woolrych, and Wilcour from whose reports the following is collated.

As might be expected in the county Cumberland, where the population is more dense, and the ornamental flowering plants more extensively cultivated, a greater number of plants are open to selection by the bees, and in the various replies such answers as "all the summer fruit-trees," "garden flowers" occur. As in other parts of the Colony, native trees, such as the Eucalypts, are by far the most remarkable as yielding honey; the ironbark, grey gum, bloodwood, blue and white gums, with the blackbutt and woollybutt being named by the observers, with different varieties of ti-trees, acacias, banksia, grass-tree, boronia, waratah, and "all the bush flowers."

As above pointed out, cultivated plants claim an amount of attention, the orange, lemon, apple, pear, peach, apricot, and grape vine being mentioned by several, whilst among vegetables the cucurbitaceous plants, as melons, pumpkins, cucumber, vegetable marrow, and squash, together with the pulses, (peas, beans, scarlet-runners, and French beans) are the best. In plants cultivated for ornamental purposes, the mignonette, sunflower, clematis, tuberose, evening primrose, verbena, candytuft, wallflower, and aster are those most frequently recorded, but bees have also been noticed on dandelion, thyme, sage, horehound, rosemary, maize, buck-wheat, also on spear-grass, kangaroo, and couch-grass.

In this, the Metropolitan county of the Colony, the above-named plants are in bloom in the seasons of the year as follows, and, regarding their value as honey-producing plants, at different times, the observers give information from which the following notes are made. The various fruit blossoms are recorded by the greatest number as flowering in the spring, ten of the gentlemen mentioning them in general terms, while six others named the orange, three the lemon and apple, and the peach, pear, plum, apricot, and grape vine are each mentioned by one; other spring blooming plants noted are the wattle by nine, Eucalypts and clover by six, ti-tree and thyme by six, and dandelion, thistle, pumpkins, red honeysuckle, mignonette, waratah, giant lily, willows, turpentine, and stringybark, with the small wild flowers by others. In the summer the Eucalypts stand at the head of the list,

being recorded by eight observers, and the sunflower is noted by seven; the garden flowers being now in full bloom are more or less noted by all the reporters. The citrus fruits, mignonette, pumpkins, maize, honeysuckle, thyme, clover, buttercup, dandelion, passion fruit, melon, and cucumber being all noted. To these are added in the autumn, rosemary, myrtle, Lima bean, loquat, blackthorn and box; mignonette and passion fruit appear after the Eucalypts to be the best plant in this season. During the winter season, preference seems to be given to the wild flowers and weeds, but the banana, apple-tree, and mignonette are given also, and one observer mentions that the wattle is frequented at "end of winter for pollen."

## North Coast.

Following the coast line northwards, Messrs. Harden, Patten, and Pender replied from the Hunter; Mr. Buttsworth from Stewart's River; Messrs. Dick and Trotter from Port Macquarie; Messrs. Anderson, Davies, Folbigg, Green, March, Morissey, and Nelson from the Clarence River; and from the Richmond River, Messrs. Bagot, Bianden, Carlill, Daly, Fisher, Gaggin, Horan, Hutchinson, Martin, Morris, M'Donald, Perry, Rankin, Selwood, and Steinmark.

The character of the vegetation becoming more tropical, a vast amount of trees and shrubs are found to be visited by the insects in their quest for both honey and pollen; and added to the indigenous vegetation is the great number of cultivated fruit-trees and crops. The genus Eucalyptus is very melliferous, notably, blood-wood, ironbark, grey, blue, and red gums, and the stringybark, while the ti-tree is also considered a good honey-yielding plant, ten different observers from the Richmond and nine from the Clarence noting it. Other trees mentioned are the acacia, silky-oak, bean-tree, mangrove, peppermint, and wild apple. Of the smaller shrubs, the native raspberry, honeysuckle, and the various indigenous heath plants, with the lantana, appear to be most frequented.

The introduced fruit-trees have great attraction for the insects, the orange, lemon, peach, and quince being the most favoured, but melons, pumkins and gramma, the banana, and guava have all been noted. The flowers of maize are very attractive, an account of the great amount of pollen they contain.

Eighteen observers from the Richmond and Clarence districts note clover, while the sunflower, buck-wheat, grass-tree, mignonette, passion-fruit flowers, and bell-flower are all mentioned, as well as various species of grass, notably couch, rib, and wire grass.

In the reports from the Hasting and Manning the turpentine, bloodwood, and ironbark, the broad and narrow-leaved ti-tree are the best of the timber-trees for bearing honey-yielding flowers, and maize, clover, mignonette, and mustard are much sought after. Reporters from all parts of the northern coastal districts mention the good qualities of the fruit-trees, the blossoms of which afford honey of the finest quality and flavour. Prominent among these are the orange, lemon, apple, and quince, the peach and apricot, nectarine and loquat.

From the North Coast clover is recorded by thirteen observers as flowering at springtime, the other plants of the season mentioned being the gum-trees and wattles. At this time they note maize, the orange, and lemon, ti-tree and mangrove, peach, and apricot, bananas, buckwheat, lucerne, sunflower, all the native heath plants, and one observer adds the cut stumps of sugar-cane. In the summer the native trees (Eucalypts, ti-tree, Christmas bush), and the numerous garden flowers are available. Bloodwood appears to be

the favourite, while melons, pumpkins, maize, rape, and hemp, sunflowers, bananas, buckwheat, and citrus fruit-trees are also noted. Mahogany, which is stated to "bloom every other year," is given as a valuable honey-producing tree at this season. The ti-tree, maize, and pumpkins are noted by the greatest number of observers as being visited in autumn, other plants mentioned for this portion of the year being the thistle, banana, lucerne, lantana, hemp, and lemon. Regarding the ti-tree, it is stated by an observer at Broadwater, Richmond River, "to be the largest honey-yielder we have."

In winter time the plants in bloom would seem to be limited in these parts of the Colony, an observer, writing from Casino, Richmond River, stating that "our best honey plants, as a rule, do not bloom in winter." The following are, however, mentioned :—"Coral-tree, wild raspberry, lantana, and Scotch thistle (which blooms on the Clarence all through the winter), bananas, clover, and also a few eucalypti and scrub flowers."

## North Table-land.

The Northern Table-land being well adapted for agriculture, the reports from that district of the Colony have an especial interest. Reports in answer to the questions were forwarded by Miss Mack, Pallal Station, and by Messrs. Chamberlain, Crawford, Croker, Deverell, Dunbar, Engil, Hayne, Hooke, Hopson, Lock, Merry, Pemberton, Pennington, Richardson, Rowsell, Teys, Wales, Waller, Webb, and Whitten.

The replies given by these observers, in the main, bear testimony to the value of the indigenous flora as honey plants. All refer to the Eucalypts and wattles as being, when in flower, much visited by the bees. In the vicinity of the towns, Armidale, Tenterfield, Inverell, and Glen Innes, the cultivated plants and fruit-trees are mentioned. Sunflowers, white clover, mignonette, forget-me-not, and lucerne, being the most generally noted ; at Tamworth, these are all given, as well as several flowering trees and shrubs, such as bignonia, honeysuckle, holly, the grape vine, Bougainvillea, horehound, and the white poppy ; and at Armidale the Scotch thistle is added to the list.

Further north at Glen Innes and Tenterfield, the same plants hold place, together with pumpkins, scarlet-runners, the cherry, and the blackberry. From all places, whence reports were returned, maize is specially noted as valuable for pollen, while sunflowers, mignonette, clover, and the pumpkin would appear to be the best of the cultivated plants, excepting the roseaceous and citrus fruit-trees.

In this district the spring and summer are the best for honey plants, the fruit-trees and wattles in spring with the Eucalypts and garden plants in summer forming the chief attractions. The fruit-trees noted are peach, apricot, apple, pear, and cherry, those with clover, sunflower, blackberry, mignonette, Scotch thistle, sorrel, and mustard ; of native trees mentioned along with the wattles are the native apple, yellow jacket, blackbutt, white and grey gum. In summer, maize, scarlet-runner, pumpkins, lucerne, horehound, and white clover are given, while the Eucalypts and native apple are the chief indigenous plants whose flowers are noted for honey. These trees are also mentioned for the fall of the year, while maize and Japanese buckwheat are the only two added to the list. In the winter, the orange and lemon, clover, lucerne, mignonette, and the wallflower are visited by the bees, and when in bloom the yellow-box and red-gum. The native apple is also recorded for this season of the year.

## Western Districts.

From the Western districts, embracing Bathurst, Parkes, Orange, and the counties west of the Blue Mountains, reports were received from Messrs. Beggs, Berney, Bowen, Brennan, Brown, Chapman, Davis, Dennett, Ezzy, Fielding, Gardiner, Garner, Grunsell, Halsted, Hanson, Hawke, Hyland, Kirkpatrick, Lumsden, Marsh, Mathias, M'Kenny, Newman, Niven, Poilie, Richardson, Shakespear, Shaw, Sheathfield, Sykes, Taylor, Waldron, Walsh, Westcott, Willott, Wilson, and Wright. As is natural, from such an extensive fruit-growing district, as that represented by the reporters named, the summer fruit-trees occupy an important position, and are the most generally noted to be frequented by bees. The various trees, coming under that category are all given by correspondents from the different centres in the district under review. Conspicuous amongst these are the apple, pear, quince, plum, cherry, peach, apricot, with the gooseberry and strawberry. The forest growth is, however, not neglected by the bees, the white, red, and grey gums being the most frequently noted.

From Bathurst, the reporters mention white clover, lucerne, thistles, grasses, and buckwheat, while herbs, such as sage, pennyroyal, thyme, and lavender, with the sunflower, mignonette, and wallflower, are noted, and the reports from Orange and Molong give also the poplar, hawthorn, willow, blackberry, hollyhock, dandelion, and horehound as well as the beforementioned plants.

A great number of plants bloom in spring in this district of the Colony, the replies to the question covering the majority of the cultivated plants of the district. The fruit-trees are now in flower, and with the Eucalypts, wattles, and clovers, yield an abundant supply of honey. The other plants most in favour are: dandelion, lucerne, mignonette, thyme, buckwheat, horehound (stated to be 'superior to all others'), and the buttercup. The poplar and willow are also recorded as honey producers. The sunflower, maize, white clover, pumpkin, and melon are the principal cultivated plants noted as yielding honey, but the Eucalypts seem to be more productive. Other indigenous plants given are the native apple and Darling pea; these, with the golden rod, white lily, marshmallow, dandelion, borage, and mignonette complete the list. In autumn Eucalypts are the best plants for bees, and are given by no less than nine of the reporters as yielding honey in this season. The white box and native apple are likewise mentioned; other plants noted are the sunflower, lucerne, maize, centuary, evening primrose, and plantain. The want of winter flowering plants is in this district severely felt. A reporter from Blayney says, that the bees require to be fed during winter, unless they have collected a good store of honey; the chief plants noted for the season are bottle bush, grass-tree, white box, garden honeysuckle, and a species of eucalyptus. It may be noted that one observer in this district (Bathurst) mentions furze as being a good plant for the bees, and adds that it is "in blossom all the year round," and another gives the spider plant (*Cleome pungens*) as being the "greatest honey-producing plant that we have."

## South Table-land.

From the southern districts replies were forwarded by Messrs. Armstrong, Berrisford, Brett, Brockman, Brown, Clegg, Dewe, Douglas, Faulkner, Ferguson, Frauenfelder, Grosse, Jones, Kendall, Halloran, Hanckel, Hensley, Lesmond, Manns, Marks, Maxwell, Macansh, MacDonough, McGillivray, McGrath, Niblock, Pacey, Paterson, Peers, Plim, Plummer,

Smith, Stafford, Timms, Wallace, Warby and Wood. Here, as elsewhere, the indigenous trees and shrubs would seem to possess great attraction for the bees. About Albury, the white, red, and yellow box, with the stringy-bark, red-gum, and native apple are the most frequently noted. The familiar garden flowers and herbs are, however, recorded as being favourite objects of attention, the sunflower, mignonette, violets, and melons, with the potherbs, such as mint, sage, thyme, rosemary, and borage being noticed. The various fruit-trees and some of the common field plants, grasses, and dandelion are named by the reporters. In the more northerly parts of the district maize, poppies, and thistles are noted about Junee and Wagga Wagga, while in the Adelong and Queanbeyan districts the lilac, jasmine, yucca, and lavender are added to the list of mellifluous plants, and the old English favourites, the hawthorn and wallflower, are given from the neighbourhood of Cooma. Observers residing at Deniliquin and Moama note practically the same plants, particularising the gum-trees, with the fruit-trees and garden plants as well, and give the names of the pear, quince, cherry, peach, orange and lemon, as well as cucumbers, turnips, and the chrysanthemum.

The replies given by observers in this district regarding the plants of the different seasons are very exhaustive. Prominent amongst those noted are the wattle, red-gum, and clover, these being mentioned, the first by thirteen and the other two, by ten reporters. The fruit-trees and dandelion come next for spring blooming plants, while the common plants of the kitchen garden are nearly all enumerated, as well as several of the favourite flowering plants, such as the wallflower, mignonette, clematis, and poppy. The majority of these trees and plants continue in bloom during the summer, while pumpkins, melons, sunflowers, honeysuckle, and oxalis, increase the range of plants open to selection. The native trees in bloom at this season are chiefly the yellow box, pepper tree, red gum, stringy-bark, native apple, ironbark, blue-gum ; the Christmas bell and lantana are also now in bloom. The autumn in this district of the Colony is not so prolific of flowering plants as the warmer parts, but the Eucalypts are still the best from an apiarist's point of view, but the chrysanthemum, maize, sorghum, couch, and summer grass, pumpkin, cucumber, and sunflower are also noted. The winter in this district is noted by several reporters as having no flowering plants, but others mention white and yellow box, grey and white gum, "sometimes" rosemary, sage, thyme, violets, dandelion, and honeysuckle.

## South Coast.

The large dairying districts along the Southern Coast from Eden northwards to Sydney offer great facilities for apiculture, and the reports of beekeepers from that district are, therefore, of interest. The following gave the result of their observations on the plants visited in their several localities :—Messrs. Beckitt, Bielieter, Colhoun, Crawford, Cutcher, Geldmacher, Gordon, Hungerford, Jenner, Kelly, Millington, Neville, Phillips, Somerville, and Whiteley. Judging from their reports the indigenous plants are most valuable for the purposes indicated ; the majority of the observers named giving "native wild flowers" and the various species of Eucalyptus as great favourites, and some mention the wattles and native apple. About Kiama and Wollongong pumpkins, maize, sunflower, buckwheat, and the strawberry are noticed ; and the same favour is extended to these plants about Nowra.

Amongst the forest-trees mentioned are the ironbark, stringybark, the blue, white, gray, and spotted gums, the bloodwood and the blackbutt. The best of the cultivated plants are maize, clover, thyme, wallflowers and sunflowers, while thistles, dandelion, and sorrel are noted. A little further south, as the climate becomes more temperate, in the vicinity of Bombala, Bega, and Eden, the gooseberry, raspberry, strawberry; the fruit-trees—apple, pear, peach, and quince, together with such widely different plants as broad beans, pumpkins, cabbage, maize, sunflower, poppy, dandelion, and mignonette are noted. Here again, as elsewhere, the forest trees, Eucalypts, acacias, and native apple, as also the grass tree, native honeysuckle, the numerous wild heaths and bush flowers are reported to be, when in flower, covered with insects searching for honey or pollen, as the case may be.

The seasons at which the various plants, noted above, bloom in this district, is also of interest, particularly the winters being cold, it is desirable that persons who have bees should know what plants to cultivate or encourage during the other seasons, in order that their stocks may survive the winter, and require as little artificial feeding as possible. The indigenous spring blooming plants noted are, first, the wattle, then the ironbark, dog-tree, and mountain ash; clover is now in bloom, as well as mignonette, the sunflower, poppy, and strawberry; these, with the fruit-trees are all resorted to by the bees. As the season advances the Eucalypts come into bloom, the blackbutt, stringybark, woolly butt, bloodwood, and gray-gum being separately mentioned. Maize, clover, and hops are now available, and wild flowers are plentiful, while of garden plants those mentioned are the sunflower and mignonette. Heath flowers in the autumn with some of the Eucalypts (which have remained in flower) are the only honey plants mentioned, excepting the general favourite, mignonette, the vine, and thistles. A few gum-trees flower in the winter months. One observer mentions the spotted gum, but wallflowers, honeysuckle, and ivy are the only other plants noted.

*Conclusions.*

Reviewing the foregoing condensed notes, it is worthy of remark that the flora of Australia possesses honey-producing trees, shrubs and plants of a high standard of excellence. The honey produced by bees in the near neighbourhood of the forest being of the finest quality, and having few (if any) faults. Judging from the replies to the other questions asked, the bee, while a gum-tree is in bloom, will pass over the most tempting plant in a garden and wing its way to the borders of the bush; but, on the other hand, a field of maize in tassel is a source of the greatest pleasure to the busy little workers, who swarm in countless numbers, collecting the pollen so necessary for their wants. The plants which next seem to have the greatest attraction are the fruit-trees, familiarly called summer fruits. These are mainly of the natural order, *Roseaceæ*, the flowers borne by these being of a white or pinkish colour, are very sweet-smelling, and possess a quantity of good honey, eagerly collected by the bees; the citrus family of fruits also are favourite hunting grounds, as from all parts of the Colony the orange and lemon are noted. The sweet perfume of these trees is proverbial, and the honey collected by bees in the neighbourhood of an orange orchard is of the finest quality. Clover (both white and red) yields a large quantity of first rate honey, and bees kept at places where clover grows never fail to visit the modest flowers of the plant; dandelion, also, is a valuable honey-yielding flower, and is noted in all districts from Albury to Tenterfield.

Regarding the size and colour of the flowers most affected by the bees, much diversity of opinion exists amongst apiarists, and in the face of the

very conflicting replies, it would be vain to determine what coloured flowers are most attractive. It is indeed an open question if colour has any effect in the matter, but, as a general rule, it may be taken that white or light pink, yellow and pale blue seem to be the favourite colours of bee-plant flowers; and, again, while the majority of observers give it as their opinion that small flowers are preferred, it must be remembered that the flowers of melons, pumpkins, and sunflowers are anything but small. No rule, however, can with certainty be laid down, the insects apparently seek for honey wherever it is to be found, quite regardless of size; as one observer tritely says, "The bee is quite indifferent to the size of a flower, provided it gets what its wants."

In conclusion, it may be of interest to give two instances—one, of the—it may be called—eccentric tastes of the bee, and the other as illustrating how an experiment intended for one purpose may lead to the development of another and different use. Mr. A. J. Perry, of Ballina, mentions in his report that in the month of February he "noticed at a saw-mill, where they were cutting some teak, that the bees came in large numbers to the saw-dust every day for about two weeks, even while it was exposed to the sun"; and adds that he was quite unable to account for the fact; and Mr. G. E. Hooke, of Tamworth, writes that "one year I grew a plot of white poppy for experiments with opium, and found the flowers literally crowded from daylight to dark with bees."

# Medicinal Plants.

By. T. PHILLIPS-GIBSON,
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## Jalap (*Exogonium Purga*, Bentham).

Jalap is a native of the eastern slopes of the Mexican Andes, in which situation it is exposed to the sea breezes from the Gulf of Mexico. It grows naturally at an elevation of from 5,000 to 8,000 feet above the sea level. It is particularly abundant about Chiconquiaco and the neighbouring valleys, and also around San Salvador and the eastern slope of the Cofre de Perote. The principal market for the drug is Xalapa or Jalapa (from whence it derives its common name), and is exported mainly from Vera Cruz, a seaport some few miles from that town. The climate of these tropical localities is very humid—in fact, rain falls almost every day, and the temperature varies from 60 degrees to 75 degrees F. It will thus be seen that it is a plant suited for cultivation on the mountain ranges of the north coast of this Colony, where in the partly cleared forests, with a deep rich soil and shady situation, it would succeed to perfection. The *Chemist and Druggist* (London) of 20th April, 1888, in a notice of Baron F. von Mueller's "Select Extra-Tropical Plants," says: "Jalap might be grown successfully in Australia," and the implied doubt as to the profit of the crop is met by the fact that when once started it would require little or no attention, but the plants might be left to ramble naturally about the stems of the shrubs and trees at will; and, further, Humboldt, in "New Spain," vol. iii, page 36, states that the true jalap, "*Purga de Xalapa*, delights only in a temperate climate, or rather an almost cold one, in shaded valleys and on the slopes of mountains."

Although a native of the tropics, jalap has been grown as far north as New York, and grows freely in a sheltered border in the south of England and the Channel Islands, but its flowers are there produced so late in the autumn that they rarely expand and the roots are liable to be killed by the frosts, but in the parts of this Colony indicated there would be little danger of this occurring. It has been introduced into India, and grown with success on the Neilgherry Hills, and has been said at Ootacamund to "grow as freely as a yam," producing tubers of a very large size.

The jalap plant belongs to the same Natural Order as the convolvulus, sweet potato, and ipomœa, and has at different times been called *Convolvulus purga* and *Ipomœa purga*. The flowers, however, mark it as a distinct species from either, being salver-shaped, and Bentham's name (as above) fully meets its characteristics, the word "exogonium" meaning that the stamens project out of corolla.

The use of the tuber of a convolvulaceous plant, as a purgative medicine in Mexico, was made known to European doctors by the early Spanish voyagers. The new drug at once came into favour, and so highly was it esteemed that during the sixteenth century large quantities were imported.

Monardes, in 1568, says that it was called *Ruybarbo de las Indias* or *Ruybarbo de Mechoacan*, the first meaning Indian rhubarb, and the latter in allusion to the province of Mechoacan, from which place the supplies were derived. Some writers have said that this drug mentioned by Monardes was the jalap of modern commerce, but this can hardly be correct, as the description of the drug, and the place from which it is stated to have come, do not agree with the true jalap, and the trade terms in use distinguished between the two, the Mechoacan drug being known as "white jalap" and the officinal kind, from its darker colour, "black jalap." The two kinds, indeed, were often confounded one with the other, but were perfectly separated in 1619, by Colin, a physician of Lyons, who mentions jalap "*racine de jalap*," as then a new drug in French practice, and but lately introduced. The source of jalap was not clearly ascertained until about the year 1829, when Dr. Coxe, of Philadelphia, published a description and a coloured plate from a plant sent to him from Mexico two years before. (*American Journal of Medical Science*, 1829–1830.)

The part of the plant which is employed in medicine is the root, or, correctly speaking, the tubers. A root of jalap throws out several underground shoots, which have other roots at intervals. These, while but an inch or so long, become thickened or carrot-shaped, gradually growing larger, sending out a few rootlets from their surface, and tapering off below. For propagating, each of these rootlets will form a new plant, and as they are very abundant, no difficulty can be experienced in increasing the plantation when once a stock has been established. The fresh root is extremely rough, on the outside of a dark brown colour, but is white and fleshy internally.

Except in Botanic Gardens and in India, where, in 1888, at Dodabetta, between 5,000 or 6,000 tubers and several thousand cuttings were planted, and in the Neilgherry Hills, no proper efforts have been made to cultivate jalap on a commercial basis, though Schiede, writing in 1829, says that the Indians of Chiconquiaco were then commencing to grow it in their gardens. The trade is therefore dependent on the supply of the wild plants collected by the natives of Mexico, who are said to dig up the roots during the whole year. It would appear that this is not a very sensible mode of collection, as it is evident that the best time for gathering them would be when the plants have died down and the roots are at rest, which is a further argument why the proper culture of the plant and a rational mode of collection would result in making the venture profitable. The smaller roots are dried whole, and the larger ones are cut transversely, or are simply gashed with a knife, so that they may dry more readily. As sun-drying would be very slow on the shaded slopes of Andes, if not impossible, the roots are hung up in nets from the roof of the Indian's hut, where they gradually dry, but at the same time often acquire a smoky smell. According to the reports of the drug sales of the last few years the roots now appear to be cut much smaller, probably in order to dry them more quickly.

The jalap of commerce is in irregular sized pieces, mainly depending on the size of the original roots. The pieces are usually pointed at the lower end, deeply wrinkled and furrowed, of a dark brown colour. The larger roots are cut lengthwise or in halves and quarters, but the smaller ones are usually entire. Some are spindle-shaped like a radish, others are nearly globular. These, however, are seldom solid. Good jalap is described as "ponderous, tough, hard, and often horny, becoming brittle when long kept, and breaking with a resinous, non-fibrous fracture. Internally, it is of a pale dingy brown or dirty white. It has a faint smoky, or rather coffee-like odour, and a mawkish taste, followed by acridity."

Jalap owes its value as a medicine to a resin contained in the tubers, and called *Jalapin*. This is obtained by digesting the powdered root in rectified spirit, and concentrating the extract to a small bulk, after which it is poured into water. The resin is thus precipitated and afterwards washed and dried.

The British Pharmacopœia recognises four distinct preparations, namely, the resin above mentioned, a tincture, an extract, and the powdered root. It is also an ingredient when mixed with scammony of another officinal powder. In the preparation of the extract the jalap is macerated for seven days in rectified spirit, the tincture pressed out and filtered, after which the spirit is distilled off, leaving a soft extract; to remove any extract that may remain the jalap is again macerated, but in water, for four hours, and strained through flannel; this is evaporated, and the resulting extract mixed with that previously obtained by the agency of the spirit, and the whole evaporated at a temperature not exceeding 140 degrees F. until it becomes thick enough to form pills. The dose of this extract is from 5 to 15 grains. Powdered jalap is composed of five parts of the ground root, nine parts of acid tartarate of potash (cream of tartar), and one part of ground ginger, well mixed, and passed through a sieve; dose from 20 to 60 grains. The tincture is more difficult to prepare, and as it requires considerable attention during the process, it is not advisable to attempt the operation without proper appliances, and time to attend to it.

Jalap in any of its forms is a powerful and useful purgative, but occasionally causes nausea and griping. It is given to overcome habitual constipation, as a derivative purgative in affections of the head and also in some other cases. It is usually a safe medicine for children, but care must be exercised, as overdoses may give rise to purging and inflammation. The secretions of the intestinal canal are increased by jalap, while the researches of Doctors Rutherford and Vignal have demonstrated that jalapin excites the flow of bile, and Bartholow in "Materia Medica," page 468, says, "With proper attention to the conditions in which it is admissible, and to the dosage, jalap is entirely safe, and is a very certain and effective cathartic," and recommends the aromatic syrup of rhubarb as a suitable medium for giving it to children.

Jalap is almost altogether imported from Vera Cruz, and some idea of the value of the trade may be gained when it is considered that the annual imports, into England alone, varies from 180,000 to 200,00 lb., realising from 1s. to 1s. 9d. per lb. according to quality.

Besides the true jalap the roots of other Mexican plants of the same natural order are employed either as substitutes or adulterants. The two following are the best known, although several others are used, viz., light jalap and tampico jalap. The first is also called Orizaba root, and is the male jalap of the drug trade or the *Purgo macho* of the Mexicans. It is the root of *Ipomœa orizabensis*, Ledanois, a plant found on the sides of Orizaba, and very nearly allied to true jalap. The second, called in Mexico, *Purga de Sierra Gorda*, growing on the mountain of that name, as well as near Oaxaca. This plant has been described by Hanbury as *Ipomœa simulans*, and is closely related to the other two, but differs in having a bill-shaped corolla, and pendulous flower-buds.

In conclusion, it may be pointed out that, according to Bentley and Trimen in "Flora Medica," the jalap, "as an ornamental plant has considerable claims to notice," its purplish-violet flowers and bright green leaves rendering it a plant well worth cultivating for covering fences and other unsightly objects.

## Dill (*Anethum graveolens*, Linn).

This is an erect annual or biennial plant, which is a native of Southern Europe, Egypt, Palestine, and the north of Africa, but is now cultivated in England, France, and many widely-separated localities, such as Norway, North America, Cape of Good Hope, and was found growing abundantly in the Bermudas by the "Challenger" Expedition. It is extensively grown in these countries for its aromatic fruits, which are used in medicine and confectionery.

It is a plant of the Natural Order *Umbelliferæ*, being related to several others used as condiments, as caraway and cumin, and also to such useful plants as the carrot, celery, and parsley.

Dill is commonly regarded as being the *anethum* of ancient Greek writers, as well as being the plant mentioned by that name in Matthew xxiii, 23 (but translated from Wickliff downwards "anise") as being one of the garden plants on which the Pharisees paid tithe, making a display of paying on an humble crop, while they neglected larger and more important objects. It is also mentioned by Pliny as a condiment (Nat. Hist. xix, 61 and xx, 75).

Dill, as well as fennel, coriander, and cumin, was in frequent use in Britain in Anglo-Saxon times, and in the "Herbarium Apuleii," about 1050, as also in the "Book of Leechdoms" it is noticed. The common name is derived, according to Prior (Popular Names of British Plants, 1870), from the old Norse word *dilla*, to dull, in allusion to the carminative properties of the fruit or seeds; and we find the words "dill" and "till" used in this sense in the tenth century by Alfric, an Archbishop of Canterbury, and also in Germany and Switzerland as early as the year 1000 A.D.

Dill may be easily grown from seed sown in the spring, and produces seed abundantly. Any good garden soil will suit for its cultivation. The ground should be worked as fine as possible, and the seed sown in drills. As the seed is small it should not be sown deeply. In this Colony the beds or drills will require to be gently watered and kept very free from weeds. As the plants are of upright habit they may be allowed to grow fairly close together, but should not be too much crowded; the drills are best about 18 inches apart, which gives room for hoe cultivation. The flowers will appear in the end of November or beginning of December, and are soon succeeded by the heads of seed. These heads should be cut off before they are too ripe, else a quantity of the seed will be cast and lost, and as soon as gathered are to be spread on a sheet in a dry and well-ventilated room, when they may be rubbed up to separate the seed from the stalks. It can then be winnowed or sifted out at leisure, and packed in calico bags as soon as perfectly dry.

The whole plant is aromatic, but the part used in medicine is the fruit; these are about one-sixth of an inch long, oval, flat, and surrounded with a membranous border; they are of a brown colour, the border being somewhat paler, of an agreeable aromatic smell and taste.

The preparations in use are dill water and oil of dill. The British Pharmacopœia recognises only the oil distilled in Britain from dried fruit. It is of a pale yellow colour, with a pungent odour and a hot but sweetish taste. The yield is about 3 per cent. The oil has a specific gravity of from ·977 to ·900. Dill water is prepared by putting 1 pound of the fruit into 2 gallons of water and distilling off 1 gallon. Both the water and the oil are used as carminatives, and to relieve flatulency, colic, and hiccough, the dose being a teaspoonful of the water or one to two drops of the oil, on a lump of sugar, for an infant, and five drops of oil or from ½ to 1 oz. of the water for an

adult. Dill water is also used to cover the unpleasant taste of other medicines, particularly the various sodas, as Epsom and Rochelle salts.

The plant is largely grown in various parts of India under the local names of *suva* or *soyah*. It there grows to a height of from 2 to 3 feet, and was consequently regarded by Roxburgh as a distinct species, which he named *Anethum sowa;* but the Indian plant has no botanical characteristics to warrant its separation from the common and officinal dill of Southern Europe. The seeds are much used in India for culinary purposes, forming one of the ingredients of many native dishes and curries.

Although known for such a long time, there is but little legendary lore attached to dill; it was, however, supposed to excite the passions when boiled in wine, but it is probable that the excitement arose from the wine more than the boiled seed; and it had also the reputation of counteracting the enchantments of witches and sorcerers, as an old poem has it,

> "The vervain and the dill
> That hindereth witches of their will."

# The Sugar-cane Disease.

By Dr. G. KOTTMANN, Ph. D.
Inspector of Mills, Colonial Sugar Refining Company.

The following memorandum was prepared for the General Manager, and is now sent to us, through the officers of the company, for publication, and we have much pleasure in giving it the publicity of our columns:—

[Memorandum.]

I now submit for your consideration the conclusions to which I have come with reference to the sickly condition of some of the cane on the Clarence and Richmond Rivers—conclusions formed on impressions received during my two recent visits to these districts, such visits, however, not having been of sufficient duration to enable me to make exhaustive investigations.

I may commence by saying that the cane which has been affected on the Clarence does not in all cases present the same symptoms; in some fields the cane dies off from the top in a similar way to the stoppage of growth caused by the checking of the arrow; in others, in place of the ordinary top is a bunch of leaves growing in a fan shape, and springing from a joint studded with buds, below which there are a few joints which have not developed any. In the former case the cane is said to be suffering from "the disease," while in the latter the cane is reported to be attacked by Sereh, this name having apparently been selected for want of better knowledge on the subject. Sereh, as will be remembered, is the name given to the disease which in recent years committed great ravages in the canes in Java. It is really the native name of a bush grass growing in Java, and was adopted because the cane suffering therefrom produced leaves without stalks which resembled this grass. The cane on the Clarence does not present such an appearance; and, moreover, the highly-trained scientific men who have been occupied exclusively for a number of years in Java investigating the condition of the disease there have not, to my knowledge, ascertained what Sereh actually is.

As to the origin of the sickly condition of the cane here, which I shall henceforth refer to as "the disease," some observers have contended that it is due to injury caused by insects or fungi, or other untoward influences; but, although I am not in a position to assert positively that this is not the case—as such an assertion can only be made after patient investigation by entomologists, pathologists, and chemists—I can say that I believe the disease has not been caused by untoward influences such as those named, but that it is the natural consequence of many series shortcomings in the cultivation, aggravated by the unusual rainfall for the last few years; in other words, I believe that the disease can be avoided, and that its occurrence will prove to be not without advantage to the farmer if he profits by the warning he has received.

In my investigations I examined the roots of stools of healthy and diseased canes, and found in all cases that the root development of the latter was much more on the surface and weaker than that of the former; thus the healthy stools were found to send a dense network of roots down to about 20 inches or more from the surface, while the diseased cane showed a close network of roots only near the surface, and not to a greater depth than from 10 to 14 inches, from which I came to the conclusion that any condition favouring the development of the roots close to the surface only assisted the spread of the disease. In support of this statement I would point out that the cane has been most affected on land having a subsoil of heavy clay or on ridges with a subsoil of sand. The unusually wet seasons since '87 have been injurious to both, the former being in a measure swamped by heavy rain, while the latter has had the fertilisers washed out, on account of the low retentive capacity of sand for these, thus causing the roots to develop mainly near the surface. The cane therefore had to draw the nourishment from a limited layer of soil, and in addition, in dry weather, it would, by reason of the absence of moisture, find but little nourishment where the roots had spread. The unfitness of the subsoil for the development of roots may also explain the slight appearance of the disease on a farm at Carr's Creek, which, though the proprietor appeared to take little notice of it, at the time of my visit was causing some alarm elsewhere, the owner stating it as his opinion that the outturn of the crop was thereby scarcely interfered with. On examination it was found that under a first-class surface soil of about 14 inches depth there was a hard subsoil of more sandy appearance into which only a few roots had penetrated. The land had been under cultivation—probably very shallow—for about twenty-five to thirty years, the owner relying on the flood deposits to produce good crops. At another farm on Carr's Creek the slight appearance of disease was by a neighbour attributed to the stools having been much shaken by a gale, which would injure the roots at some depth—a fact which may be well worth mentioning. On the Richmond where the disease has not manifested itself to the same extent as on the Clarence, like causes seemed to obtain.

Such being the conditions prevailing more or less throughout the affected districts, I have the less hesitation in saying that defects in the system of cultivation practised are in the cause of the appearance of the disease, these being chiefly want of proper drainage, shallow cultivation, exhaustion of the vegetable matter of the soil, and, to crown all, an astonishing carelessness in the selection of cuttings for plants.

As to the drainage, I may say that there are fields of cane on these rivers which for weeks and even months of this and preceding years have been literally swamped, and it is generally remarked how little has yet been done towards draining the low parts of the farms, though in most instance there are ample facilities in the way of creeks and other water-courses for receiving the surface drainage, while it is now understood that the Roads Department offer no objection to drains be taken under the roads to the river where these are properly constructed, which then would afford in most cases the greatest fall from the lowest point of the farm.

In regard to the shallow cultivation, it will be found when correctly measuring the average depth to which the plough has penetrated that this is not more than 5 or 6 inches. Only a small layer of the surface soil is thus kept in a loose condition, while, except on land of unusually good quality the air cannot penetrate to any extent below this depth, and thus sweeten the soil and render soluble its dormant fertilisers ; in other words, the plant has to draw its supply of food from the surface, whence it practically receives

none in dry weather. In addition to this the small depth of soil that is loosened reduces the soakage capacity, so that a slight rainfall is sufficient to swamp the land, and by souring this, seriously injure the roots of the canes. I do not advocate a sudden change from shallow to deep ploughing, as by the latter method dead soil would be turned up, which for some time would give a very bad yield; but the air can be given access to the lower layers by subsoiling, and much more cheaply than if the land were ploughed very deep, such subsoiling, besides sweetening the lower layer and rendering it more easily penetrated by the roots of the crops, would also serve to remove the surface water rapidly, and this work could easily be done with an ordinary plough by removing the mould board and fitting on a narrow share instead of the ordinary one, which is rather wide for the work.

Then as regards the restitution of vegetable matter to the soil, the importance of this will be recognised when it is remembered that it is this matter that makes the soil loose, and thus allows access of air, and provides channels for the escape of surplus water; besides supplying carbonic and organic acids, which make plant-food available from otherwise sterile soil, and, in addition, increases the capacity of the land for absorbing and retaining water. To what degree vegetable matter serves the last-named purpose may be seen from the following figures :—

Decaying vegetable matter or humus has been found to absorb 180 per cent., grey clay 70, and pure sand 25 per cent. of their own weight of water. When exposed to the air for some hours at a moderate temperature humus was found to lose 20, grey clay 32, and sand 88 per cent. of the water thus absorbed. Humus, therefore, will soak up seven times the quantity of rain that pure sand will, and two and a half times as much as grey clay will; and when dried under certain conditions it will still contain 144, grey clay 48, and pure sand not more than 3 per cent. parts of water for every 100 parts of their own weight. Although vegetable matter or humus therefore ranks as one of the main safe-guards for the sound growth of cane, especially in a somewhat capricious climate like that of New South Wales, with alternating heavy rains and protracted droughts, the system of cultivation on the Northern rivers has been such as to convey the impression that the aim of the farmers so far has been to get rid of the humus in the shortest possible time. The trash has always been religiously burned, and all that has been restored to the soil in the shape of vegetable matter are the poor remnants of the burnt trash, and of occasional maize crops and weeds. It will be interesting to the cane-growers of the northern districts to hear that the trash is not burned in Cuba, which is the largest producer of sugar from cane. The trash is there put between rows, and assists in keeping down the weeds by smothering them. The cane is ratooned from one plant for ten years or more, and that this is possible I attribute greatly to the beneficial effect of the organic matter in the trash, rich as that soil in the first instance is. Though I believe in the saving of the organic matter in the trash before ratooning, by shifting the latter on every alternate bank and cultivating the clear banks, I would go so far as to say that burying the trash is the best course to adopt when ploughing out. Certainly it is much better than doing nothing at all in the way of returning organic matter to the soil, but it cannot do as much good as green manuring; and, in case both cannot be done, preference should be given to the latter. The green manuring crop, when made to grow vigorously, supplies more valuable fertilising matters than the trash, and it is unwise to leave the soil when bare exposed to the hot sun and heavy rains of a semi-tropical climate, which will tend to reduce its fertility. Green manuring is a most excellent means of returning vegetable

matter to exhausted soil, and thereby restoring that which gives its principal value to virgin land. The American cowpeas have of late come into prominence as a superior seed for green manuring. They are regularly used by sugar-growers of Louisiana during the fallow they give between ploughing out and planting, and will, I hope, in the early future be largely used in the same way in New South Wales. There is not, however, a sufficient quantity of seed yet available for practising green manuring with this crop on a large scale, and we must therefore look out for a plant that can at once be made to serve this purpose. This is maize. Though not assimilating as much nitrogen from the air as cowpeas, it has been found to answer well for green manuring in Fiji, when sown broadcast, on account of its heavy and sure growth, and it is easily ploughed under when between 3 and 4 feet high. It will then soon rot, and does not in any way interfere with the subsequent cultivation, and indeed it will often be possible to sow two crops between ploughing out and replanting, a course that can be much recommended.

It is chiefly, however, the carelessness displayed in the selection of cuttings for planting that has brought about the present trouble. The farmers frankly admit that they have often taken plants from the poorest cane on the farm in order to save the good cane for the mill. If, therefore, disease appeared in the cane on the farm as a consequence of a bad system of cultivation, or, for argument's sake, owing to untoward influences, the farmers were certain to propagate it. It may be assumed that the mistake having been recognised, will not be repeated, and the energetic measures recently taken to procure sound cuttings for the infested districts of the Clarence will go some way to produce an improvement; and in connection with the selection of plants, it may here be mentioned that all stalks or tops of stalks with bulbous or sprouting eyes should be rejected instead, as has been done here and there, of being preferred on account of their being likely to sprout quickly. The planters in Java were very particular on this point in 1888, when preventive measures were taken against the sereh, and they only allowed plants to be selected with small tight eyes that were pressed close to the stalk, unsoundness of the cane usually manifesting itself by the sprouting of the eyes near the top. It is, of course, a different thing when the eyes are made to sprout by bedding or pitting the plants for some time in small heaps under trash. This, when carefully done, has given satisfactory results on the Clarence, and the farmer who tried it successfully advised that the beds or pits be distributed over the land to be planted, in order to avoid injury to the beds during transport. This method allows also of a selection of plants which will sprout from those that will not, and is largely adopted in Mauritius.

During my last visit to the Clarence I found that those of the leading farmers on the lower river with whom I had the opportunity of conversing on the subject are quite aware that the old system of cultivation must be changed, and have already taken steps to improve the drainage and to plough deeper, while they also declared themselves ready to try subsoiling and green manuring with maize on land that will be ploughed out after the end of the crushing season and replanted next season, and not to let land lie under a bare fallow; and it is to be hoped that the disease of the cane will be dealt with in this spirit by the majority of the farmers.

I must, however, point out that nothing was said at the meeting held at Chatsworth on the 22nd of November last to discuss the question of the disease of the cane indicating that the farmers attending this meeting realised the need for selecting plants and for improving the cultivation, nor did anyone draw attention to the fact that the appearance of the disease on virgin

land was due to the use of unsound cuttings, or that the comparative exhaustion of much of the frontage land on the Clarence by continuous cropping without manuring other than that given by the floods, and the setting of the subsoil by the ploughing of the surface, offered strong reasons for a marked change in the system hitherto adopted of working the land. Till such changes are made the crops are bound to be sickly and inferior, and the so-called disease will spread unless the farmers generally face the position as did the planters in Java, when the sereh caused such serious damage. These men, though they summoned to their aid the most scientific skill they could command, did not sit down to wait for a description of the disease and of the possible cure ; they went vigorously to work to improve their cultivation in any way that seemed possible, especially with regard to discretion in the use of irrigation water, the loosening of the soil over the whole area instead of only in the plant furrows, the return of more vegetable matter to the land, &c., and then made arrangements for procuring cuttings from the hills, where a healthy stand of cane could be procured, with the result that before the scientific men are satisfied as to the cause of the trouble the latter has already been diminished, and the production of sugar again shows signs of a healthy increase. And this was done in a country where some details of the cultivation were so carefully done that the cane-fields were called "gardens," and rotation of crops was strictly enforced. Let the farmers of New South Wales follow this example, and there will soon be a change for the better.

I may mention in conclusion that the appearance of disease in the cane is not a novel experience in New South Wales, for I learn that nearly twenty years ago two purple canes then grown on the Clarence were destroyed by disease. A similar fate met the Bourbon cane at Mackay and in New South Wales, and at a late period it was found necessary to discontinue altogether the planting of ribbon cane, though such action appears to have been taken mainly because the other varieties promised to yield a better crop."

# Cold Storage of Fruit.

THE following Report was made by Mr. A. H. Benson, Fruit Expert to the Department:—The recent experiments in the cold storage of fruit at the Government meat markets, Darling Harbour, which, as intimated in our issue of October last, were carried out under the supervision of the Department of Agriculture on lines suggested by Mr. W. E. Shoobridge, of Bushy Park, Hobart, Tasmania. This gentleman recently visited Sydney for the purpose of getting the Governments of New South Wales and Victoria to join with the Government of Tasmania in sending a trial shipment of fruit to England in a vessel, the hold of which shall be thoroughly ventilated with cool air, instead of placing the fruit in the cold chambers used for the conveyance of frozen meat, as is done at present. Messrs. Hudson Bros. kindly placed a cool room at the disposal of Mr. Shoobridge, by whom the preliminary experiments were carried out, as described in the *Gazette* above referred to. Mr. Shoobridge has given a very great deal of attention to the export of fruit to England, and in order to determine exactly how the fruit kept and the condition in which it arrived in England, he accompanied a consignment of apples from Tasmania to London. The result of his experience is that in every case where the fruit is placed in the cold chamber used for the frozen meat trade there is always a loss, arising from the want of ventilation with fresh air and the consequent condensation of moisture on the fruit, especially that contained in the lower cases. He also noted that the fruit ripens very much faster during the voyage than is the case when stored in Tasmania, even though the temperature was kept considerably below that of the average winter temperature of Tasmania; and this he also attributes to want of ventilation. The experiments were conducted from the 27th of August, when the first fruit was placed in the cool room, to the 7th of December, when all the fruit then in the room was sold. The fruit stored was confined to oranges, emperor mandarins, and lemons, all of which were wrapped in tissue paper and packed in ordinary fruit packing cases, after having been allowed to remain for a few days in an airy place to thoroughly dry the fruit from all excessive moisture in the skin, and to help to toughen the skin and render it thus less liable to bruise in transit. The fruit was generally very unsuitable for long keeping, as the emperor mandarins were very puffy, and consequently difficult to keep or handle, on account of their being so easily bruised. Many of the oranges were covered with scab and otherwise injured, which prevented their keeping; and lemons do not require cold storage and keep much better without it if only properly handled, and cured in accordance with the instructions issued in Part IX, vol. III, "Preparation of the Lemon for Market," of the *Agricultural Gazette*. In order to substantiate this statement I may say that on August 4th I cut a case of lemons from the orchard of the late Mr. E. H. Acres, of Baulkham Hills, which when examined on December 6th, were found to be in perfect condition—only one lemon showing any signs of decay; and these

lemons have been stored in one of the offices of the Department and subject to all the changes of temperature. Mr. Cairns, of Parramatta, has also lemons cut about the same time and stored in his cellar, which are in first-class condition, and which were pronounced by a large English fruit merchant to be the best lemons he had seen in the Colony, and to be exactly suited to the English market.

The original experiment, as devised by Mr. Shoobridge, underwent several modifications, as it was not found to work satisfactorily. The ventilation was insufficient, and the temperature was only kept down by opening the door leading from the meat-room to that in which the fruit was stored, and allowing the cold air to get in. The butchers who had hired chambers in the meat-room from Messrs. Hudson Bros. complained of this, as they said the smell of the fruit was spoiling their meat. The fruit was, therefore, removed to another room on the 27th of September, which was not fitted up with any means for keeping the temperature down, and remained till the 8th of October exposed to the ordinary outside temperature, which ranged from 58 to 66 degrees. The average temperature previous to the removal of the fruit from the cold room was 48·5 degrees from 27th August to 7th September, and 50·3 degrees from the 7th to the 27th September.

On 8th October it was finally placed in a cool room that had been specially prepared to receive it, and in which the temperature was brought down to 45 degrees by means of cold air and a coil of brine pipes inside the chamber.

The outer air was cooled by being passed over a coil of brine pipes placed inside an insulated box on the outside of the cool chamber in the market. The outer air entered at the top of the box and passed over the pipes, and thence into the cool room, the in-draught being produced by a torpedo cowl placed on the top of a ventilating shaft connected with a ventilator placed in the centre of the ceiling of the cool-room. The cool air was thus drawn in at the bottom of the room and the warmer air was drawn off at the top. This gave a sufficient amount of ventilation, but was only a partial success as the cool air was not sufficient to keep the temperature low enough, especially on the side of the room opposite to that at which it entered. In order to obviate this a coil of brine pipes was introduced into one side of the room, and the cool air entered at the other. This proved very satisfactory, as while there was always good ventilation the temperature was maintained very evenly. From October 8th to November the 7th, a period of 31 days, the average minimum temperature was 41·4 degrees, and the average maximum temperature 45·2 degrees, or a mean average of 43·3 degrees, which I consider highly satisfactory.

Owing to the condition of the fruit when placed in cold storage, and the changes of temperature it underwent during the progress of the experiment, and also on account of its having to be moved out of the chamber and repacked at least twice to remove spoilt fruit, I consider that the fruit kept remarkably well. The experiment has demonstrated conclusively that the temperature can be maintained evenly and low enough with a constant influx of cool, fresh, comparatively dry air. This can be done at a very cheap rate, and it should be of great value in the export of fruit, as by similar means the hold of a vessel could be cheaply fitted up so as to carry fruit better and cheaper than when carried in the freezing chambers, when, in addition to a very heavy freight of 4s. 6d. per case, there is always more or less loss owing to the condensation of moisture on the lower cases of fruit. With ventilation this condensation is prevented, as the whole of the aqueous vapour is drawn off by the exhaust fan through the ventilator shafts. In the cold storage of fruit one precaution will, however, have to

be carefully taken, and that is, the temperature of the cold room will have to be gradually raised from that of the cold room to that of the outer air as, if taken at once from a cooler to a warmer temperature, there is always a heavy condensation of moisture from the atmosphere on the fruit which causes a rapid decay to set in, as well as entirely spoiling all the papers used to wrap the fruit. If the temperature is, however, gradually raised, this will be entirely prevented. The success of the experiment is mainly due to Messrs. Hudson Brothers, who did everything in their power to assist the Department, and to the gentlemen who sent their fruit for storage.

Subsequently, on the 4th January last, Mr. Benson paid another visit to Darling Harbour, where Mr. F. W. Hudson was kind enough to agree to the cool chamber being used by the Department for the conduct of storage experiments with soft fruits, such as apricots, peaches, pears, plums, grapes, &c.

In regard to the fruit stored during the previous experiment an account sales handed to Mr. Benson shows that in Melbourne 36 cases of oranges realised an average of 8s. 7½d. per case, which, taking into consideration the difficulties explained in the above report, must be considered a highly satisfactory result. Moreover, at the time they were first placed in cool storage they would not have realised more than 3s. a case at the outside.

# Report on the Frozen Meat Trade of New Zealand.

By ALEX. BRUCE,
Chief Inspector of Stock.

I HAVE the honor, in compliance with the instructions I received from the Hon. the Minister, to make the following report on the frozen meat trade of New Zealand; and, in doing so, I desire to acknowledge the assistance I received in collecting materials for my report from Mr. J. D. Ritchie, Secretary of Agriculture, and Mr. Thos. Brydone, general manager of the New Zealand and Australian Land Company, Dunedin; and to notice in passing that New Zealand owes a great deal of its progress to the able management of the directors of that company of their extensive properties, and the sound judgement, energy, and practical knowledge of agricultural and pastoral matters displayed by their general manager during the twenty-five years he has held that appointment. In the first place it was largely through the company, under Mr. Brydone's advice, that more than twenty years ago an improved system of tillage, and the growth of roots and grass crops was introduced, whereby an excellent system of rotation of crops (a thing, I am sorry to say, almost unknown to this Colony) was adopted, and the fertility of the land maintained, while heavy lots of prime fat sheep have been turned off at 18 to 20 months old, at prices ranging from 15s. to 19s. each. To enable this to be done, the breeds of the best sheep have had to be introduced, and the breeding and quality, both as regards mutton and wool, has had to be maintained; and this, too, has been so well and successfully carried out in the company's flocks of the leading breeds of longwoolled sheep, that they are held in general estimation throughout the Colony, and their rams meet with a ready sale.

The next matter was the successful initiation of the frozen meat trade, and that Mr. Brydone, under directions from his directors in London, and the information he received in this Colony (where the first attempt was made by the late Mr. T. S. Mort), successfully accomplished when the first cargo of frozen meat from New Zealand, consisting of some 4,000 sheep and 600 lambs, which had been killed on one of the company's stations and frozen on board the sailing vessel "Dunedin," was delivered in good order and condition in London in the beginning of 1882, and realised the handsome price for sheep and lambs of 6½d. per lb. In alluding to what this company has done for New Zealand, I think I may add that they were the first (in 1882) to establish a dairy factory on their property at Edendale, and now there are over 100 in that colony doing well, and turning out large quantities of excellent butter and cheese.

My object in making this statement in regard to the work done by the New Zealand Land Company is twofold—(1) to give credit where it is fairly

due, and (2) to induce the owners in this Colony, who hold good country, with a rainfall and climate similar to that of New Zealand, to adopt, as far as possible, the New Zealand system of tillage, stock-breeding and fattening, and export of meat. And although the circumstances are, perhaps, not so favourable in this Colony for the adoption of that course as in New Zealand, yet I have no doubt that many of our owners in the colder and more temperate portions of the Colony will be able to adopt the New Zealand system, and the breeding of crossbred sheep; and that will materially assist in establishing an export trade in frozen mutton. I will now proceed to state as briefly as I can how the frozen meat trade was established in New Zealand, to give some account of its extent, and to say how it is conducted.

## 1. How the New Zealand Frozen Meat Trade was Established and Companies formed.

The trade was initiated, as already stated, by the New Zealand Land Company, and it was fully established by the formation of joint stock meat companies. As there was an over-abundant supply of fat sheep in New Zealand when the first shipment of frozen meat was made to London (that colony was then, as ours now is, suffering from glutted markets and low prices), and as the prices obtained for the first shipment were very remunerative, the natural result followed. Joint stock meat companies, in which not only stock-owners, but it may be said all classes of the community took shares, were formed. Freezing works were, in the course of a few years, erected in most of the districts where fairly steady supplies of fat stock could be obtained, and shipping engaged to carry the meat to London, and, so successful has the trade been generally, that while there are now twenty-one freezing depôts at work, with an output of some 2,000,000 of fat sheep a year, there are only three or four companies where even the shareholders who own neither sheep nor cattle, nor have any direct interest in stock, have not regularly received at least fair interest for the money they have invested in these companies; while those shareholders who are stock-owners have, in addition to their dividends, benefited to an enormous extent through the rise in the price of fat sheep—for sheep which in 1882 were bringing only 7s. 6d. and 8s. 6d. are to-day selling at from 16s. to 19s. each at the freezing works.

As it is naturally a matter of considerable interest to our stock-owners who, it may be said, have been endeavouring unsuccessfully for the past ten or twelve years to form companies for the export of our surplus meat, to learn how such companies were successfully established in New Zealand, I would explain that in that colony the course generally adopted was for those who moved in the formation of the company to obtain a guarantee from the stock-owners in the district that they would annually supply a certain number of fat sheep for shipment. On this being obtained, a prospectus, bearing the name of gentlemen in whom the stock-owners and the public had full confidence as provisional directors, was issued, showing that the undertaking would be a paying one; the public were invited to subscribe the necessary capital, and the company was soon formed, for, as already explained, almost all classes in the community took shares. The guarantee given was necessary, principally because freight was comparatively scarce, and the shipping companies insisted upon a guarantee being given by the meat companies as to the number of sheep which would be shipped before they would undertake to call at any of the ports and take the frozen sheep.

As it turned out, however, this guarantee entailed no risk, for space on board ship was very shortly at a premium (each shareholder was entitled to so much space in proportion to his shares), and as much as 2s. 6d. per sheep was in early days paid for space, which, of course, the greater part of the shareholders could not use themselves. The fact is, the business proved a remunerative one, and it was seen, too, that the supply of fat sheep could not only be maintained, but increased, for, situated as New Zealand is, with land and pasture as good as any in the world, a favourable climate, with sufficient rainfall, large numbers of the very best mutton-producing sheep, and thoroughly reliable practical business men to manage these companies, the people taking shares had every confidence that the investment they were making would be both a profitable and lasting one; and they have not, except in a few cases, been disappointed.

## II. The Freezing Works in New Zealand, their number, position, and capabilities.

There are twenty-two meat-freezing works in New Zealand, including one in course of construction. Of these thirteen are in the North Island, and nine in the South. These companies are all of colonial origin, though some of them, such as Nelson Brothers, are believed to be assisted by English capitalists. This firm, it is said, owns four or five of these works, and largely controls the business of three or four other companies, and they also act as agents in London for several of the others. It will thus be seen that this company have a very large say in the conduct and management of the frozen meat trade; and, notwithstanding the very great deal of good they have unquestionably done both in New Zealand, and are also doing in this Colony, there is a feeling there as here that the formation of additional companies with capital and enterprise like theirs would be to the advantage of stock-owners in both colonies.

To the great body of our stock-owners it will be a matter of surprise to learn that in a colony with such a comparatively small area as New Zealand, and with less than one-third of the sheep in New South Wales, so many freezing works should be established, and this feeling will be increased when they are informed that in the portion of New Zealand fairly stocked with sheep these works are to be met with not more than 60 or 70 miles apart, while in or near Wellington there are no fewer than three different works, near Christchurch two works, and in the vicinity of Napier two works. Of the twenty-two works alluded to, twelve of them were visited by Mr. Gordon and myself, and the following are the places at which the works have been erected:—In the North Island: Auckland, Gisborne, The Spit (Napier), Tomoana, Waipukarau, Woodville, Waitara, Patea, Wanganui, Wellington, Nghauranga, The Gear. In South Island: Belfast (Christchurch), Nelson, Islington, Timaru, Oamaru, Dunedin, Milton, Matura, The Bluff. Of these the first erected were the works at Bernside, Dunedin, then those at Christchurch and Wellington, and afterwards those at Napier, Tomoana, Timaru, Oamaru, and Invercargill in the order in which they are mentioned.

## III. Capabilities of the Works.

From the statements received it would appear that the works at the places stated, with capabilities ranging from 300 to 1,600 sheep per day of twelve hours, can freeze from 12,000 to 13,000 sheep in a day, which would be equal to about 4,000,000 a year. This is considerably more than the cast of

fat sheep and lambs in the colony would actually require to be provided for. But the necessity for this additional space arises, of course, through the sheep not being sent to the works day by day during the year in regular numbers, but irregularly as the owners require to part with them, and, of course, in very much larger numbers at one season of the year than another. This irregularity in the supply of sheep coming to the works has also to be met by night work, and a good few of the works are provided with electric lighting to enable the freezing and loading to go on by night when required.

## IV. The Kind and Cost of Building and of Works.

As a rule the buildings in New Zealand erected in connection with the meat works have, with the exception of the freezing chambers in some of them, been constructed of wood and at a comparatively small cost, and they have answered the purpose as well as more expensive brick or stone buildings, while the first cost has been very much less, and any alterations which have afterwards been found necessary have not entailed much expense. To show how economically they go to work in New Zealand, it may be stated that the estimate quoted to us for a complete set of works to deal with 1,000 sheep and their offal in a day of twelve hours was from £17,000 to £20,000, and such a set was understood to include a railway siding, receiving, and chilling rooms, freezing chamber and cold store, with engine, freezing machine and plant complete, shed for running and preparing the offal, rendering room and digesters and tallow house, shed for fellmongering, wool scouring, wool drying, and wool packing, and a building with engine and plant for desiccating the offal as it comes from the slaughterhouse and converting it into a portable manure.

It is scarcely necessary to point out the very great difference it makes to the returns from a company with works constructed in this complete and still very economical manner, compared with some which have lately been erected in Queensland, two of which, it is said, cost, £150,000, or even compared with works constructed in this Colony at a reputed cost of £40,000, which have very much less accommodation for dealing, as is done at the principal works in New Zealand, with both the stock and the whole of the offal, so as to turn that which is largely a perquisite of the company to the best possible account. But this is not all. Refrigeration is still in a transition state, and this fact should be borne in mind in the erection of such works, for alterations in the buildings and machinery cost considerable sums, and the less expensive the buildings are the less outlay will be entailed should alteration be necessary. In giving the estimates quoted of the first cost of such works, they are calculated on the understanding that the machine used would be the Haslam Cold Air, and if the ammonia machine proves, as it is believed it will, a thorough success, then the estimate would be from £2,000 to £3,000 less.

## V. Best Site for Works.

Provided sufficient water can be obtained (say, from 4,000 gallons to 5,000 gallons an hour), the best site for meat works—so far as the saving of time, labour, and expense in carrying on the works is concerned—is on a rising ground, for not only can the sheep in that case be passed from hand to hand and from place to place by gravitation as they are dealt with, but the whole of the offal can be handled in the same way, if the buildings on which the different portions of the work are done be set down in the right positions

and proper arrangements made for its despatch; and if the site of the works is such as to admit also of the mutton and all the different portions of the offal being, when they are ready to leave the works, also passed by gravitation to the railway trucks or lighters—all which is possible—then the site is an excellent one. Where a natural elevation cannot be obtained the buildings can be raised and the sheep driven up to the slaughter-house; but this, of course, entails additional expense, while some of the branches of the works cannot be so conveniently carried on as if the elevation was a natural one. It will be noted that sites of the same description should be selected for killing and chilling depôts.

A great deal has been said in this Colony about the necessity for having freezing works right on deep water, where ocean-going vessels could come close up to the works and load the frozen meat. But, while this would no doubt be a great advantage if it could be obtained, the fact is that so far as regards New Zealand there are only one or two instances in that colony, if there be that, of freezing works alongside which the large steamers now loading frozen mutton can come and take the mutton direct from the works into the vessel. In almost every instance the mutton is lightered to the vessel which is to convey it to England, and that, too, in several cases after having first been conveyed from the freezing works, situated at shorter or longer distances from the port, by the train to the lighter—in one instance close upon 100 miles. Nor is this all. The steamers in some cases anchor in open roadsteads, and at times have on account of the weather to leave before the loading is completed. Supposing, therefore, that the lower floor of the Darling Harbour meat market were, as proposed, converted into a freezing and storage room, and the mutton sent down from the up-country killing and chilling depôts were sent there and frozen, it would be far more convenient and safer to run the refrigerating cars into the building alongside the store-rooms, load them with the frozen mutton, run them down to the ocean-going steamers at the deep water wharf at Pyrmont, and transfer it from the cars to the steamer, than to do as is done in New Zealand, in shipping the frozen mutton there for London.

## VI. The System of Refrigeration.

In New Zealand the system of refrigeration adopted has, in every case, until recently, been by the cold-air process with the Haslam machine, and with ordinary care these machines have, so far as doing effective work was concerned, given thorough satisfaction. But the system is a comparatively expensive one to work; and if what has been stated to Mr. Gordon and myself can be substantiated, very much more so than the "Linde" ammonia machine, which is said to be equally efficient. I will, further on, submit a brief statement, contrasting the work done by the two machines, and the expense in each case. Latterly the Haslam has in several cases been supplemented by an ammonia machine, to chill the meat before it is transferred to the freezing chamber to be operated on by the Haslam. The arrangement is likely to become general, for it is both safer and more economical, in so far as when the meat is properly chilled to the bone before being sent to the freezing chambers, there is no risk of bonestink, and refrigerating costs considerably less under the ammonia system than the cold-air process.

Recently another cold-air machine, the "Goodfellows," has been brought out and erected in two or three of Messrs. Nelson Brothers' works, and is said to be a considerable improvement on the Haslam. Within the last twelve months, again, a "Linde ammonia machine" has been erected at the

new freezing works at Nghauranga, near Wellington, and when inspected by Mr. Gordon and me was doing very satisfactory work, and, as was represented to us, at much less expense than the Haslam. The following comparative statement of the expense of working the two machines, furnished by one of the agents of the "Linde," would seem to bear out the favourable results claimed for that machine :—

| Linde. | Haslam. |
|---|---|
| Sheep per day, 1,000 | Sheep per day, 1,000. |
| Fuel per day, 3 tons. | Fuel per day, 12 tons. |
| Labour in 24 hours, 5 men. | Labour in 24 hours, 8 men. |

That gentleman stated, too, that it has been shown from independent tests, thoroughly carried out, that the "Linde" machine only requires, for the same amount of cold produced, from one-fourth to one-fifth of the fuel necessary for cold air machines.

The result of the comparison here given of the two systems, if it be only approximately correct has most important bearings, for if the superiority of the "Linde" machines can be substantiated to anything like the extent there shown, and it is found to be sufficiently powerful for freezing as well as chilling, and if the meat frozen by the ammonia process looks and keeps as well as that frozen by the cold air, then the ammonia is evidently the machine to use. And the latest accounts received from Wellington (New Zealand), and from Melbourne, where these machines are now at work, are very favourable, and would seem to confirm, to a very great extent at least, the statement here given showing the great economy of the "Linde" machine over the "Haslam." If further experience thoroughly confirms this information, then the economy in working will lead to the reduction of the charges for chilling and freezing preparatory to shipment.

That of itself would be a considerable boon to stock-owners, but if, as it is said, the "Linde" process is likely also to supplant the "Haslam" on board ship, that would lead to still greater reduction in the cost of sending frozen meat to London, in the shape of reduced freights, brought about of course through the great saving in the consumption of coal on board ship by working the "Linde" instead of the "Haslam" machine. Besides the ammonia machine on the "Linde" principle, which we saw at work at Wellington, we inspected another one at Patea, which was used for chilling the meat forwarded by the company killed there to Wanganui, a distance of 44 miles, and to Wellington, a distance of about 200 miles, for freezing and shipment to London. The only Carbonic Anhydride machine in use in New Zealand is that at The Spit, near Napier, which was not visited by us, as it was not working at the time. The reports with respect to it were rather contradictory. Another impression left on our minds from the information we obtained with regard to this machine was that its superior efficacy and economy over the other systems now in use in New Zealand has yet to be proved.

## VII. The work done by Freezing Companies and their Remuneration.

The services rendered by these companies to sheep-owners and others who send their stock to be slaughtered, frozen, prepared for shipment and shipped, and sold in London, and the charges made for these services are the following:—Receiving, killing, freezing, and weighing, per lb. ·37; labelling, bagging, delivering alongside ship, and export dues, ·08; freight, 1·00; primage, 5 per cent., ·05; insurance against all risk, ·10; conveyance to

store, receiving, storage, delivery, and commission on sale, ·28; total, 1·88. As regards the offal, the owner gets the skins and rendering fat, while the company retains the head, tongue, kidneys, runners, blood, &c. The skins and rendering fat are generally sold on owner's account, at market rates, to the fellmongers and soap-boilers, the skins of crossbreds selling immediately after shearing at 1s. 3d. to 1s. 6d., and up to 6s., and even 6s. 6d. when full fleeced. In some cases the companies fellmonger the skins, and render the fat, and sell them on owner's account, deducting reasonable charges for the service.

At most of the works in New Zealand the sulphide of sodium, instead of the sweating process, has been adopted in fellmongering. The prices of crossbred pelts worked in that way and properly dressed, salted and packed in casks resembling tallow casks, are said, if very good, to be worth as high as 26s. per dozen (2s. 2d. each) in London. The pelts of the merinos are worth very much less, and some of them which are wrinkly are useless, and are thrown away on that account and their thinness. The best of the merino pelts are said not to be worth more than 9d. each. At some of the works we found improved appliances for drying (slipe) and wool, in the shape of centrifugal and revolving wool-drying machines. The runners, or guts, after being thoroughly cleaned, are salted and shipped to America, where they find a ready market—the larger for sausage casing, and the smaller for gut strings, &c. The tongues, again, are preserved by tinning, and the kidneys which, packed in crate boxes, are frozen, and bring from 8d. to 14d. per dozen in London. The rest of the offal the companies either give to pigs or convert into portable manure by boiling, drying, grinding the bones and other processes, and sell it at fairly remunerative prices, say from £4 to £8, and up to £10 per ton for pure desiccated blood. With proper arrangements and care in working up the offal immediately it leaves the sheep, the preparation of manure can be carried out with little or nothing that is offensive, and with a fair demand for the manure, its sale should, it is said, go a good way towards paying the working expenses of the establishment. The most complete plant we saw in New Zealand for dealing with the offal in this way was an American one imported from Chicago, at the Nghauranga works at Wellington.

## VIII. The different ways in which Fat Sheep are sold in the Colony.

1. Owners at times sell their sheep on foot to the companies' buyers on the station, to be delivered at the yards there or at the works; and last year as much as 17s. 6d. to 18s. 6d. for full-fleeced 60-lb. wethers was paid at owners' yards, and which was considered better than selling at per lb. at the works. 2. They sometimes sell to be delivered at the works at prices up to 2¼d. per lb. for prime first-class Canterbury mutton dead-weight, with a deduction of, say, 1½ lb. for shrinkage in freezing, the vendor retaining the skin and the rendering fat, which are sold on his account; and in this way he would make, for full-fleeced 60-lb. wethers, 17s. 9d. at the works, which is not so good a return as No. 1. 3. They sometimes sell at 3¼d. per lb. for prime first-class mutton other than Canterbury, the purchaser getting the skin and rendering fat, which would give a return of 16s. 3d. for a 60-lb. wether. 4. They also sell at per lb. at the works, the owner retaining the rendering fat and wool, the company fellmongering the skins and retaining the pelt. Latterly, in New Zealand, owing to the competition

amongst the companies, and also among ship-owners (there were lately more ships offering than there were sheep to fill them), there has been a strong demand for sheep for freezing and export, and, as a rule, owners have found it more advantageous to sell at home rather than to freeze and ship, or even send them on to the works for sale. When sheep are sold at the works at per lb. the companies' weights are invariably taken, someone on the vendors' behalf going out occasionally to test the weights taken by the company.

They call prime fat sheep, weighing from 55 lb. to 65 lb., first-class; 50 lb. to 54 lb., second-class; 66 lb. to 80 lb., third-class; and 40 lb. to 49 lb. fourth-class. But, of course, the weight does not in all cases decide the grade, and some of those whose opinions carry weight consider that more attention should be paid in grading to the quality of the mutton than is now given, and that instead of four there should be only three classes, *i.e.*, 50 lb. to 70 lb, for first-class, 71 lb. to 80 lb. second-class, and 40 lb. to 49 lb. third-class. Sheep weighing more than 80 lb. are either sold to the local butcher or put into the boiling pots; but the hind legs of these large sheep are sometimes frozen and exported. The average prices obtained in London for frozen mutton from the time the frozen meat trade was established in 1883 till the present time are as follow:—In 1883 the price was 6¼d. per lb., in 1884 it was 5⅛d., in 1885 it was 5d., in 1886 it was 4¾d., in 1887 it was 4d., in 1888 it was 4¼d., in 1889 it was 3⅞d., in 1890 it was 4⅜d., in 1891 it was 4⅛d., and in this year (1892) it will be about 4d.

## IX. Up-country Killing, Chilling, and Freezing.

With freezing works, it may be said at every 60 or 70 miles where the country is sufficiently good to keep an average number of sheep, sheep-owners in New Zealand are far more favourably situated than ours so far as marketing their sheep is concerned, for they can thus get them to the freezing works without waste or deterioration, and at very little cost, while many of our owners have to drive their sheep perhaps 100 or 200 miles, and some of them even 300 miles, on foot, and then send them 150 or 200 miles further by rail, thereby both deteriorating and wasting the mutton, and entailing heavy expense. To save this as far as possible, we propose to erect killing and chilling depots at the main centres of the stock traffic, and kill and chill, and forward the mutton in refrigerating cars to Sydney and Newcastle, where it can be either sold for local consumption, or frozen and exported.

This arrangement, which was considered thoroughly practicable, has, however, been objected to on the ground that it would not be safe to freeze mutton which had been chilled up country and brought to the seaboard in that state, even in refrigerating cars, and although the advocates of this mode of dealing with the meat pointed out that the chilling was really only a preliminary step, and a very necessary one in successful freezing, and that instead of increasing the risk of taint by chilling, that process would add to the certainty of the mutton being perfectly frozen, objection was still taken by those who set themselves up as authorities on the subject of refrigeration. I am glad, however, to say that the information obtained in New Zealand on the point thus raised is thoroughly confirmatory of the views of those who held that there is no risk whatever in killing the sheep up country, conveying them in refrigerating cars to the seaport, and there freezing them for shipment. Not only has this course been adopted with mutton, but also even with beef with perfect success. Both mutton and beef have for years

been killed at Patea, chilled, and sent 200 miles to Wellington, and what is more, at certain seasons of the year beef, as well as mutton, are sent without any chilling whatever in plain insulated cars without any ice, and frozen and shipped to London in perfect condition. The same course has been adopted, with the same results, with both mutton and beef slaughtered at Longburn, 94 miles from Wellington.

Farther than this, we had the decided opinion of Mr. William Nelson, of Temoana Freezing Works, at Hastings, 8 miles from Napier, one of the highest authorities on freezing in New Zealand, to the effect that unless we can slaughter and chill our stock near their pastures, and freeze them at the ports of shipment, we had better leave the trade alone. This is not all. While we were going over his works—one of the largest, if not the largest, in New Zealand—we found that he was adding a carbonic anhydride machine to his cold-air Haslams for chilling preparatory to freezing, and this course is, as already stated, now generally followed at all the principal freezing works recently constructed, as both the safest and most economical mode of doing the work with cold-air machines. There cannot, therefore, be the slightest risk in adopting the system we had laid out in this Colony in freezing meat which has been killed and chilled up country, and sent down in refrigerating cars to Sydney or Newcastle, and if the markets are not favourable, and the owner, instead of storing in the cold chambers and keeping for a rise in price, instructs his agents to freeze and ship, the cars can, without being opened, be run straight to the freezing works and delivered into the freezing chambers, without the slightest risk of any failure in the operation.

## X. Shipment of Meat and Freight to England.

For a considerable time, although what would be considered high rates of freight were offered, it was difficult to obtain space in the vessels fitted up to carry frozen meat. So much was this the case that the space on these vessels (which by the terms of co-partnery of the meat companies was usually divided among the shareholders *pro rata*, according to the number of their shares) was at a considerable premium, as much as 2s. 6d. per sheep, and as high as 2½d. per lb. was paid at first for freight, and that too by sailing vessels. Such very high rates as these before long worked their own cure—more sailing vessels were fitted up for the trade, and by-and-by one of the companies put steamers on the line. Then other steam companies followed, in many cases with steamers of large size, and the outcome has been that the rates of freight of frozen mutton from New Zealand to London have from time to time been lowered till the rate is now 1d. per lb. Freight in Queensland is, I believe, still lower than this (13-16d. per lb.), but it is explained that this is the case because the Queensland companies have bound themselves to ship a certain quantity of meat during the year by regular instalments.

While again the rates of freight have been reduced, another change for the better has taken place. Far more vessels are carrying frozen mutton. Three fleets of steamers belonging to three different companies are now engaged in the trade, and there is now no difficulty in finding space. In fact, when we were in New Zealand more space was offering than there were sheep to fill, but it was expected that after shearing the supply of sheep would be considerably increased. However this may be, so many steamers are carrying frozen mutton that owners can get their sheep away almost as fast as they can be sent to the freezing works. Notwithstanding the large

reduction which has already been made in the rate of freight, shippers are looking for still lower rates, and as further improvements in refrigeration still continue to be made, I think we are safe in concluding that frozen meat will be carried at still lower rates. The low price now obtained in London for frozen mutton call for the freight to be reduced to the lowest rates which will pay the shipowner.

## XI. The Sale of Frozen Meat in London.

The latest statement received in this Colony of the wholesale prices of the different kinds of mutton in London are:—Prime Scotch, 4s. 6d. per stone of 8lb., or 6¾ per lb.; prime New Zealand, crossbred, 2s. 10d. per stone of 8 lb., or 4¼d. per lb.; prime Sydney, merino, 1s. 8d. per stone of 8 lb., or 2½ per lb. From this statement it will be seen that the best New Zealand crossbred mutton was bringing 1s. 8d. per stone of 8 lb., or 2½ per lb., less than the best Scotch mutton; and that the best Sydney merino mutton was bringing 2s. 10d. per stone, or 4¼ per lb., less than the best Scotch, and 1s. 2d. per stone, or 1¾d. per lb., less than the best New Zealand. That is, prime New Zealand crossbred mutton was only bringing about two-thirds of the price of prime Scotch, and prime Sydney merino a little more than one-third of the price of the best Scotch mutton. With these facts before us, it is a matter of the very first importance to all the colonies, but especially to New South Wales and Queensland, where the sheep are nearly all merino, to ascertain the reason for this apparently unreasonable difference (for it is unreasonable, notwithstanding that the New Zealand and Australian mutton is frozen) in the price received by them for their mutton and that paid for the home article, and having ascertained what the reason really is, to see if something cannot be done to bring the price received for our mutton more on a level with that obtained for the Scotch and English.

In looking for this reason, I think the first question to settle is whether the mutton of our merino sheep, when they are killed in prime condition on or near their own pastures without deterioration or waste can be termed first-class; and there is no question that it can, for although it may not be quite so juicy, nor have the full flavour of the prime Scotch or Southdown mutton, it is much finer in the grain and sweeter than either of the home breeds mentioned, and when killed on or near the station where it is fattened it is equal to prime Welsh mutton. The fact of the excellent quality of the merino mutton, when obtained in prime condition and not wasted or deteriorated, is thoroughly well known to all who have been in the bush, and is only noticed here to emphasise the fact that the excessively low price which our merino mutton brings in London is not due to its being really an inferior article, but either because it is offered there in a deteriorated state, or because we do not receive fair value for it; and there is no doubt but both causes operate in a greater or less degree. I will therefore notice both, but the first very briefly, and will in the present paper deal principally with the second cause, as it affects the price obtained for merino mutton.

The complaint is made in regard to the New South Wales frozen mutton that it is dark in the colour, dry, and comparatively insipid. No doubt this is now true as regards a good deal of it through the ill-treatment and starvation to which under the existing live stock trade sheep are subjected, thereby causing deterioration in the appearance and flavour of our mutton. This calls loudly for a remedy, which it is believed has been found in the erection of up-country killing and chilling depôts, and the establishment of a fresh

meat trade, at which a commencement has been made, and there is every prospect that the movement in that direction will continue to increase until the trade is entirely changed. While, however, acknowledging that a good deal of the Australian merino mutton is not prime when offered in London, the greater part of it is of very fair quality and is put on the market in good condition, and would, it is believed, bring considerably more than it now does if better arrangements were made for its distribution and sale, and if it passed through fewer hands than it now does in reaching the consumers, with whom the producer of the mutton ought to be brought into closer contact. This again, it is thought, might be brought about by the formation of larger distributing companies, which would have cold stores in the great centres of the population through Great Britain, and which would obtain direct supplies of frozen meat from the freezing companies in this Colony and in Queensland.

Before, however, this can be brought about it will be necessary to assure these home-distributing companies that they will be able to obtain a constant supply of beef and mutton, and this assurance cannot be given until there is a considerable increase in this Colony and Queensland in the number of freezing works and in their daily output of frozen beef and mutton. When this takes place, and the freezing companies in the two colonies are in a position to guarantee a constant supply of frozen meat—and with such an extensive area and such large number of both cattle and sheep in the two colonies there ought not to be any trouble in keeping the home companies constantly supplied—it is believed that a thoroughly safe and remunerative meat-distributing business, conducted by firms or joint stock companies with the necessary capital, could be established in almost every one of the great centres of population in Great Britain and Ireland. To carry on such a business it would, of course, be necessary that extensive refrigerating stores should be erected, to which the frozen meat could be taken direct from the steamers and distributed with horses and carts every morning, and, if necessary, also in the afternoon, in the same way as milk is now delivered and paid for in all the large cities.

To enable these distributing companies again to enter upon and carry on their business successfully it would be necessary that the freezing companies in Australia should enter into an agreement to supply them with stated quantities of frozen beef and mutton—say, every fortnight or every month—for six or twelve months, at prices to be agreed upon between them, and, as has already been said, there would be little or no risk, with the two colonies to draw from, of the supply running short, even if a drought should occur in one part of Australia. That these distributing companies would pay there can, I think, be very little doubt, for they could, with about the same expense as that which the distribution of milk entails, deliver the meat which the same families require, while the gross cash returns for the meat would be many times greater than for the milk they use. And when it is considered that the expense of such a business would be very light compared with what the distribution of the same quantity of meat delivered from retail shops would be, it will be seen that such companies as are here suggested would pay well, and that the suggestion is very likely to be acted upon as soon as the colonies are able to guarantee constant supplies of first-class frozen beef and mutton, which, it is hoped, they will very soon be able to do.

It is scarcely necessary to point out that such an arrangement as that now sketched would, if practicable, be a very advantageous one for our sheep-owners, inasmuch as it would bring them and the consumers very much

more closely together than they now are, and would dispense with the middle man, the person who, it is said, now reaps the greatest benefit from the frozen meat trade, without doing much, if anything at all, for the toll he levies on the meat as it passes from the producer to the consumer. It has been proposed that our owners should go further than is here suggested, and distribute their meat from shops belonging to themselves in Great Britain. But the risk in adopting that course is too great, while it is believed that the suggestion here made would go a very long way in remedying the defects which now exist in the sale and distribution of our frozen meat, without incurring the risk which our retailing of the meat at home would inevitably entail, for the business with the distributing companies then would, so far as the Australian colonies are concerned, be a cash one, or what would be equal to cash on delivery in London.

## XII. Why private enterprise has not in New South Wales taken up the Meat Export Trade as it has done in New Zealand.

From what has been said, it will be gathered, not only how the frozen meat trade was established in New Zealand, and how it has been conducted, but also that it has on the whole been very successful, and it will naturally be asked why the same course has not been followed in New South Wales; and the answer is that the circumstances in this Colony are very different and far less favourable for the development of private enterprise in the meat trade than New Zealand. Briefly stated, the difference in the circumstances of the frozen meat trade is the following:—

1. The climate of New Zealand is a comparatively steady and certain one. There they seldom or never suffer from droughts, as we, unfortunately, at times do, and when anything of that kind occurs in New Zealand it never does so with the same severity as it sometimes does in this Colony. In New Zealand, too, the rainfall is more evenly distributed throughout the year, and has a much more beneficial effect. That, of course, leads, where the land is good, to a steady, and in many places luxuriant, growth of rich pasturage, and that again brings a full and regular cast of fat stock, and not only stock-owners, but the people generally, having every confidence that the supply of fat stock would be maintained and increase, have been induced to invest their money in freezing companies, and have thus materially assisted in their establishment. With our uncertain climate the case is different, for there is considerable risk of the works being idle, perhaps for many months, and it is not to be expected that those who have no direct interest in stock would take shares in freezing companies with this uncertainty hanging over them.

2. The soil generally throughout New Zealand, with the exception of a portion of the North Island, is both very fertile and easily worked, and where there is any great depth of it—which there is in a great deal of the improved portions of the Colony—crops of all kinds are grown to an extent and in an abundance which would surprise our New South Wales pastoralists and farmers. This is especially noticeable in the splendid grain and root crops, as well as in the luxuriant and extensive fields of ryegrass and clover, with cocksfoot and other cultivated grasses intermixed, to be seen on all sides, from Taranaki and Gisborne in the North Island, to Invercargill and the Bluff in the south. When it is stated that the wheat crops in New

Zealand run from 20 to 50 bushels per acre, with an average of about 30 bushels, their turnip crops from 15 to 30 tons per acre, and that they carry and fatten from three to six and even eight sheep to the acre on their best grazing land, through the soil responding to the favourable rainfall, helped as it now is in many cases by manure, and worked under a systematic rotation, it will be evident to anyone who knows what our own Colony can do that the circumstances as regards the nature of the soil in a great deal of New Zealand are also different from those in the greater part of New South Wales, and that for these reasons also New Zealand is very much better able than this Colony to maintain a large and steady output of first-class fat sheep for the London market in proportion to the area of the Colony.

3. The New Zealand sheep again were, at the time the frozen meat export trade began, as they now are, in every way suited for the purpose. They were to a large extent crosses with the merino and the best English long-woolled breeds, and their crossbred wethers and maiden ewes were just the sort for the London market, for in appearance and quality the mutton so nearly resembled some of the best English as to enable the retail butcher (at first, at least, whatever they may do now) to sell the colonial mutton for English, thereby making a much greater profit than selling prime English, for which they had to pay at least one-third more money per stone. It need scarcely be said that our merino mutton could not be passed off for English, for both its size and colour would lead to any attempt of that sort being at once detected. Besides, the merino mutton is objected to on account of its small size. They say in England, "that there is not enough of cutting in a leg of merino mutton for an ordinary-sized family." The English people are accustomed to a good-sized leg of mutton, and they prefer what they are accustomed to. But it is hoped that when we can send them our merino mutton in prime condition without deterioration, and with all the goodness and sweetness in it, that they will, as we do, prefer the mutton of the smaller sheep.

4. Then, the proximity of the pastures in New Zealand to the seaboard, and the numerous shipping ports in that colony have given the owners there a very great advantage over ours in thus being able to ship the meat without the waste and deterioration going on in this Colony in conveying our sheep to a port of shipment, and this, too, has of course added to the other inducements to owners and others to form companies for export. The difference in this respect between the two colonies is most marked, and will have to continue until we can establish a chilled meat trade.

With a good climate, fertile soil, the right description of sheep, large tracts of improvable country, and pastoralists and farmers of the right stamp to turn these advantages to good account, as well as thoroughly reliable business men as directors, we cannot be surprised that persons in no way connected with stock, as well as those who were, invested their money in freezing companies in New Zealand, and as has already been said with good results; and in this fact lies one of the principal, if not the principal reason why that colony, with only 18,000,000 sheep, has now twenty-two freezing works, and in 1891 exported 2,000,000 of sheep, while our Colony, with some 60,000,000 of sheep, has only three freezing works, one of which has only a small capacity, with a fourth being constructed, and the export to our credit of frozen sheep during that year was less than half a million. With our uncertain climate, little or no land laid down in cultivated grasses, comparatively few crossbred sheep, an excessive proportion of breeding sheep, very few wethers suitable for freezing, and long distances to bring fat sheep to the seaboard, there has been no inducement to persons other

than stock-owners to invest their money in meat-freezing works, especially as our merino mutton has been bringing low prices in the London market, and of course the same reasons have (although they should not have done so) deterred sheep-owners themselves forming freezing and export companies.

## XIII. What should now be done in this Colony.

As, therefore, our stock-owners must depend entirely upon themselves in establishing a paying meat export trade of sufficient volume to deal with the whole of our surplus sheep in a satisfactory manner, they should, if they do not mean to let things drift and allow the entire frozen meat export trade of the Colony to remain under the control of one or two firms, take the matter up and deal with it in a thorough and businesslike manner; for it is only by systematic organisation on their part, and by making proper arrangements for the economic utilisation and distribution of the meat they produce, that they can make their calling a success. To effect this again considerable capital will be required, and to raise that there must be extensive combination and hearty co-operation on their part as a class before a paying export business can be established. This being the case, the question arises how this combination and co-operation should be brought about—whether (1) by owners voluntarily forming joint stock companies for killing, chilling, freezing, and exporting meat, or (2) by legislating, as was proposed by the Bill introduced last Session of Parliament, for promoting the establishment of an export trade in meat, by assisting in the erection of chilling and freezing works, and in other ways.

Bearing in mind the very great difference in the circumstances of this Colony and New Zealand, I think it is to be regretted that the Bill did not pass, as it has been shown that if an export trade is to be established it will have to be so by owners themselves, and they will require to take the risk there may be in doing so for the indirect advantages they will receive through its establishment. This being the case, there could not possibly have been a more liberal, equitable, or effective mode of meeting the difficulty, nor one which is more generally approved by those interested, than that contemplated by the Bill. This is confirmed by the fact that a majority of more than two to one of the owners who it was proposed by the Bill should be rated (those with less than 2,000 sheep were to get all the benefit without contributing) have declared in favour of the Bill.

It is submitted, therefore, that notwithstanding what has been said by some of the promoters of the Bill against taking further action in regard to it, the question of its re-introduction is well worth considering, seeing that there has been really nothing, or next to nothing, done by private enterprise towards the establishment of this trade since the Bill was introduced. No doubt the number of owners who stated, in reply to circulars issued by the Murrurundi Board, "that they were not in favour of the Bill," is greater than the returns of the Pastures Boards would have led the promoters of the Bill to suppose it would be; and there is reason to believe that the "boom" in the formation of chilling and freezing meat companies which took place some six or eight months ago, and which, after all, came to nothing, led a great many of these owners to reply as they did. But although they in several instances assigned as their reason for replying in the negative, that "the matter should be left to private enterprise," it would not seem that either these owners, or those who have not replied to the circular, are prepared to assist in the formation of a company or companies for the

construction of chilling and freezing works, otherwise they would have let the fact be known, and asked their fellow-owners to co-operate with them in the undertaking.

However this may be, except in the case of the killing and chilling depôts at Tenterfield, Narrandera, and Young, which were either erected or projected when the Bill referred to was introduced, our stock-owners have done nothing towards putting our meat trade on a proper footing, and if this most important matter is not to be allowed to drift, as it has been doing, and glutted markets and ruinously low prices to continue—either this Bill will have to be reintroduced and carried through, or our stock-owners will have to form strong companies, which will, without further delay, deal with the whole trade in a practical and business-like way by establishing killing and chilling works throughout the Colony, and at the same time making sufficient provision for freezing the surplus meat at the port of shipment.

I hope to be able, in the course of next week, to prepare a short report on stock and stock-raising and fattening in New Zealand—subjects which are closely connected with those dealt with in this paper, and to show that the system of farming and growing of root and green crops and cultivated grasses, and the breeding and fattening of long-woolled sheep, which have been so successfully carried out in New Zealand, can also be adopted in the colder and more temperate portions of this Colony.

# The Action of Acid Fumes on Vegetation.

In consequence of a communication received in the Department from Meadow Flat, expressing a belief that the fumes from smelting works at Sunny Corner, were causing destruction to the vegetation, the following reports have been made. The first is by Mr. F. B. Guthrie, analytical chemist, to the Department, dealing generally with the action of acid fumes in vegetation; while the second is by Mr. A. H. Benson the fruit expert who visited Meadow Flat.

Mr. Guthrie says, "There is no doubt that the neighbourhood of smelting or similar works where acid vapours are evolved is exceedingly injurious to vegetation, though the extent of the injury is not always easy to determine. The most injurious ingredient is sulphurous acid, the gas formed by burning sulphur. Vegetation appears to be injured by this gas in the following order: meadow grass, fruit-trees, cereals, potatoes, turnips, &c., grass being most liable to injury, turnips least.

The damage done is described differently by different observers. The plants of a root crop grown in the vicinity of a cellulose factory were found to have been completely charred, the injury in this case being due to sulphuric acid. In the neighbourhood of blende smelting works, it has been observed that grain crops grow thin, the ears small, stalks weak, and potato leaves wrinkled and covered with black spots. The ash of these sickly plants has been found to contain more sulphates than that of the same plants grown at a greater distance. The leaves of trees exposed to this smoke also contains more sulphuric and less carbonic acid than those of uninjured trees. In the case of straw injured by the same cause, 17 per cent. more sulphates were present in the ash than in the case of healthy straw. At the same time the amount of sulphuric acid present does not furnish a safe guide, as this ingredient differs in healthy plants of the same kind, and it has not frequently been found that the injured plants contained less than uninjured ones.

Young meadow herbage was found to be most susceptible to the influence of smoke from blende works, oats resisting its action better than wheat, while potatoes were even able to thrive on it.

At a meeting of scientists in Cologne, where this subject was under discussion, the conclusion arrived at was that the principal damage was due to sulphurous acid gas from the coal used for fuel. Besides the direct action of sulphurous acid on the plants it undoubtedly acts prejudicially on the air. It has been found, for instance, that the ozone in the air near towns has been destroyed by this gas.

A mass of evidence was given before a Royal Commission appointed in England in 1878, to inquire into noxious vapours. From the account of various witnesses it appeared that the sulphurous acid from coal smoke was particularly injurious, grass, trees, cereals, potatoes suffer in the order

named; turnips appeared to be the least affected, cattle suffer when fed upon the injured crops. The radius of the affected area appears to be about 1½ miles, though this would be greatly influenced by other conditions, the strength and the direction of the prevailing winds, and position, sheltered or otherwise, of the crops.

One of the results of the Commission, was the recommendation that the presence of 1 grain of sulphur (in the form of any of its compounds) in 1 cubic foot of the exit gases from chemical works, &c., be an offence under the Act, and, I believe, that in England that limit has been fixed by law.

As to the action of arsenic, its injurious effect appears to be confined to the roots; where the leaves alone are exposed the action is very slow. It is, however, exceedingly poisonous when applied to the roots, one part of arsenic in a million parts being sufficient to wither a plant. It appears to act on the protoplasm of the root, hindering osmose and consequently absorption of food.

It is very difficult to estimate the extent of the damage done, or even to be quite certain that it is really due to acid fumes. The external appearance of plants injured in this way is very similar to plants injured by disease, bad drainage, or insufficient nourishment. Neither does the chemical analysis of the plant afford any reliable proof, for the reasons I have stated above.

It is necessary, therefore, to eliminate all other possible causes of injury, such as the above-mentioned, presence of insects, &c. It is to be noted that healthy plants withstand the action of noxious vapours far better than weak or ill-nourished ones. It is well to consult Dr. Angus Smith's book on "Air and Rain," at the end of which is a table, "the Scale of Injury," which gives the order in which different forms of vegetation suffer. If, for instance, potatoes are found to suffer more than grass, the injury could not be attributed to smelting works.

The orchard in question is so far from the works that I should be inclined to doubt whether the fumes would cause any permanent injury."

Mr. Benson reported, as the result of his visit to the orchard on the 2nd December last, that "the action of the fumes would not be likely to do damage at Meadow Flat, as it is at least 6 miles away from the works. The apples are badly affected with scab (*Fusicladium dendriticum*), and it is the effect of this fungus disease that has been put down to acid fumes. The pears are affected with *Fusicladium pyrinum*, and cherries with *Monilia frutigena*, destroying the foliage."

# Comparison of American and Australian Maize

By F. B. GUTHRIE,
Departmental Analyst.

A SAMPLE of the ground pith of maize-cob was forwarded to the Department for analysis by the Principal of the Hawkesbury Agricultural College. The following numbers give the percentage composition of the sample:—

| Corn-cob Meal. | | Ash. | |
|---|---|---|---|
| Water ... ... | 13·575 | Silica ... ... | 20·476 |
| Fat ... ... ... | ·595 | Lime ... ... | ·817 |
| Fibre ... ... | 35·311 | Phosphoric acid ... | 4·859 |
| Albuminoids ... | 4·451 | Magnesia ... ... | 1·753 |
| Carbo-hydrates ... | 44·471 | Potash ... ... | 24·360 |
| Ash... ... ... | 1·597 | | |
| | 100· | | |

The above was a somewhat coarsely ground meal. The feeding value is fair, being about 50. The ratio between albuminoids and carbo-hydrates being 1 to 10⅓.

Compared with maize-meal it does not contrast so unfavourably as one would at first expect. The feeding value is rather more than half that of maize, the principal difference being the high proportion of insoluble and practically indigestible fibre present in the cob, and the diminution in the digestible constituents, the fat having almost disappeared. The following is the average composition of maize meal.

| | |
|---|---|
| Water ... ... ... ... ... ... ... ... | 14·2 |
| Fat ... ... ... ... ... ... ... ... | 5·0 |
| Albuminoids ... ... ... ... ... ... ... | 9·3 |
| Starch, &c. ... ... ... ... ... ... ... | 66·5 |
| Cellulose ... ... ... ... ... ... ... | 3·0 |
| Ash ... ... ... ... ... ... ... ... | 2·0 |
| | 100· |

A comparison of these analyses shows at once the difference in the two products.

The starch in the maize-meal has, to a large extent, vanished in the cob. Its place, however, is taken by a soluble form of cellulose (which is also abundantly present in grass), and to which is assigned a feeding value somewhat lower than starch. The full significance of its value is not at present properly understood, but it probably has a value little less than that of starch. There is also no doubt that the fibre present in cob-meal, though practically indigested by the animal, and of no value as food, has nevertheless a distinct value in mechanically promoting digestion. There is, therefore, some difficulty in assigning its feeding value to cob-meal.

Its true value can only be determined by a series of experiments in feeding cattle upon it, with a view to determining its digestive and assimilative power upon different animals.

The addition of maize would, of course, greatly increase its feeding value. Suppose a mixture were made of one-half corn-meal and one-half cob-meal, its composition would be approximately the following :—

| | |
|---|---|
| Water ... ... ... ... ... ... ... ... | 13·9 |
| Oil ... ... ... ... ... ... ... ... | 2·8 |
| Fibre ... ... ... .. ... ... ... ... | 19·55 |
| Albuminoids ... ... ... ... ... ... ... | 6·85 |
| Carbo-hydrates ... ... ... ... ... ... | 55·5 |
| Ash ... ... ... ... ... ... ... ... | 1·8 |
| | 100·00 |

The nutrient value of such a mixture would be 70; the ratio between albuminoids and carbo-hydrates, 1 to 9·2.

It will be interesting to compare other analyses of this product with that of the sample under discussion. I have only been able to find three other analyses, all from America—two from the Department of Agriculture, Washington, by Messrs. Collier and Wiley respectively, and the third by Mr. Schweitzer, of the Missouri Agricultural College.

For the sake of comparison these are all calculated to dry substance in the accompanying table:—

*Analyses of Corn-cobs.*

| | Missouri— Mr. Schweitzer. | Washington. I Mr. Collier. | Washington. II Mr. Wiley. | Department |
|---|---|---|---|---|
| Oil... ... ... | 1·07 | 0·84 | 0·52 | 0·68 |
| Fibre ... ... | 34·27 | 42·18 | 33·48 | 40·85 |
| Albuminoids ... | 3·06 | 2·72 | 2·76 | 5·16 |
| Carbo-hydrates ... | 60·11 | 52·95 | 61·77 | 51·46 |
| Ash ... ... | 1·49 | 1·31 | 1·47 | 1·85 |

The most striking feature in the above numbers is the large percentage of nitrogen albumen in the Australian product—at least, in the sample analysed.

Mr. Schweitzer also gives an analysis of the ash, which is subjoined for the sake of comparison :—

| | Missouri. | Department. |
|---|---|---|
| Silica ... ... ... ... ... | 24·98 | 20·476 |
| Ferric oxide .. ... ... ... | ·19 | ..... |
| Phosphoric acid ... ... ... | 2·82 | 4·859 |
| Lime ... ... ... ... ... | 1·77 | ·817 |
| Magnesia ... ... ... ... | 5·45 | ..... |
| Potash ... ... ... ... ... | 51·16 | 24·360 |
| Soda ... ... ... ... ... | 0·8 | ..... |

There is here a strongly marked deficiency in potash in our product, which is very remarkable. This discrepancy in the ash becomes, however, a very small one when the numbers are calculated to the whole meal—not more than about 0·3 per cent.

The manurial value of the cob-meal is small, the following being the percentages for the chief manurial ingredients, calculated upon the whole substance—about 12s. per ton when ground up.

| | |
|---|---|
| Potash ... ... ... ... ... ... ... | ·389 per cent. |
| Phosphoric acid ... ... ... ... ... ... | ·077 ,, |
| Nitrogen ... ... ... ... ... ... ... | ·712 ,, |

The value of the manure resulting from its use as food could only be determined by analysis.

# Analyses of Soils.

By F. B. GUTHRIE,
Departmental Analyst.
(With notes by the Director of Agriculture).

## Tambar Springs.

A sample of soil from Tambar Springs has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 51 per cent. Absolute weight per acre, 6 inches deep, 2,489,758 lb.

A mechanical analyses of this soil shows that it contains of root fibres, ·06 per cent.; stones over ¼-inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, 2·5 per cent.; fine gravel, more than $\frac{1}{30}$-inch diameter, 1·25 per cent.; fine soil, 96·19 per cent., comprising sand, 38·45 per cent., and impalpable matter, chiefly clay, 57·74 per cent.

An analysis of the fine soil discloses moisture, 9·595 per cent., and volatile and combustible matter, principally organic, 5·553 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), 3·086 per cent., the general value of which is excellent, being equivalent to 61,720 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·235 per cent., the general value of which is good, being equivalent to 4,700 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·092 per cent., the general value of which is satisfactory, being equivalent to 1,840 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·089 per cent. (equal to ·109 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 1,780 lb. (*d*) in an acre of soil 6 inches deep. There is also magnesia (MgO), ·776 per cent., general value of which is very good; ferric oxide ($Fe_2O_3$), 4·155 per cent.; general value satisfactory; and sulphuric acid ($SO_3$), ·069 per cent.; general value, fair; ferrous oxide, ·615 per cent.

In connection with the foregoing particulars, the special points of value in the soil are lime and potash, and there are no special defects. Its general character mechanically is good, and chemically very good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are vines, lucerne, potatoes (if enough rain), while it is unsuitable, without special manure or special treatment, for none suited to the climate. The manures and treatment

Note.—(*a*) This amount of lime would be supplied in 68,577 lb. of quicklime, or 90,617 lb. of slaked lime, or 122,458 lb. of chalk. (*b*) This amount of potash would be supplied in 9,400 lb. of commercial sulphate of potash, or 39,166 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 7,360 lb. of commercial bone-dust, or 11,040 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 8,900 lb. of sulphate of ammonia, or 10,680 lb. of nitrate of soda.

recommended for trial are, as the phosphoric acid and nitrogenous matter are the valuable manurial constituents that will fail first, a dressing of 2 cwt. per acre of dried blood and bone-dust or Sugar Company's No. 2 (superphosphate and sulphate of ammonia) may be found to pay well.

Speaking generally, the soil ought to grow for some years good crops of anything suited to the climate. Judicious working to let the oxygen and carbonic acid gas of the air exert their beneficial influence, will benefit the soil very much.

## Raymond Terrace.

A sample of soil from Raymond Terrace has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water, 27·66 per cent. Absolute weight per acre, 6 inches deep, 3,248,931 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·08 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·41 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 1·35 per cent.; fine gravel, more than $\frac{1}{50}$ inch diameter, 13·33 per cent.; fine soil, 84·83 per cent., comprising sand, 66·64 per cent., and impalpable matter, chiefly clay, 18·19 per cent.

An analysis of the fine soil discloses moisture 1·452 per cent., and volatile and combustible matters, principally organic, 3·301 per cent.

The fertilizing substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·228 per cent., the general value of which is good, being equivalent to 6,840 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·336 per cent., the general value of which is good, being equivalent to 10,080 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·068 per cent., the general value of which is fair, being equivalent to 2,040 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·117 per cent. (equal to ·142 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 3,510 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·083 per cent., general value of which is fair; ferric oxide ($Fe_2O_3$), ·651 per cent., general value deficient; and sulphuric acid ($SO_3$), ·047 per cent., general value, satisfactory; ferrous oxide, ·216 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its mechanical condition; its special defect, phosphoric acid; its general character mechanically is very good, and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are vegetables, fruit trees, roots; while it is unsuitable, without special manure or special treatment, for grain crops. The manures and treatment recommended for trial are: good bone-dust, 4 to 6 cwt. per acre, or Sugar Company's No. 2 manure. If for green crops, broadcast it; if for vegetables, sow in the drills, mixing well with the soil.

Speaking generally, first a good dressing of lime, 1 ton per acre, lightly harrowed in during autumn is recommended. This will decompose any

Note.—(*a*) This amount of lime would be supplied in 5,066 lb. of quicklime, or 6,694 lb. of slaked lime, or 9,047 lb. of chalk. (*b*) This amount of potash would be supplied in 20,160 lb. of commercial sulphate of potash, or 84,000 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 8,160 lb. of commercial bone dust, or 12,240 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,550 lb. of sulphate of ammonia, or 21,060 lb. of nitrate of soda.

clay and vegetable matter in the soil. Then at end of winter, or before crop is put in, 4 to 6 cwt. of good bone-dust, or bone-dust and blood, which should be buried lightly. In the second year Sugar Company's No. 2, 4 cwt. per acre in the spring.

## Chatsworth.

A sample of soil from Chatsworth, Clarence River, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water 57 per cent. Absolute weight per acre, 6 inches deep, 2,367,311 lb.

A mechanical analysis of this soil shows that it contains of root fibres ¼ per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{20}$ inch diameter, ·0 per cent.; fine soil, 99·86 per cent., comprising sand, 47·08 per cent., and impalpable matter, chiefly clay, 52·78 per cent.

An analysis of the fine soil discloses moisture, 3·353 per cent., and volatile and combustible matter, principally organic, 6·675 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·369 per cent., the general value of which is good, being equivalent to 8,610 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·226 per cent, the general value of which is good, being equivalent to 5,273 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·152 per cent., the general value of which is good, being equivalent to 3,547 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·151 per cent. (equal to ·183 per cent. of ammonia), the general value of which is good, being equivalent to 3,523 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·211 per cent., general value of which is good; ferric oxide ($Fe_2O_3$), 3·338 per cent., general value satisfactory; and sulphuric acid ($SO_3$), ·075 per cent., general value, fair; ferrous oxide, ·671 per cent.

In connection with the foregoing particulars, the special points of value in the soil are potash and phosphoric acid; its special defects, none. Its general character mechanically is good, and chemically, good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are maize, sugar-cane, grass; while it is unsuitable, without special manure or special treatment, for none suited to the climate, if properly treated. The manures and treatment recommended for trial are lime (1 ton per acre) the first autumn; Sugar Company's. No. 2 manure, 4 cwt. per acre, in spring; filter press muck is not complete enough in itself to suit this soil, but should be composted with twice its weight of lime before being applied to the soil.

Speaking generally, the lime will break up the clay, mellow the soil, liberate the latent and insoluble potash of the clay, and decompose the organic matter in the soil. The Sugar Company's manure in spring will supplement this and nourish very heavy crops of maize or cane. Land should be left fallow or in furrows as much as possible, without being levelled down, in order to let air exert its beneficial influence.

Note.—(*a*) This amount of lime would be supplied in 8,200 lb. of quicklime, or 10,835 lb. of slaked lime, or 14,642 lb. of chalk. (*b*) This amount of potash would be surplied in 10,546 lb. of commercial sulphate of potash, or 43,942 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 14,188 lb. of commercial bone-dust, or 21,282 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 15,100 lb. of sulphate of ammonia, or 18,120 lb. of nitrate of soda.

## Bathurst.

### *No.* 1. *Light Granitic Soil.*

A sample of soil from Bathurst Experimental Farm has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is light sandy loam; the reaction of the soil is neutral; and its capacity for water 26 per cent. Absolute weight per acre, 6 inches deep, 3,061,179 lb.

A mechanical analysis of this soil shows that it contains of root fibres, $\frac{1}{3}$ per cent,; stones over $\frac{1}{4}$-inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$-inch diameter, ·52 per cent.; fine gravel, more than $\frac{1}{50}$-inch diameter, 19·46 per cent.; fine soil, 79·90 per cent., comprising sand, 60·68 per cent., and impalpable matter, chiefly clay, 19·22 per cent.

An analysis of the fine soil discloses moisture, ·887 per cent., and volatile and combustible matter, principally organic, 1·396 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·170 per cent., the general value of which is satisfactory, being equivalent to 5,100 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·095 per cent, the general value of which is satisfactory, being equivalent to 2,850 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·039 per cent., the general value of which is indifferent, being equivalent to 1,170 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·061 per cent. (equal to ·074 per cent. of ammonia), the general value of which is fair, being equivalent to 1,830 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·095 per cent., general value of which is fair; ferric oxide ($Fe_2O_3$), ·855 per cent., general value deficient; and sulphuric acid ($SO_3$), ·048 per cent., general value indifferent; ferrous oxide, ·252 per cent.

In connection with the foregoing particulars, the special point of value in the soil is its good mechanical condition; its special defects, phosphoric acid, organic (nitrogenous) matter, and low power of retaining moisture. Its general character mechanically is good, and chemically, tolerable. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are potatoes and fruit trees; while it is unsuitable, without special manure or special treatment, for grain crops, green stuff, or good grass. The manures and treatment recommended for trial are Sugar Company's No. 2 manure (2 to 4 cwt. per acre); Gee's bone-dust and dried blood (2 to 4 cwt. per acre); farmyard manure, enriched with 2 cwt. of bone-dust per ton; ploughing in peas or vetches. If this soil will not pay for manuring it will hardly pay for wheat-growing without manure after the first few years.

Speaking generally, treating the soil with these manures should give good results for a few years, after which potash also will be needed. Lime (1 ton per acre) will liberate this from the granitic sand in the soil at the least possible cost. It will be a calamity to crop this soil, and get it into bad heart in very few years, instead of feeding it fairly from the start, and thus keeping on improving it.

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Note.—(*a*) This amount of lime would be supplied in 5,665 lb. of quicklime, or 7,486 lb. of slaked lime, or 10,118 lb. of chalk. (*b*) This amount of potash would be supplied in 5,700 lb. of commercial sulphate of potash, or 23,750 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,680 lb. of commercial bone-dust, or 7,020 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 9,150 lb. of sulphate of ammonia, or 10,980 lb. of nitrate of soda.

*No. 2. Dark Alluvial Soil.*

A SAMPLE of soil from Bathurst Experimental Farm has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 64·33 per cent. Absolute weight per acre, 6 inches deep, 1,938,746 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·22 per cent.; stones over $\frac{1}{4}$ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·0 per cent.; fine gravel, more than $\frac{1}{30}$ inch diameter, ·41 per cent.; fine soil, 99·37 per cent., comprising sand, 28·81 per cent., and impalpable matter, chiefly clay, 70·56 per cent.

An analysis of the fine soil discloses moisture, 4·891 per cent., and volatile and combustible matter, principally organic, 8·275 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·431 per cent., the general value of which is good, being equivalent to 8,620 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·181 per cent., the general value of which is good, being equivalent to 3,620 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·135 per cent., the general value of which is satisfactory, being equivalent to 2,700 lb. (*c*) in an acre of soil 6 inches deep, nitrogen, ·241 per cent. (equal to ·292 per cent of ammonia), the general value of which is good, being equivalent to 4,820 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·289 per cent., general value of which is good; ferric oxide ($Fe_2O_3$), ·864 per cent., general value deficient; and sulphuric acid ($SO_3$), ·044 per cent., general value indifferent; ferrous oxide 1·008 per cent.

In connection with the foregoing particulars, the special points of value in the soil are phosphoric acid and organic (nitrogenous) matter, capacity for retaining moisture; its special defects, stiff character for working, presence of ferrous oxide, which can easily be got rid of; its general character mechanically is very fair, and chemically good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are any suited to the climate; while it is unsuitable, without special manure or special treatment, for root crops, for which it is rather stiff. The only treatment needed at present is good cultivation. The atmosphere will sweeten the soil and turn the lower black oxide of iron into the red oxide (rust); it will also decompose the insoluble manurial constituents making them soluble and therefore available for plant food. Speaking generally, if this soil is not fallowed before cultivation, the addition of 1 ton of lime per acre will greatly improve it. This dressing will also be very beneficial for grass or any crop which does not allow of regular cultivation.

## SPRINGWOOD.

A SAMPLE of soil from Springwood has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its

NOTE.—(*a*) This amount of lime would be supplied in 9,577 lb. of quicklime, or 12,655 lb. of slaked lime, or 17,102 lb. of chalk. (*b*) This amount of potash would be supplied in 7,240 lb. of commercial sulphate of potash, or 30,166 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 10,800 lb. of commercial bone-dust, or 16,200 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 24,100 lb. of sulphate of ammonia, or 28,920 lb. of nitrate of soda.

capacity for water, 53·33 per cent. Absolute weight per acre, 6 inches deep, 2,117,314 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·33 per cent.; stones over ¼ inch in diameter, 2·70 per cent.; coarse gravel, more than $\frac{1}{10}$ inch in diameter, 8·81 per cent.; fine gravel, more than $\frac{1}{60}$ inch diameter, 8·02 per cent.; fine soil, 80·14 per cent., comprising sand, 14·72 per cent., and impalpable matter, chiefly clay, 65·42 per cent.

An analysis of the fine soil discloses moisture, 3·127 per cent., and volatile and combustible matter, principally organic, 10·199 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·156 per cent., the general value of which is satisfactory, being equivalent to 3,120 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·108 per cent., the general value of which is satisfactory, being equivalent to 2,160 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·070 per cent., the general value of which is fair, being equivalent to 1,400 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·280 per cent. (equal to ·340 per cent. of ammonia), the general value of which is good, being equivalent to 5,600 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·120 per cent. general value of which is satisfactory; ferric oxide ($Fe_2O_3$), 2·279 per cent.; sulphuric acid ($SO_3$), ·059 per cent., general value, fair; ferrous oxide, ·792 per cent.

In connection with the foregoing particulars, the special points of value in the soil are nil; its special defect, phosphoric acid; its general character mechanically is tolerable and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are summer fruit, hay, and beans, while it is unsuitable, without special manure or special treatment, for grain, citrus fruit, and roots. The manures and treatment recommended for trial are—Dressing of lime, 1 ton per acre in autumn, with 2 to 4 cwt. per acre of dried blood and bone-dust in winter, or the same weight of Sugar Company's manure in spring.

Speaking generally, working and opening to the air will improve this soil very much. Drainage ought to make it suitable for all classes of fruit trees.

## Bullahdelah.

A sample of soil from Bullahdelah has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The nature of the soil is clay loam; the reaction of the soil is neutral; and its capacity for water, 43·7 per cent. Absolute weight per acre, 6 inches deep, 2,165,273 lb.

A mechanical analysis of this soil shows that it contains of root fibres, 18 per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, ·58 per cent.; fine gravel, more than $\frac{1}{60}$ inch diameter, 1·35 per cent.; fine soil, 97·89 per cent., comprising sand, 30·12 per cent., and impalpable matter, chiefly clay, 67·77 per cent.

Note.—(*a*) This amount of lime would be supplied in 3,466 lb. of quicklime, or 4,580 lb. of slaked lime, or 6,190 lb. of chalk. (*b*) This amount of potash would be supplied in 4,320 lb. of commercial sulphate of potash, or 18,000 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 5,600 lb. of commercial bone-dust, or 8,400 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 28,000 lb. of sulphate of ammonia, or 33,600 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, 2·584 per cent., and volatile and combustible matter, principally organic, 2·865 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of: Lime (CaO), ·135 per cent., the general value of which is satisfactory, being equivalent to 2,700 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·289 per cent., the general value of which is good, being equivalent to 5,780 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·054 per cent., the general value of which is fair, being equivalent to 1,080 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·084 per cent. (equal to ·102 per cent. of ammonia), the general value of which is satisfactory, being equivalent to 1,680 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·085, general value of which is fair; ferric oxide ($Fe_2O_3$), ·730 per cent., general value deficient; and sulphuric acid ($SO_3$), ·044 per cent., general value indifferent. Ferrous oxide, ·072 per cent. Contains also ·137 per cent. soluble alumina, equivalent to ·459 per cent. of sulphate of alumina, which, if present as potash-alum, would represent 1·273 per cent. This amount is not likely to prove injurious, if deep cultivation and fallowing a few months before sowing are practised.

In connection with the foregoing particulars, the special points of value in the soil are nil; its special defects, phosphoric acid and nitrogenous matter; its general character mechanically is fair but rather stiff for seed crops, and chemically fair. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are beans, peas, summer fruit, while it is unsuitable, without special manure or special treatment, for grain, hay, or good grasses. The manures and treatment recommended for trial are liming, 1 ton per acre; bone-dust and dried blood, such as Gee's fertiliser, 2 to 4 cwt. per acre for grass, maize, oats, and vegetables.

Speaking generally, the lime will burst up and mellow the clay, liberating the latent supplies of potash which is at present insoluble; it will also help to neutralise any ill effects of the alum present. Whether it will pay to treat the soil and manure it as indicated, is a matter for local experience. The soil is not likely to do much good for a long period without such treatment.

## Port Macquarie.

A sample of soil from Telegraph Point, Port Macquarie, has been submitted to analysis by Mr. F. B. Guthrie, F.C.S., the Analytical Chemist to the Department. The geological formation of the surrounding county is sandstone; the nature of the soil is loam; the reaction of the soil is neutral; and its capacity for water, 48 per cent. Absolute weight per acre, 6 inches deep, 2,373,434 lb.

A mechanical analysis of this soil shows that it contains of root fibres, ·06 per cent.; stones over ¼ inch in diameter, ·0 per cent.; coarse gravel, more than $\frac{1}{10}$ inch diameter, 1·14 per cent.; fine gravel, more than, $\frac{1}{50}$ inch diameter, 2·56 per cent.; fine soil, 96·24 per cent., comprising sand, 43·68 per cent., and impalpable matter, chiefly clay, 52·56 per cent.

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Note.—(*a*) This amount of lime would be supplied in 3,000 lb. of quicklime, or 3,964 lb. of slaked lime, or 5,357 lb. of chalk. (*b*) This amount of potash would be supplied in 11,560 lb. of commercial sulphate of potash, or 48,167 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 4,320 lb. of commercial bone-dust, or 6,480 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 8,400 lb. of sulphate of ammonia, or 10,080 lb. of nitrate of soda.

An analysis of the fine soil discloses moisture, 2·164 per cent., and volatile and combustible matter, principally organic, 6·377 per cent.

The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consists of: Lime (CaO), ·163 per cent., the general value of which is satisfactory, being equivalent to 3,803 lb. (*a*) in an acre of soil 6 inches deep; potash ($K_2O$), ·066 per cent., the general value of which is fair, being equivalent to 1,540 lb. (*b*) in an acre of soil 6 inches deep; phosphoric acid ($P_2O_5$), ·032 per cent., the general value of which is indifferent, being equivalent to 747 lb. (*c*) in an acre of soil 6 inches deep; nitrogen, ·151 per cent. (equal to ·183 per cent. of ammonia), the general value of which is good, being equivalent to 3,523 lb. (*d*) in an acre of soil 6 inches deep. There is also of magnesia (MgO), ·035 per cent., general value of which is bad; ferric oxide ($Fe_2O_3$), 1·063 per cent., general value deficient; sulphuric acid ($SO_3$), ·062 per cent., general value fair; ferrous oxide, ·720 per cent.

In connection with the foregoing particulars, the special points of value in the soil are none; its special defect, phosphoric acid; its general character mechanically is fair, and chemically moderately good. The crops for which it is most suitable, judging by its mechanical condition, chemical composition, and the climate of the district, are green feed, summer fruit; while it is unsuitable, without special manure or special treatment, for cereals, roots, or citrus fruit. The manures and treatment recommended for trial are any complete manure, such as fowl dung or stable manure, Gee's complete fertilizer, 4 to 6 cwt. per acre, or Sugar Company's No. 3 manure, 4 cwt. per acre. Lime ½ ton per acre in autumn, would benefit the soil very much, breaking up the clay and liberating the potash.

Speaking generally, the manure most required is some form of phosphoric acid, whether bone-dust or superphosphate; the former should be applied in the autumn, the latter when the seed is sown or in the spring.

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NOTE.—(*a*) This amount of lime would be supplied in 4,226 lb. of quicklime, or 5,584 lb. of slaked lime, or 7,546 lb. chalk. (*b*) This amount of potash would be supplied in 3,080 lb. of commercial sulphate of potash, 12,833 lb. of kainit. (*c*) This amount of phosphoric acid would be supplied in 2,988 lb. of commercial bone-dust, or 4,482 lb. of superphosphate. (*d*) This amount of nitrogen would be supplied in 17,615 lb. of sulphate of ammonia, or 21,138 lb. of nitrate of soda.

# Poultry.

By The Sub-Editor.

## Soft Foods.

Having in a previous issue dealt shortly with the varieties and method of feeding grain to poultry, a few hints with regard to soft food may possibly come as news even to farmers who have had a "few hens about the place" for years. It will doubtless be admitted that any method of utilising waste must of necessity effect economy, and therefore any otherwise waste matter which can be beneficially used, instead of purchasing fresh material, would naturally ensure a better return in selling the product. In no instance is this better exemplified than in feeding poultry for the market, and it is astonishing the quantity of waste on a farm which may be beneficially fed to poultry.

The writer is personally strongly in favour of feeding a soft meal every morning all the year round. These meals admit of infinite variety, and can be fed warm in the cold weather and cold in summer. A very good plan is to keep a sort of stock-pot, in which may be thrown all kitchen scraps, bones, meat, surplus cooked vegetables, puddings, &c. To this may be added thoroughly cooked waste portions of vegetables, i.e., the outside leaves of cabbages, turnip and carrot tops, potato parings—in fact, any fresh edible vegetable matter. As may be supposed, this "mess" is of too soupy a character to feed as it comes from the copper. This very soupiness is one of the greatest drawbacks in feeding soft foods, and is the cause of many complaints to which fowls are liable. In order to avoid this, a portion should be taken out in a sieve or colander, so that the surplus moisture may run off. When this has been accomplished it may be either fed alone as a separate meal, or placed in a tin dish and gradually mixed with pollard, until it becomes sufficiently dry to crumble to pieces when dropped on the ground, and then be used for the early morning meal. This is the proper state in which to give soft food to fowls, and the best plan, both to avoid waste and insure cleanliness, is to distribute the mess in the rough iron troughs described in last month's issue. It is very essential that the stock pot, or rather its contents, should always be sweet. It is a great mistake to suppose that fowls thrive on anything. By some miraculous means fowls do occasionally pull through on all sorts of filth, but should they contract disease under such circumstances nothing will save them.

Advantage should be taken of this soft meal to give any general medicine that may be required. Thus, during the moulting season, a small quantity of powdered sulphur may be given with advantage two or three times a week, and (say) once a week, some of the sulphate of iron tonic.

Whether soft food be fed hot or cold, it should always be mixed with boiling water, and during the hot weather the simplest way is to mix up sufficient over night, in order that it may be ready to feed cold in the

morning. Should no table scraps and vegetables be available, a mess may be made of two parts bran and one part pollard, mixed "short" with boiling water, and fed warm or cold, according to circumstances.

There are, of course, other and more expensive poultry foods which are useful, and even necessary under certain circumstances. In breeding for show purposes, and for young, well-bred chickens, some of the patent foods are almost essential if success would be achieved. Probably the best of these is that manufactured by Spratt and Co., and known as "Spratt's Poultry Meal," now obtainable in Sydney. The mixture recommended by Lewis Wright, is equal parts of half-ground oats or coarse oatmeal and Spratt's meal.

With regard to quantity, there cannot be any hard and fast rule laid down. There should be a sufficient number of troughs to permit of all the fowls "getting their heads in," and the proper rule is to remove the surplus food and wash out the troughs as soon as the birds cease to eat with avidity and begin to pick the food over.

There are many little additions to the soft food which find favour with different breeders. Thus in the cold weather some add a little red pepper or a few peppercorns. The writer has a predilection in favour of curry powder, and the curry which is left over from the table is invariably saved for the fowls and is eaten with evident relish. Any poultry-keeper who takes an interest in his stock will naturally find out what his birds take with a relish and note it for use when he wants to give them a "fillip."

Having dealt with soft foods, more particularly as applied to adult fowls, a few words on the feeding of young chicks are necessary to make the subject more complete. There is no doubt that bread soaked in milk and well squeezed is the best food to give after the first twenty-four hours, for the first two or three days. This may be followed by chopped egg and breadcrumbs, varied with a mixture of two-thirds oatmeal to one-third barley meal, and a daily meal of Spratt's "crissel," to supply the place of insect food so necessary for gallinaceous birds. In every instance the rule regarding a moderate amount of moisture must be strictly adhered to.

It is not for one moment assumed that the whole subject of soft foods has been dealt with in this article. The information given in these columns is intended to cover the main features of the subject considered, and to be suggestive in character. A hint is sufficient for anyone who really takes an interest in any subject, and in many cases petty detail becomes irksome. Then again the desire is also to arouse an interest where none at present exists, and in such cases detail is not pleasant to start with. Should what appears regarding soft foods or anything else in connection with poultry arouse sufficient interest to create a desire to know more, any detailed information will be gladly supplied on application to the Department.

## Notes.

One of the results of the very wet season we have experienced will probably be an increase, particularly amongst the Asiatic breeds, of elephantiasis or "scaly legs." This is caused by a parasitic insect, and is consequently very contagious; and should be promptly attended to. The scales on the legs of the affected bird become rough, and the leg appears to thicken. When these symptoms are noticed, and a good poultry man or woman will notice them immediately, the bird should be caught, its legs thoroughly washed with soap and warm water, and then a mixture of sulphur and lard (sulphur ointment) well rubbed in. If taken in time one

rubbing is usually sufficient. Although the bird affected does not appear to droop, it may be taken for granted that a bird suffering from elephantiasis is not fit for the table; and this is a point which should be carefully looked at when buying fowls.

Now is a good time to purchase a well-bred cockerel to run with any crossbred hens there may be about the farm. In cases where the farmer does not care to go to the expense of purchasing a pen of thoroughbreds this system will be found an excellent alternative. All the chief breeders will have a number of young male birds, big framed and with excellent constitutions, yet quite useless for their purposes from some defect in colour. Although this is of importance to a fancier it is immaterial to the farmer who simply wants to improve the stamina of his common fowls. The selection of breed should be according to the most marked characteristics of a majority of the hens, if they have any. In any case, there can be no harm in purchasing an upstanding, healthy young Australian game, as they cross well with almost any breed.

# General Notes.

## The Vineyard and the Cellar.

In consequence of the absence from Sydney of Mr. Despeissis, who is engaged in judging vineyards in connection with the national prize competition, the chapter in the series under the above heading has not been prepared. In the meantime we cannot do better than refer vignerons to Mr. Despeissis' article on "Wine Fermentation," which appeared in Vol. II. pt. 6, and express the hope that the series will be resumed in our issue for March next.

## Some Results of Spraying.

As showing the beneficial results of spraying fruit-trees, the following extract from a report by Inspector T. G. Treseder, dated 29th October, 1892, on a visit to the orchard of Mr. Ezzy, at Millthorpe, should be an incentive to orchardists to act upon the suggestions offered by the Department.

Mr. Treseder, says "Mr. Ezzy's place is in much better condition than many others I have seen, and I attribute this to nothing else but spraying the trees with the different mixtures advised in the *Agricultural Gazette*. Mr. Ezzy showed me three apricot trees which he sprayed early in spring with *Eau Céleste*. The first time of spraying was just before the trees burst into leaf; the second time when the fruit was nicely formed, and the leaves about the size of a shilling (this time only two trees), and the third time one tree when it advanced in growth about 3 inches. It is surprising to notice the difference in these three trees although they are standing close to each other. The one sprayed three times is as bright as anyone could wish to see a tree, free from shot-hole fungus in the leaves, and from scab on the fruit. That sprayed twice a shade worse in all respects; while that sprayed once is really badly infected with scab on the fruit, and shot-hole fungus on the leaves.

"The pear trees were infected worse than any other fruits with mite, and I sprayed them with resin and soda to the great satisfaction of the spectators. There was a little peach aphis on one or two of the trees, and I sprayed these with the same mixture, the spectators being highly pleased to find that the aphides were immediately destroyed.

"Mr. Ezzy showed me a Windsor pear which he had treated with the same mixture early in spring. This tree had for years borne scarcely a pear. This year he has a fair crop, and next year he expects to save 50 or 60 per cent. of the set blossom. In order to prove beyond doubt that the spraying did save the crop, I may mention that another Windsor pear-tree close by was not treated, and is in a dreadful state both with black spot and pear mite."

## The Export of Meat.

A correspondent writing recently to the *Sydney Morning Herald* calls attention to the apparent uselessness of reminding stock-owners of the common practice all over Australia of preserving meat. He points out that from the earliest times in Australia it has been the habit of stockmen to take the bones out of meat, slightly salt it, season it with saltpetre and sugar, and then hang it up to dry. Instead of this, "still they go on boiling down, freezing, potting, panning, extracting, and making salt junk for ships' use." The point contended for is that there is both less risk and less expense in the Australian process, by which the more costly carriage in the freezing chamber would be dispensed with. Without expressing any opinion as to the success likely to meet with such a product on the London market as compared with frozen meat, it is safe to say that this meat is infinitely more palatable than the salt junk usually to be obtained on shipboard, and certainly not more expensive to cure.

## The New Style of Farming.

In the *Australasian* of November 26th, 1892, appears an article under this head, in which the writer calls attention to the necessity of growing a variety of crops in order to make farming a profitable pursuit. He says, "In the northern parts of the Colony of Victoria farmers generally have attempted to make a fortune by wheat-growing. Very few of those, however, who have devoted their attention solely to cereals have done more than earn a bare living. The most wide-awake selectors knew such would be their fate from the first, and they wisely avoided putting all their eggs into one basket. They found time to plant a few fruit trees and vines, while the raising of vegetables also formed a feature of their experiments. . . . . In my travels through the Victorian Colony I have never met a farmer owning 640 acres who has paid for his land, built a substantial house, and generally raised himself to affluent circumstances by wheat-growing alone. Now this is an extraordinary and perhaps humiliating statement to make, but it is based on fact all the same. I have never come across—and I would travel a long way to see him—the selector who has secured his independence by wheat and nothing but wheat."

In calling attention to this article, the Departmental Inspector of Cereals points out that the statements may to some extent be applied to farmers in this Colony. As he is in the best possible position to ascertain the true state of affairs, this paragraph is published as a warning both to farmers who so far have adhered to the practice now condemned and to those who are about commencing operations.

## Tomatoes as Insect Clearers.

According to a translation in the Melbourne *Weekly Times* from a South American paper, tomato leaves have proved to be value in an unanticipated direction. It appears that the owner of a number of peach trees attacked by *curculio* placed tomato leaves round the trunks and branches to shade them from the sun, and was surprised to find, on visiting the orchard next day, that the trees so treated were entirely clear of insects. Acting on the hint thus obtained, he steeped a quantity of fresh tomato leaves in water, and sprinkled the liquor over some peach, rose, and orange trees, which had

not previously been treated with the tomato leaves, and in two days, of the numerous insects of all kinds which had infested the trees, not one was to be seen.

The Department would be glad to have the experience of any fruit-grower who may have tried growing tomatoes among fruit trees; also to know whether the above-mentioned decoction has been tried in the Colony, and, if so, with what effect.

## New Wheats.

The special attention of wheat-growers is called to the fact that a good number of the new wheats sent out by the Department have proved very suitable to certain districts.

Those who wish to inform themselves concerning the facts will do well for the present to address themselves to the farmers who, in the ten different districts, undertook to grow those wheats during the past season.

The names and addresses of those experimenters are as follows:—

Principal Thompson, Hawkesbury Agricultural College, Richmond.
W. Farrer, Lambrigg, Queanbeyan.
Joseph Faint, Kelly's Plains, near Armidale.
Thomas Quick, Woodlands, Tamworth.
Thomas Bragg, Allington, Narramine, near Dubbo.
T. C. Worboys, Spring Hill, near Orange.
Edward Taylor, Rose Hill, Young.
H. D. Coker, Brookfield, Jindalee, near Cootamundra.
Robert Young, Umaralla, near Cooma.
B. B. Bennett, Brucedale, Wagga Wagga.
G. F. Berthoud, Riverside, Corowa.

The kinds of wheat sent for trial to each of the experimenters were as follow:—Blount's Lambrigg, Leak's, Ward's Prolific, Smith's Nonpareil, Steinwedel (one bushel of each); Belatourka, Queensland Defiance, Talavera, Town and Country, Mummy, Medeah, Pugh's Allora Spring, Farmer's Friend (half bushel of each); 5-lb. sample White Hogan; 1 lb. of Summer Club, King's Jubilee, Early Para and Australasian Wonder; small packets, from ½ lb. to 1 oz., Victorian Defiance, Rattling Tom, Red Californian, Square-headed Sicilian, Fillbag, Cooke's, Goldsmith's Pedigree, Blount's Fife, Broderick's, Ward's Prolific (Marshall White), Sicilian Boart, Australian Glory, Manitoba, Tourmaline, Niagra, Jordan's, Fluorspar, Bega Wheat, Quartz 58A, Anglo-Australian or Anglo-Canadian, Jacinth, Improved Fife. In addition to which, small packets, eleven of each, were sent of cross-fertilised wheats.

## Sisal Hemp Plants (*Agave rigida*, Mill., var. *Sisalana*.)

As announced in a previous number of the *Agricultural Gazette* the Department has been in communication with the Colonial Secretary of the Bahamas, with regard to obtaining a quantity of these fibre plants for distribution to persons in this Colony desirous of experimenting with them in suitable localities. We regret to learn, however, from a reply just received through the Agent-General, that the exportation of the sisal hemp plant from Bahamas for any purpose whatever is forbidden by statute until the expiration of 1898. The Department will now endeavour to obtain plants of this variety from some other reliable source.

## Appointment of Tobacco Experts.

In connection with the encouragement of the tobacco industry in this Colony the following temporary appointments have been made by the Minister:—Mr. Samuel Lamb and Mr. G. F. Sutherland. These officers are now visiting the more important tobacco-growing districts in the Colony with the view of giving information to growers with regard to best methods of cultivation, most suitable varieties, and approved methods of harvesting and curing the leaf, which, it is hoped, may lead to the industry being placed on a more satisfactory basis.

## Quotations for Agricultural Lime.

We have received numerous inquiries from farmers and fruit-growers with regard to procuring, at a reasonable price, lime suitable for applying to their soils; and in response to the Department's invitation the following quotations have been submitted by manufacturers of this article:—

Messrs. J. and F. Toyer, lime and cement manufacturers, Liverpool-street, Sydney, offer to supply in trucks at Ben Bullen Railway Siding (Mudgee line), 122 miles from Sydney, genuine, well-burnt agricultural lime at 7s. 6d. per ton, bags extra. The rail freight from Ben Bullen to Darling Harbour is 10s. 8d. for a single ton, and 9s. 4d. per ton for a truck load if not less than six tons. If desired, they can deliver the lime at any of the steamer wharfs in Sydney at 21s. per ton, bags extra.

Mr. John Fry, of Nos. 237, 239, Castlereagh-street, Sydney, offers to deliver in Sydney at steamer's wharf agricultural lime in bags at 21s. 6d. per ton.

# Number of Vignerons in New South Wales.

NUMBER of Vignerons in New South Wales, also acreage under vines and production for the year 1891–92.

| Electorates. | Number of Growers | Area. | | | | Production. | | |
|---|---|---|---|---|---|---|---|---|
| | | Wine-making. | Table-use. | Not bearing. | Total area. | Wine. | Brandy. | Table use. |
| A.—*Northern Division*— | | acres. | acres. | acres. | acres. | gallons. | gallons | tons of fruit. |
| 1. Coast. | | | | | | | | |
| Richmond ... ... ... | 54 | 36 | 21 | 22 | 79 | 2,700 | ... | 23 |
| Clarence ... ... ... | 3 | ... | 8 | ... | 8 | ..... | ... | 3 |
| Grafton ... ... ... | 24 | 23 | 9 | 7 | 39 | 3,680 | ... | 14 |
| Macleay ... ... ... | 8 | 6 | 7 | 1 | 14 | 1,650 | ... | 16 |
| Hasting and Manning ... | 58 | 96 | 45 | 31 | 172 | 25,760 | ... | 115 |
| Totals ... ... | 147 | 161 | 90 | 61 | 312 | 33,790 | ... | 176 |
| 2. Table-land. | | | | | | | | |
| Inverell ... ... ... | 45 | 143 | 27 | 17 | 187 | 38,291 | 926 | 33 |
| New England ... ... | 5 | 16 | ... | 6 | 22 | 3,750 | ... | ... |
| Glen Innes... ... ... | 2 | 14 | ... | ... | 14 | 3,600 | ... | ... |
| Tenterfield ... ... ... | 5 | ... | 3 | ... | 3 | ..... | ... | 3 |
| Tamworth ... ... ... | 23 | 41 | 23 | 14 | 78 | 11,460 | ... | 54 |
| Totals ... ... | 80 | 214 | 53 | 37 | 304 | 57,101 | 926 | 90 |
| 3. Western Slopes. | | | | | | | | |
| Gunnedah ... ... ... | 12 | 1 | 9 | 2 | 12 | 120 | ... | 9 |
| Gwydir ... ... ... | 12 | ... | 12 | 14 | 26 | ..... | ... | 18 |
| Namoi ... ... ... | 36 | 1 | 31 | 12 | 44 | 120 | ... | 47 |
| Totals ... ... | 60 | 2 | 52 | 28 | 82 | 240 | ... | 74 |
| Totals—Northern Division ... | 287 | 377 | 195 | 126 | 698 | 91,131 | 926 | 340 |
| B.—*East Central Division*— | | | | | | | | |
| 4. Coast. | | | | | | | | |
| Gloucester ... ... ... | 3 | 31 | 2 | 12 | 45 | 3,000 | ... | 2 |
| Durham ... ... ... | 48 | 180 | 11 | 18 | 209 | 75,260 | 27 | 26 |
| Newcastle ... ... ... | ... | ... | ... | ... | ... | ..... | ... | ... |
| Morpeth ... ... ... | 5 | 38 | 6 | 18 | 62 | 10,020 | ... | 6 |
| Northumberland ... ... | 17 | 5 | 17 | ... | 22 | 1,300 | ... | 25 |
| Maitland, East ... ... | 8 | 18 | 11 | 2 | 31 | 4,200 | ... | 26 |
| Maitland, West ... ... | 6 | ... | 8 | ... | 8 | ..... | ... | 19 |
| Hunter ... ... ... | 157 | 879 | 131 | 181 | 1,191 | 292,380 | 1,662 | 254 |
| Patrick's Plains ... ... | 108 | 308 | 113 | 137 | 558 | 73,550 | ... | 137 |
| Wollombi ... ... ... | 36 | 25 | 10 | 23 | 58 | 4,470 | ... | 11 |
| Hawkesbury ... ... | 100 | 69 | 107 | 44 | 220 | 17,520 | ... | 164 |
| Nepean ... ... ... | 113 | 173 | 108 | 90 | 371 | 29,096 | 374 | 95 |
| Totals ... ... | 601 | 1,726 | 524 | 525 | 2,775 | 510,796 | 2,063 | 766 |

NUMBER of Vignerons in New South Wales—*continued.*

| Electorates. | Number of Growers | Area. | | | | Production. | | |
|---|---|---|---|---|---|---|---|---|
| | | Wine-making. | Table use. | Not bearing. | Total area. | Wine. | Brandy. | Table use. |
| B.—*East Central Division*—(continued). | | acres. | acres. | acres. | acres. | gallons. | gallons | tons of fruit. |
| 5. Metropolis and Environs. | | | | | | | | |
| Metropolis ... ... ... | ... | ... | ... | ... | ... | ..... | ... | ... |
| St. Leonards ... ... | 16 | ... | 27 | 13 | 40 | ..... | ... | 26 |
| Canterbury ... ... | 9 | 3 | 14 | 5 | 22 | 450 | ... | 28 |
| Parramatta ... ... | ... | ... | ... | ... | ... | ..... | ... | ... |
| Central Cumberland ... | 510 | 41 | 791 | 284 | 1,116 | 6,770 | ... | 1,646 |
| Totals ... ... | 535 | 44 | 832 | 302 | 1,178 | 7,220 | ... | 1,700 |
| 6. Table-land. | | | | | | | | |
| Hartley ... ... ... | 3 | ... | ... | 3 | 3 | ..... | ... | ... |
| Upper Hunter ... ... | 40 | 128 | 17 | 9 | 154 | 35,600 | 141 | 16 |
| Mudgee ... ... ... | 55 | 117 | 76 | 27 | 220 | 10,088 | ... | 53 |
| Macquarie East ... ... | 4 | 3 | 7 | 6 | 16 | 400 | ... | 7 |
| Macquarie West ... ... | ... | ... | ... | ... | ... | ..... | ... | ... |
| Orange ... ... ... | 12 | 3 | 13 | 18 | 34 | 900 | ... | 14 |
| Carcoar ... ... ... | 19 | 9 | 10 | 8 | 27 | 550 | ... | 14 |
| Molong ... ... ... | 9 | 8 | 8 | 4 | 20 | 1,600 | ... | 14 |
| Wellington ... ... | 23 | 29 | 27 | 7 | 63 | 3,435 | 60 | 44 |
| Totals ... ... | 165 | 297 | 158 | 82 | 537 | 52,573 | 201 | 162 |
| 7. Western Slopes. | | | | | | | | |
| Bogan ... ... ... | 26 | 53 | 53 | 13 | 119 | 8,330 | ... | 89 |
| Forbes ... ... ... | 23 | 15 | 23 | 32 | 70 | 3,300 | ... | 44 |
| Grenfell ... ... ... | 14 | 33 | 20 | 25 | 78 | 4,090 | ... | 63 |
| Totals ... ... | 63 | 101 | 96 | 70 | 267 | 15,720 | ... | 196 |
| Totals—East Central Div. ... | 1,364 | 2,168 | 1,610 | 979 | 4,757 | 586,309 | 2,264 | 2,824 |
| C.—*Southern Division.* | | | | | | | | |
| 8. Coast. | | | | | | | | |
| Camden ... ... ... | 83 | 64 | 69 | 177 | 310 | 14,280 | 148 | 169 |
| Kiama ... ... ... | ... | ... | ... | ... | ... | ..... | ... | ... |
| Illawarra ... ... ... | 10 | 1 | 11 | 2 | 14 | 370 | ... | 52 |
| Shoalhaven... ... ... | 3 | 1 | 4 | 1 | 6 | 200 | ... | 10 |
| Eden ... ... ... | 8 | 7 | 21 | 7 | 35 | 1,000 | ... | 21 |
| Totals ... ... | 104 | 73 | 105 | 187 | 365 | 15,850 | 148 | 252 |
| 9. Table-land. | | | | | | | | |
| Argyle ... ... ... | 9 | 1 | 16 | 5 | 22 | 300 | .. | 14 |
| Goulburn ... ... ... | 2 | ... | 5 | ... | 5 | ..... | ... | 5 |
| Braidwood ... ... ... | 6 | 7 | 4 | 8 | 19 | 1,100 | 50 | 2 |
| Queanbeyan ... ... | 2 | ... | 2 | 8 | 10 | ..... | ... | 3 |
| Monaro ... ... ... | 1 | ... | 6 | ... | 6 | ..... | ... | 4 |
| Yass Plains ... ... | 3 | 2 | ... | 2 | 4 | 500 | ... | ... |
| Boorowa ... ... ... | 6 | 13 | 1 | 5 | 19 | 2,000 | 50 | 3 |
| Young ... ... ... | 28 | 50 | 40 | 30 | 120 | 6,150 | 20 | 34 |
| Gundagai ... ... ... | 15 | 21 | 8 | 5 | 34 | 3,690 | 30 | 6 |
| Tumut ... ... ... | 5 | 9 | 5 | ... | 14 | 1,762 | ... | 4 |
| Totals ... ... | 77 | 103 | 87 | 63 | 253 | 15,502 | 150 | 75 |

NUMBER of Vignerons in New South Wales—*continued.*

| Electorates. | Number of Growers | Area. | | | | Production. | | |
|---|---|---|---|---|---|---|---|---|
| | | Wine-making. | Table use. | Not bearing. | Total area. | Wine. | Brandy. | Table use. |
| C.—*Southern Division*—(continued). 10. Western Slope. | | acres. | acres. | acres. | acres. | gallons. | gallons | tons of fruit. |
| Hume ... ... ... | 121 | 438 | 39 | 799 | 1,276 | 74,812 | 731 | 26 |
| Albury ... ... ... | 93 | 636 | 18 | 62 | 716 | 120,875 | 1,895 | 37 |
| Murray ... ... ... | 19 | ... | 12 | 26 | 38 | ..... | ... | 14 |
| Murrumbidgee ... ... | 47 | 47 | 62 | 41 | 150 | 8,128 | ... | 104 |
| Totals ... ... | 280 | 1,121 | 131 | 928 | 2,180 | 203,815 | 2,626 | 181 |
| Totals—Southern Division ... | 461 | 1,297 | 323 | 1,178 | 2,798 | 236,167 | 2,924 | 508 |
| D.—*Western Division.* | | | | | | | | |
| Balranald ... ... ... | 6 | 3 | 3 | 1 | 7 | 300 | ... | 4 |
| Wentworth ... ... | 2 | 1 | 2 | ... | 3 | 200 | ... | 3 |
| Wilcannia ... ... ... | 1 | ... | ... | 2 | 2 | ..... | ... | ... |
| Bourke ... ... ... | 10 | ... | 15 | ... | 15 | ..... | ... | 15 |
| Sturt ... ... ... | 3 | ... | ... | 1 | 1 | ..... | ... | ... |
| Totals—Western Division ... | 22 | 4 | 20 | 4 | 28 | 500 | ... | 22 |
| Totals—New South Wales ... | 2,134 | 3,846 | 2,148 | 2,287 | 8,281 | 913,107 | 6,114 | 3,694 |

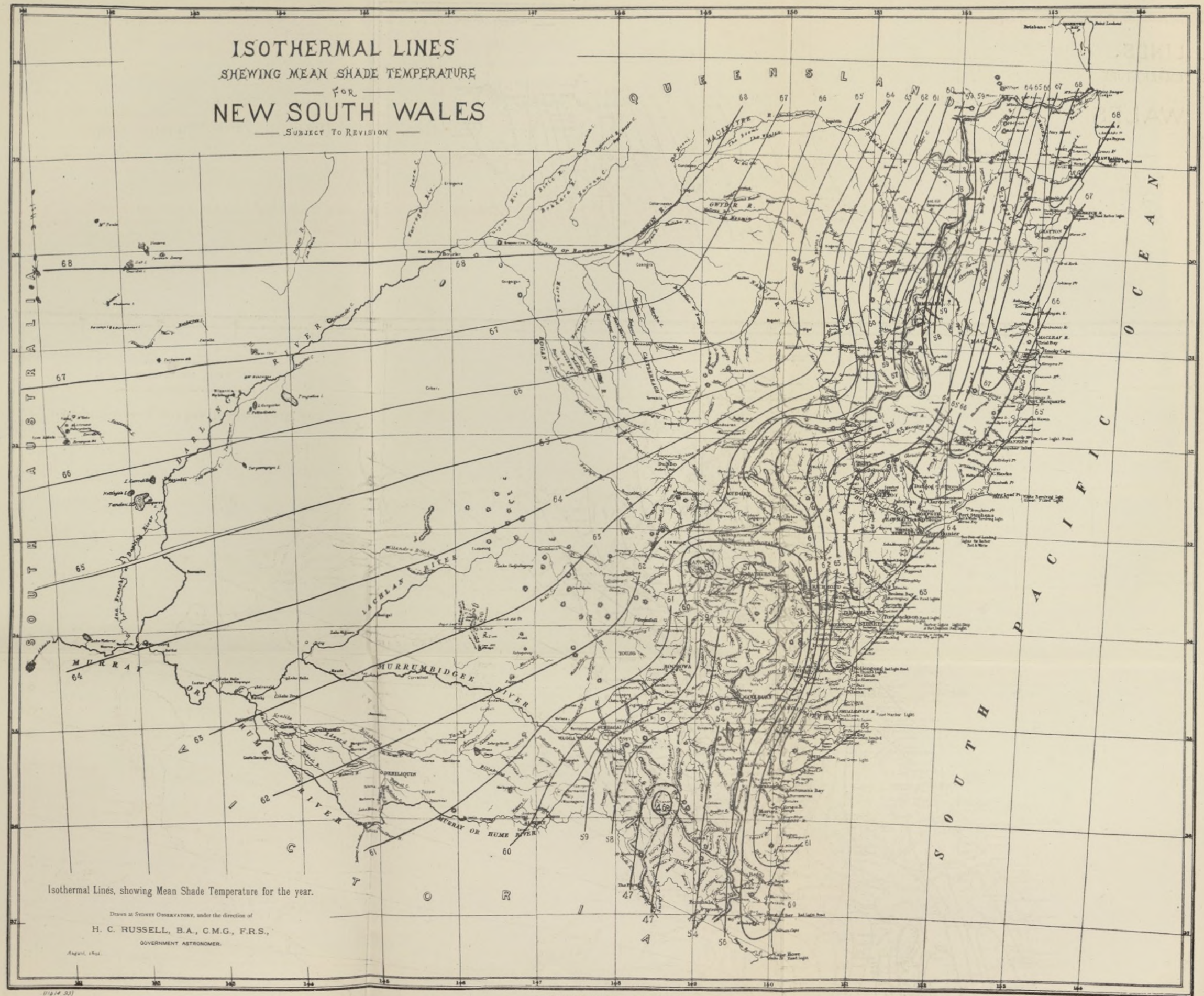
# ISOTHERMAL LINES

SHEWING MEAN SHADE TEMPERATURE

— FOR —

# NEW SOUTH WALES

— SUBJECT TO REVISION —




Isothermal Lines, showing Mean Shade Temperature for the year.

Drawn at SYDNEY OBSERVATORY, under the direction of

H. C. RUSSELL, B.A., C.M.G., F.R.S.,

GOVERNMENT ASTRONOMER.

August, 1892.

(11614.93)

PHOTO-LITHOGRAPHED AT THE GOVT. PRINTING OFFICE, SYDNEY, NEW SOUTH WALES.

# Diagram of Isothermal Lines.*

The diagram of isothermal lines for New South Wales herewith is intended to convey to the reader a general view of the mean shade temperature in the various districts of the Colony, and for the purpose of drawing these, the mean shade temperature for each station has been derived from all the past records of temperature at that place. In all cases the temperatures so obtained have been corrected for index errors when any existed, the standard used for this purpose being the Sydney copy of the Kew standard.

These isothermal lines are not intended to convey the impression that the exact temperature is known at all points in the Colony. Many places are practically uninhabited, and therefore furnish no returns, and in others, the country is so rugged that considerable differences in temperature may be found within a mile or two, but they are intended to indicate the probable mean temperatures, and they have been drawn after having ascertained in the way described above the mean temperature for every possible point in New South Wales. To draw the isothermal lines over a great part of the Colony was found to be a simple matter, but in the more rugged parts difficulty arose from local conditions, and, in some cases, several discordant records were found; after eliminating, as far as possible, the effect of differing elevations a mean was taken, and the curve drawn through that point, and in every case the greatest care was exercised in order to make this first attempt at drawing a set of isothermal lines for New South Wales as accurate as possible.

A peculiarity in the lines in the coast district came as a surprise when drawing the original isothermals, but it was found to be quite correct, and also in accordance with what one might expect, for the places close to the sea are made cooler by the sea breezes, and at a short distance from the coast, on the low lands, it is warmer, because not affected by sea breeze, and then again the Isotherm trends northwards, as the rising land makes the air cooler. This is most marked in the coast districts north of Newcastle, where the mountains are farthest from the sea, and is at its minimum about Eden, in the south, where the land rises at a shorter distance from the sea.

In some of the mountain districts it will be observed that the lines have not been completed, the information available being insufficient; in others the known contour of the hills has been a help to drawing the links from station to station, but a more extensive series of observations may require a readjustment of the lines to a small extent.

* Diagram with notes kindly supplied by Mr. H. C. Russell, Government Astronomer.

# AGRICULTURAL SOCIETIES' SHOWS, 1893.

| Society. | Secretary. | Date of Show. |
|---|---|---|
| Southern New England P. and A. Association ... | J. D. Leece ... | Feb. 28, Mar. 1 |
| Robertson Agricultural Society ... ... ... | R. G. Ferguson | Feb. 28, Mar. 1 |
| Bega A., P., and H. Society ... ... ... | A. J. Wilson ... | March 1, 2 |
| Picton A. and H. Society ... ... ... ... | G. Bradbury ... | March 1, 2 |
| Port Macquarie Agricultural Society ... ... | A. E. Pountney | March 1, 2 |
| Nepean District A., H., and I. Society ... ... | R. Benaud ... | March 2, 3 |
| Glen Innes A., P., and M. Association ... ... | J. Denshire ... | March 8, 9 |
| Walcha P. and A. Association ... ... ... | H. Chapman ... | March 8, 9 |
| Murrumbidgee P. and A. Association (Summer Show) | C. H. Croaker... | March 8, 9 |
| Bellinger River Agricultural Society ... ... | F. R. H. Baker | March 8, 9, 10 |
| Crookwell A. and P. Association ... ... ... | H. J. Peard ... | March 9, 10 |
| Marulan P., A., H., and I. Society ... ... | H. Morrice ... | March 9, 10 |
| Berrima District A., H., and I. Society .. .. | J. Yeo... ... | Mar. 9, 10, 11 |
| Murrumburrah P., A., and I. Society ... ... | M. Murphy ... | March 15, 16 |
| †Camden Agricultural Society ... ... ... | W. R. Cowper | Mar. 15, 16, 17 |
| Tenterfield P. and A. Association ... ... ... | J. Harker ... | Mar. 15, 16, 17 |
| Upper Murray and Tumberumba P. and A. Society ... ... | Joint Secs. | G. D. Belson & W. Williams | March 17 |
| Gunning P. and A. Society... ... ... ... | | F. W Timmis & J. S. Sands | March 21, 22 |
| Blayney P. and A. Association ... ... ... | G. H. Woolley... | March 22 23 |
| Gundagai P. and A. Society .. ... ... | W. E. Kyle ... | March 22, 23 |
| †Inverell P. and A. Association ... ... ... | James M'Ilveen | March 22, 23 |
| †Goulburn P. and H. Society ... ... ... | J. J. Roberts ... | March 23, 24 |
| Cudal P. and A. Association .. ... .. | C. Schramme ... | March 29, 30 |
| Royal Agricultural Society, Sydney ... ... | F. Webster ... | March 29 to April 4. |
| Wellington P. and A. Society ... ... ... | R. Porter ... | April 12, 13 |
| Clarence River P. and A. Society (Grafton) ... | T. Page... ... | April 12, 13 |
| Liverpool Plains A. and H. Association ... ... | F. T. R. Veness | April 19, 20 |
| Mudgee Agricultural Society ... ... ... | J. M. Cox ... | April 19, 20, 21 |
| Richmond River A., H., and P. Society ... ... | J. T. Tandy ... | April 20, 21 |
| *Hunter River A. and H. Association ... ... | W. C. Quinton.. | April 26, 27, 28 |
| Namoi P., A., and H. Association ... .. | J. Riddle ... | April 26, 27, 28 |
| *Dubbo P., A., and H. Association ... ... | G. H. Taylor ... | April 26, 27 |
| Upper Hunter P. and A. Association, Muswellbrook | P. Healey ... | May 3, 4 |
| Warialda P. and A. Association ... ... ... | W. B. Geddes ... | May 3, 4 |
| Gunnedah A. and P. Association ... ... ... | F. P. Brigstocke | May 17, 18 |

* These Societies get the National Prizes for 1893. † Owing to a typographical error in the last issue of the *Gazette* it would appear that the Camden, Inverell, and Goulburn Societies are to receive the National Prizes grant for their respective shows in 1893. Such, however, is not the case, the Minister having approved of the prizes being offered at these Societies' Shows in 1894, so as to give intending competitors ample notice.

[4 plates and 1 diagram.]

Sydney: Charles Potter, Government Printer.—1893.