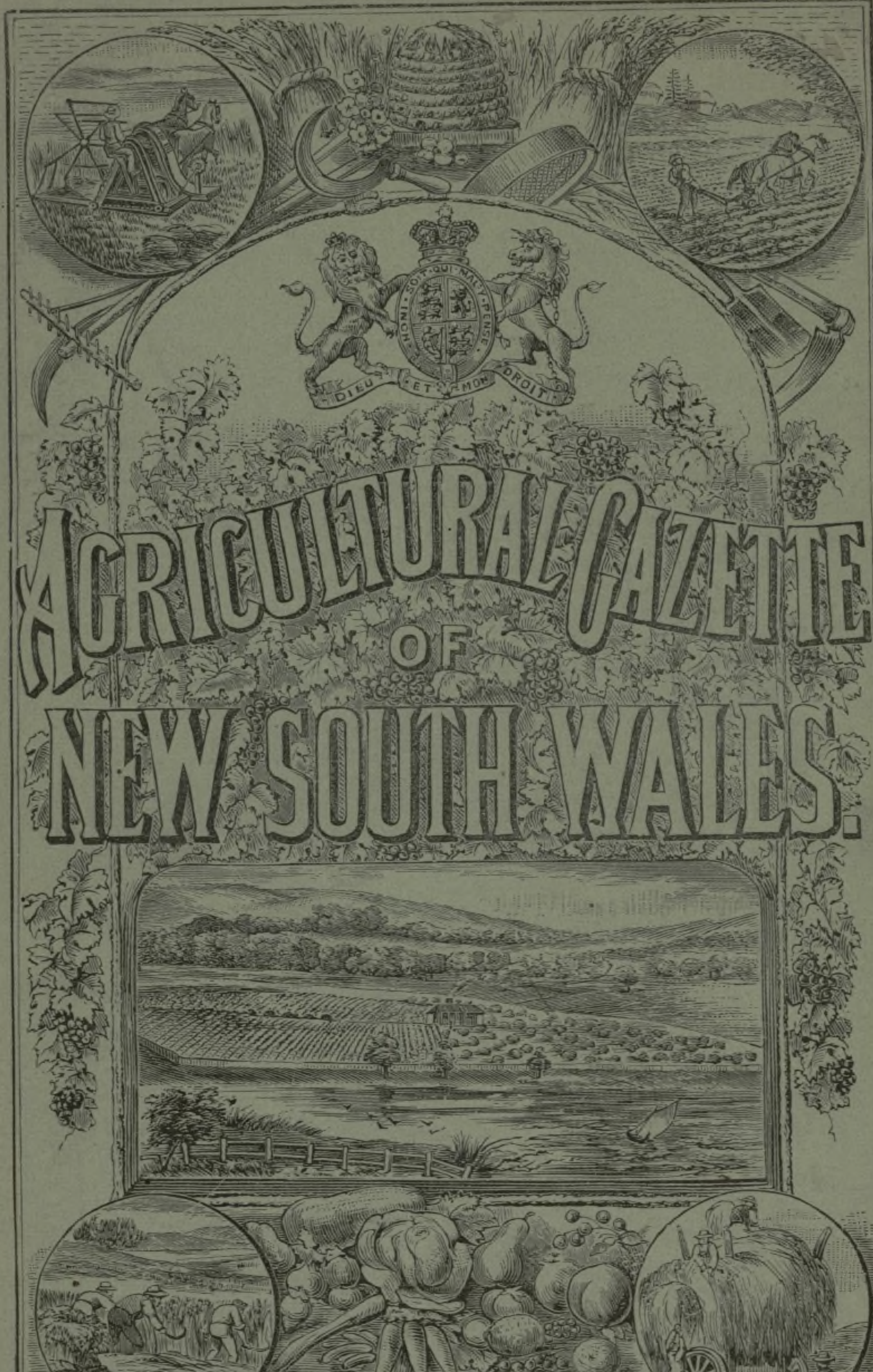
VOL. IV. *AUGUST, 1893.* PART 8.



SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER.

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

[11b 100—93 a)

THE

AGRICULTURAL GAZETTE

OF

NEW SOUTH WALES,

PUBLISHED BY

THE DEPARTMENT OF AGRICULTURE.

VOL. IV. PART 8.

AUGUST, 1893.

By Authority:
SYDNEY: CHARLES POTTER, GOVERNMENT PRINTER.

1893.

11*b* 160—93 (*a*) [1s. for a Single Number, or 10s. per Annum.]

CONTENTS.

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

Introductory Note.

It is proposed, in this series, to give an account of such Australian native plants as are worthy of cultivation or conservation on account of their value as timbers, tans, foods, forage-plants, &c. The rugged Ironbark, the useful Salt-bush, the trees yielding tan-bark, and the tiny herb or large tree yielding medicine, food, &c., for man, will be successively dealt with. It will be the aim of the writer to make the articles as simple and as interesting as possible, and to bring the information up to date.

No. 1.—The Red Cedar.

Other Vernacular Names.—Often simply called Cedar, but frequently Red Cedar, in contradistinction to other timbers known as White and Yellow Cedar.

Aboriginal Names.—"Polai" (Illawarra). "Woolia" (Richmond River, Moore). "Mamin" and "Mugurpul" (Brisbane). "Woota" (Wide Bay, Queensland). (Hon. W. Pettigrew).

Botanical Name.—*Cedrela Australis*, F. v. M. The word *Cedrela* is from the Latin *Cedrus*, a Cedar, a tree whose wood has a sweet smell. Our tree belongs to the natural order *Meliaceæ*.

Synonym.—*Cedrela Toona*, Roxb., the Toon tree of India.

Flowers.—The flowers of the Toon tree are dried, and are extensively used for the production of a red or yellow dye in India. Mr. Thomas Wardle, a well-known authority, says the dye they produce for silk is "very good." On account of the competition of aniline dyes, Red Cedar flowers, and almost every other indigenous vegetable product of New South Wales, are of no commercial importance whatever to the dyer.

Fruit.—The fruit is an oval capsule about one inch long, which soon opens and sheds its membranous seeds. These seeds always have a remunerative value; but care should be taken to collect fully ripe fruits from healthy, mature trees. The seeds should be kept dry, and preserved from insect pests, to which they are very liable. The collection of seeds of useful and ornamental Australian plants is one of those minor industries which are usually neglected, and the Department will always assist collectors in making them true to name.

Leaves.—Mr. Gamble states that the leaves of the Toon tree are used to feed cattle in India.

Exudation.—The Red Cedar produces gum, but only very rarely, and in small quantity. An old cedar-getter says that trees well exposed to the sun (? in unsuitable situations), yield most gum. The specimens I have examined are pale yellow, almost colourless, and in thin tears about an inch long. Between the teeth it almost feels leathery. It swells up largely in cold water, but in the course of twenty-four hours it nearly wholly dissolves, forming a solution colourless and faintly cloudy, and leaving but little insoluble residue. It is one of the gums which form a connecting link between those which readily dissolve in water and those which merely swell up in that liquid. It forms a fair mucilage, and it would be a valuable commodity if obtainable in large quantities.

Bark.—The outer bark is scaly, and in drying falls off, leaving an almost perfectly smooth surface of a reddish-brown colour. It is moderately fibrous, and will tear into layers if some force be exercised. The late Mr. C. Fawcett informed Baron von Mueller that the bark produces a purplish leather, and as he also stated that it contains "a considerable quantity" of tannin. I examined some from Cambewarra. The inner bark alone gave 13·38 per cent. of tannin, and the outer and inner combined 12·8 per cent., a result too low to give any encouragement to a hope that cedar bark might be of commercial value. The bark is not usually looked upon as a drug, but in India it is considered to be valuable in fevers, dysentery, &c. It has also been considered a reliable antiperiodic, and by Dr. Newton a good substitute for cinchona, according to Dr. Waring's official Pharmacopæia of India. I am not aware, however, that any alkaloid has been found in the bark, and am disinclined to look upon it seriously as a substitute for cinchona.

Timber.—But the value of a red cedar lies in its timber, for it is, without doubt, the most valuable timber produced by New South Wales, and it is in universal use. It is equal to mahogany, to which it bears a good deal of resemblance, (except that it is much lighter in weight) ; the uses of the two timbers are much the same, *e.g.*, for tables, cabinets, and furniture in general, also for doors and fittings of buildings, when the cost does not stand in the way. When kept dry it is very durable; pieces are now in existence which were recently taken from buildings erected in the very early days of the Colony, and are as sound as the day they were first used. Cedar often shows a beautiful figure, and it would be difficult to find any timber to surpass the beauty of picked specimens. Its colour is of a pleasing red ; it turns a deep, rich colour with age. It is very rarely indeed attacked by white ants.

Mr. B. P. Mitchell, of Gumeracha, South Australia, remarks that cedar saw-dust, when used for smoking ham, imparts a peculiarly nice flavour. Red cedar makes a most luxurious fuel. Cigar boxes are, in this Colony, made of the softest cedar. Fresh uses are constantly being found for this valuable timber. The *Sydney Morning Herald* of the 7th June, 1893, announces that the Railway Commissioners have accepted a tender for 200,000 cedar railway keys at £4 15s. per thousand, it having been found that cedar keys are suitable for the work, and that they are a good deal less in cost than the imported article. The cost of cedar was about 1½d. per foot in A.D. 1800; it was at that time worked by the Government. Its present market price in the log in Sydney is 15s. per 100 feet, a low price, unprecedented of late years, and likely to continue for some months to come.

Professor Warren, of the Sydney University, has, in his recently published work, "Australian Timbers," given the results of a number of carefully conducted experiments on the strength of red cedar, but they are too technical and too lengthy for reproduction here, and the reader is referred to the book. I may mention that he gives the weight per cubic foot as 28·3 lb. Mr. F. S. Campbell, of Melbourne, gives 2,000 lb. to 3,000 lb. per square inch as the tensile strength of the timber, and the Victorian Timber Board of 1884 gives other determinations.

The well-known "Toon" tree of India is, as has been already stated, either identical with our red cedar, or very closely related to it. The following notes in regard to it taken from Gamble's *Manual of Indian Timbers*, will be interesting :—

"Weight of cubic foot about 35 lb. The wood is durable, and not eaten by white ants; it is highly valued, and universally used for furniture of all kinds, and is also employed for door-panels and carving. From Burmah it is exported under the name of 'Moulmein Cedar,' and as such is known in the English market. In North-west India it is used for furniture, carvings, and other purposes. In Bengal and Assam it is the chief wood for making tea-boxes, but it is getting scarce, on account of the heavy demand. The Bhutias use it for shingles and for wood-carving; they also hollow it out for rice pounders. It is, or rather used to be, for very large trees are now rather scarce, hollowed out for canoes in Bengal and Assam. It is one of the 'Chittagong woods' of commerce."

Size, &c.—A middle-sized to a very large tree varying in height up to 200 feet and with a trunk diameter of about 10 feet, though exceptional trees even exceed these large dimensions. The size of the average trees now yielding cedar is about half the above.

"A tree was cut down near Lismore, which measured 10 feet in diameter at the base, and was calculated to yield 30,000 feet of saleable timber."—*Moore.*

Distribution.—The best cedar is found from the Bellinger River northwards to the Richmond River, and throughout Queensland, especially in the warmest and moistest districts. It is, however, found from the Illawarra northwards, in the Shoalhaven gullies, Bulli Mountain, Kowmung, and thence northwards in increasing abundance until the northern rivers are reached. In localities to the south of Sydney the cedar is practically cut out, the only remaining trees being in almost inaccessible situations.

Ulladulla, on the coast, 164 miles from Sydney, is the southern limit for cedar.

An old log cut thirty years ago at Otford, on the Illawarra line (30 miles south of Sydney), and found last year, was over 5 feet in diameter, and almost perfectly sound. This is given as an instance of the proximity of merchantable cedar to Sydney at one time.

The Sydney market obtains its principal supply from the Richmond and Tweed River districts.

Propagation.—Red cedar grows most vigorously in the rich, moist, alluvial flats and sloping ground of our northern coast districts, particularly so on the banks of creeks on the eastern slopes of the ranges, where the greatest shelter from the prevailing winds and shade are obtainable. Young plants are easily and successfully transplanted in such localities during winter and early spring, at which seasons at least 90 per cent. of the trees planted will survive, and grow at the rate of from 3 to 5 feet annually. The cedar flourishes best when planted in open places in existing forests, where there is room for the trees to mature, and they obtain the most shade, and are better protected from winds and frosts than if planted in open ground.

Seeds are rarely produced on cedar-trees growing in the dense forests, but trees planted in rich and moderately moist soil in open places will produce seeds annually in abundance after they have attained the age of 6 to 8 years. If seeds be fresh and sound they readily germinate, but they are very liable to deterioration, as has been already stated.

As an instance, however, of cedar seeds retaining their vitality for a considerable period, Mr. Forester Brown, of Port Macquarie, relates, on the authority of Mr. Donkin, that some land at Kimbreki, Manning River, was cleared. No cedar was then on it, no cedar trees near. There had been no floods for years previously, yet twelve months afterwards numbers of young cedars sprang up.

The young red cedars in the State Forest Nursery at Gosford were a few years ago a good deal injured by the larvæ of a moth which burrowed into the main stems or leaders. The moth proved to be new, and was described by Mr. S. A. Olliff in the "Records of the Australian Museum" in 1890, under the name of *Epicrocis terebrans.* The late Mr. M'Coig practically exterminated the pest by the free use of the pruning knife, and also by means of a wash made of a decoction of gum-leaves.

It is one of the very few Australian deciduous trees, although in the warmest districts it is semi-deciduous or even evergreen. It is a beautiful tree, and is well worthy of cultivation for that reason, apart from its value for timber.

The following particulars in regard to the cultivation and conservation of red cedar, and a list of the forest reserves on which it is found, are of public interest. It is to be hoped that land owners in suitable districts will see that it would be enlightened policy on their part to propagate such valuable timbers as the red cedar. A few thousand well-planted and well-tended cedars would be a valuable legacy.

Particulars from Annual Reports, Forest Branch.

1888.

On the Dorrigo Forest Reserve, cedar planting (which has been annually proceeded with since 1884) was commenced on 8th August, and continued up to the end of November; 2,288 cedar-trees were planted, and scrub being removed from around 1,569 self-sown and previously planted cedar-trees.

The total number of cedar-trees planted from 1884 to date is 25,296, and the number of trees from around which the saplings and scrub have been removed during the same period is 2,500.

Approximately the area upon which cedar-trees in all stages of growth are found on this reserve is about 10,500 acres; and cedar-trees about 45 to 50 feet in height, and 1 foot in diameter, are distributed over about 5,000 acres of reserve, averaging about five trees per acre.

On the Forest Reserves Nos. 5 and 3,753, 2,450 cedar-trees were planted in 1888.

The cedar-trees upon all these reserves are growing luxuriantly, more especially those which obtain the greatest amount of air, light, and space.

Eight hundred cedar-trees are growing on Hogan's Brush Forest Reserve, Gosford.

1890.

Up to date the Gosford State Forest Nursery has raised over 100,000 red cedar plants.

1891.

On Mount Royal Forest Reserve, county of Durham, 1,500 young cedar plants, raised at Gosford Nursery, were planted out.

At Wyong plantation 6,000 young cedar-trees were planted. Several of the plants have made a growth at least of 2 feet in height; they have evidently been planted in a site suitable to their requirements.

RED CEDAR.

1892.

At Otford 1,500 red cedar-plants were planted out. The young trees are progressing favourably.

In the Glen Innes district young cedar trees were planted.

The cedar-trees planted in 1891 at Mount Royal Forest Reserve have not latterly done so well—they have had to contend with hot and dry weather.

The young cedar-trees planted on Jock Smith's Creek, Paterson's River, Forest Reserves Nos. 202 and 3,496, are growing splendidly.

TIMBER Reserves containing Red Cedar.

County.	Reserve.	Remarks.
Brisbane	13,888	Good growth of young red cedar.
Buller	4	Cedar growing in patches.
"	14,150	" "
Buller, Clive, and Drake..	4,406	" "
Clarke	1,662	Fair growth of young cedar.
"	10,991	" "
"	10,992	Young cedar in patches.
"	10,993	" "
Drake	6,264	Good growth of cedar.
"	11,452	Fair growth of cedar.
"	11,453	" "
"	9,999	Well timbered with young cedar.
Richmond and Drake ...	379	Young cedar growing in patches.
" " ...	995	" "
Dudley	158	Good growth of cedar-trees.
"	3,753	Good growth of young and mature red cedar-trees.
Durham	201	Scarce.
"	202	"
"	3,496	"
Fitzroy	6,732	"
Fitzroy and Raleigh ...	377	Good growth of young cedar.
Gresham	1,608	Fair growth of young and mature cedar-trees.
"	6,479	Cedar growing in patches.
"	11,110	Scarce.
Gough	1,433	"
Hawes	7,974	"
"	7,975	"
Macquarie	8,235	"
Northumberland ...	70	Fair growth of young cedar.
" ...	46	Scarce.
" ...	14,972	"
" ...	217	"
Rous	250	"
"	256	"
"	1,126	"
"	4,353	Fair growth of young cedar.
Westmoreland	101	Large quantity of red cedar growing in deep ravines; access very difficult.

Reference to Plate.—A, Flower; B, Empty Capsules; C, Seed; D, General View of Tree in Winter.

Tan Substances.

By J. H. MAIDEN,
Consulting Botanist.

Canaigre.

At Vol. I, p. 108, of the *Gazette* some notes are given in regard to this American root, which at that time was coming into prominent notice as a tan. During the past three years commercial men have followed the matter up, and scientific investigations have been made with the view to ascertain to what extent the tannin varies in quantity in wild and cultivated roots, and to elucidate other points. Tans are of especial interest to the people of New South Wales, and two recent publications* give us the latest information in regard to what might have been looked upon as a rival of wattle-bark. The following notes are compiled from these publications :—

It appears that the first effort made to establish the commercial value of canaigre (the root of a large species of dock, *Rumex hymenosepalus*, Torr.) was in the year 1882, when Col. J. C. Tiffany shipped considerable quantities of the root from Deming, New Mexico, and El Paso, Texas, to New York, and also to Germany, Austria, and Great Britain. The root was first shipped green, which caused it to ferment, and its use abroad in a fermented condition destroyed the leather to which it was applied, which temporarily brought it into disfavour; but subsequently, in the year 1884, the root was shipped by one of Col. Tiffany's sons in a sliced and dried state, when it arrived abroad in good condition, was successfully used in all experiments made, and immediately met with favour. Nothing resulted from these efforts, for the reason that it was feared the root in its wild state could not be secured in quantity at a price which would enable it to be brought into general use, and its cultivation at that time was not thought of.

Mr. Thomas Fitch then formed a company at San Francisco to work the industry, but the enterprise was abandoned.

The Canaigre Supply Company of Tucson, Arizona, then went into the field, and made trial shipments of canaigre to chemists and tanners in Europe and America. These were so successful that large shipments followed to meet the demand, "the product having met with favour wherever used." This company makes an extract from canaigre which, it is stated, can be made from the cultivated root at a cost with which oak and hemlock extracts cannot compete. Canaigre extract works are also in operation at Deming, New Mexico.

* "Canaigre," by C. B. Collingwood, J. W. Toumey, F. A. Gulley, being Bulletin 7 of the Arizona Experiment Station, 1893. "Canaigre Tannin," by Henry Trimble and Josiah C. Peacock. A Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. American Journal of Pharmacy. April, 1893.

Messrs. Martin and Miller, of Glasgow, Scotland, stated that they could use 10,000 tons annually if it were possible to get it at £8 per ton in a sliced and dried state.

In 1886 a tannery was erected at Tucson, Arizona, for tanning hides with canaigre, but owing to improper management, and disagreement among shareholders, the business was never fairly started. A considerable number of cattle hides and other skins were tanned and sent to leather dealers in the United States, who reported that they were of first class quality.

The opinion of Professor Eitner, of the Vienna Research Station for Leather Industry, commands universal respect in such matters. He recommends canaigre for its quickness in tanning, its filling qualities, and its beautiful colour. He states "I consider this article especially adapted for tanning uppers, fine saddlery, and fancy leathers. It can be used alone or in connection with other materials." He looks upon the price of canaigre at Vienna (£13 per ton) as quite reasonable.

Three hundred and seventy car loads of canaigre were carried by the Southern Pacific Railroad (data in regard to other railways is not available), from 1st January, 1891, to 31st October, 1892, so that the industry would appear to have already attained some proportions.

The ordinary method of preparing canaigre for shipment is for some one to locate a good patch, and then to make a camp at the place with a number of men. The men dig the roots by contract, a certain price being paid for the roots delivered at the cutting machine. The machine slices the roots into pieces one-twentieth to one-fourth of an inch thick. These pieces are then air-dried. In this state they contain about 8 per cent. of moisture, and from 20 to 35 per cent. of tannic acid, and can be safely shipped if they are kept dry.

The following conclusions are arrived at by the writers of the *Arizona Bulletin*,* to which we are also indebted for the accompanying block. "That canaigre is an efficient and valuable tanning agent is no longer a question. It has passed the experimental stage, and would no doubt be adopted at once by the trade if it were not for the fact that the present supply is limited and uncertain."

Again, "the supply of wild canaigre is becoming limited. Good authorities state that at the present price the supply will hardly last more than two years. If canaigre is only to be obtained from the natural supply there will be a speedy end of it. But if, as the experiments at this station show, canaigre can be profitably cultivated, it will soon become a permanent factor with thousands of acres of land, producing yearly hundreds of thousands of tons of canaigre, and the problem will be to get the tannic acid into the market at the least expense."

It will be observed that, while the cultivation and use of canaigre have magnificent possibilities before them, they are not yet realised. All sorts of difficulties may crop up, and in ten years the name of canaigre may never be heard; or, on the other hand, it may represent a commercial article consumed by "hundreds of thousands of tons yearly." My advice would be for farmers to keep canaigre under careful observation, and even to put in a few roots (keeping them under control) to see how it flourishes, but not to go into the matter in a large way yet. Its home is America; our American friends have it growing wild, and are familiar with the conditions under which it flourishes best. Let us, therefore, await the result of their experience, for, although in one sense it has honorably passed the experimental stage, yet, in a wider sense, as regards a definite article of the world's commerce, it cannot be said to have done so at present.

* *Bulletin* on "Canaigre," issued by the Arizona Agricultural Experiment Station, University of Arizona, No. 7, February, 1893.

Botanical Notes.

The Moreton Bay Fig as a Fodder Plant.

Mr. J. H. Maiden writes:—"For several years past I have noticed that whenever the Moreton Bay Figs (*Ficus macrophylla*) are pruned the cows in the Outer Domain, Sydney, forsake their luxuriant pasture to browse upon the leaves. Their partiality for these unlikely-looking leaves is very marked, for they return to the prunings day after day, and consume every leaf, and even thickish twigs. I have made inquiries, and cannot find that any harm has ever been known to accrue to the cows through eating this fodder. I have also made inquiries on the Richmond River, where this tree is indigenous, and find that cattle have been known to put themselves to much trouble to get at the fig leaves, while neglecting the leaves of other trees. There is no record on the River of the fig leaves having proved injurious to the cattle, so far as I have been able to ascertain."

Earth Nuts as Cattle Feed.

In an article which appeared in the *Gazette*, Vol. II Part 5, the cultivation and uses of the Earth or Pea Nut (*Arachis hypogea*) were fully described. The value of this nut, in the form of cake, has recently been thoroughly tested as food for cattle, full details of a series of experiments which were conducted at the Royal Agricultural Society's (England) Experimental Farm, Woburn, appearing in the journal of that society, Vol. III, Part IV., No. 12, 31st December, 1892. These experiments were undertaken with a view to testing the value of earth-nut or ground-nut cake:—"This cake is made by crushing the seeds and seed-pods of *Arachis hypogea*, a plant cultivated on the northern coast of Africa, and also largely in India, more particularly in Southern India. Large quantities of the seed-pods are exported from Pondicherry (Madras), and go principally to Mediterranean ports; the oil, after crushing of the seeds, being used for adulterating olive oil, and for other purposes. The refuse cake is used for feeding cattle, both on the Continent and in India. Very little of the cake has as yet been brought over to this country, but as there was some likelihood last year (1891) of a trade in it developing, it was thought well to try at the Woburn Experimental Farm how the material would do as food for cattle. The principal objections to its use are that, owing to the rough method of pressure employed, the cake is often apt to have some amount of horsehair or bits of rough sacking (from the bags used in pressing out the oil) attached to it, and that it is very liable to turn rancid and to become sour. These points should be guarded against. The cake supplied to Woburn was fairly free from pieces of sacking, and any which were noticed were picked out before cake was given to the animals; it was also free from rancidity, but was, however, slightly acid."

Before giving the actual details of these experiments, which were conducted under the supervision of Dr. J. A. Voelcker, the well-known agricultural chemist, there are one or two points well worthy of mention. It will be noticed from a perusal of the foregoing extract that the ground-nut cake, so far as Great Britain is concerned, is an import; and, moreover, that the cake is not prepared in a particularly satisfactory manner. According to the article referred to, the pea-nut can be successfully grown over a greater portion of the eastern side of the Dividing Range—practically the coastal district of the Colony. It, therefore, becomes apparent that cattle could be fattened on pea-nut cake in this country on much better terms than in Europe, where it has to be imported. It is also worthy of note that the cake is, as regards the commercial value of the peanut, practically a waste product, in view of the many uses to which nut oil is put, and its consequently high value. It would, therefore, appear that the cultivation of this plant is a matter demanding the prompt attention of farmers, as being not only a profitable crop, but one which is realisable in so many forms as to render loss almost impossible.

The following are details of the experiments:—"Four Hereford bullocks were fed from November 28th, 1891, to March 14th, 1892 (107 days), with a mixture of earth-nut cake, oats, and barley in equal proportions, and received in addition about 45 lb. of roots and 15 lb. of clover-hay chaff per head daily. The experiment was thus parallel to that with beans, oats, and barley, described in the previous article, the only difference being that earth-nut cake was used in place of beans, so that the present may be considered as a trial of earth-nut cake against bean-meal. The cost of earth-nut cake was £8 4s. a ton, delivered at the nearest railway station, which, with cartage, breaking, &c., brought the price up to £8 8s. a ton. Analysis of average samples, taken during the experiment, gave the following composition:—

Moisture	10·77
Oil	8·47
[1]Albuminous compounds	47·44
Starch, digestible fibre, &c.	22·27
Woody fibre	4·53
[2]Mineral matter (ash)	6·52
	100·00

[1]Containing Nitrogen .. .. 7·59
[2]Including sand .. .. 2·62

"The course of feeding was similar to that with the bean-meal, the cattle beginning with 2 lb. per head daily of the cake (or 6 lb. of the mixture of earth-nut cake, oats, and barley), and gradually increasing to 4 lb. of the cake (or 12 lb. of the mixture). The bullocks did perfectly well on the cake, and there was no difficulty whatever in getting them to eat it, nor any harm from its somewhat acid character. The following table gives the main results.

Four Hereford Bullocks fed on earth-nut cake, oats, and barley, with roots and clover hay chaff.

No.	Weights at Commencement, Nov. 28, 1891.			Weights on Jan. 19, 1892.			Weights on Feby. 19.			Weights on March 14.			Gain in Live-weight in 107 days.		
	Cwt.	qr.	lb.	Cwt.	qr.	lb.	Cwt.	qr.	lb.	Cwt.	qr.	lb.	Cwt.	qr.	lb.
1	11	1	14	12	1	8	12	3	10	13	1	5	1	3	19
2	10	0	24	11	0	20	11	2	10	12	0	14	1	3	18
3	10	2	12	11	2	18	12	0	11	12	1	26	1	3	14
4	9	3	6	11	1	0	12	0	10	12	2	0	2	2	22
	42	0	0	46	2	0	48	2	13	50	1	17	8	1	17
Gain per head daily during each period ...				2·42 lb.			1·91 lb.			2·08 lb.			2·19 lb.		

No.	Fasted Live-weights in stones of 14lb.		Loss in Fasting.	Carcass weights in stones of 8lb.		Price realised at 4s. 8d. per stone (8lb.) Dead-weight.			Cost of Additional Food (Earth-nut Cake, Oats, Barley) consumed in 107 days.			
	st.	lb.	per cent.	st.	lb.	£	s.	d.		£	s.	d.
1	102	4	3·82	102	3	23	17	9	Earth-nut	4	7	7
2	93	9	3·46	97	5	22	15	7	Oats	4	15	5
3	97	2	2·71	98	1	22	17	11	Barley	3	13	0
4	98	4	1·71	101	4	23	13	8				
...	391	5	Average. 2·92	399	5	93	4	11		12	16	0
Average per head				99	7	23	6	3		3	4	0

"Comparing these results with those obtained in the experiment with beans, oats, and barley, we have:—

	Daily Gain per head in Live-weight.	Carcass weight per head (8-lb. stone)		Prices realised per head at 4s. 8d. per stone.			Cost per head of Additional Foods.		
	lb.	st.	lb.	£	s.	d.	£	s.	d.
Bullocks fed on beans, oats, and barley...	2·01	100	2	23	7	8	3	6	9
" " earth-nut cake, oats and barley...	2·19	99	7	23	6	3	3	4	0

"Accordingly, each beast fed on earth-nut cake realised 1s. 5d. less, but cost 2s. 9d. less to keep than a similar one fed on bean-meal.

"The earth-nut cake, therefore, proved to be a useful feeding material for cattle, and to have a feeding value just about equal to that of beans."

Tobacco as a Farmer's Crop for N. S. Wales.

(*Continued from page* 522.)

By G. F. SUTHERLAND,
Department of Agriculture.

Harvesting.

A MODERATELY bright but cool day after the dew has left the plants is best for harvesting tobacco, but the possession of a good field shelter, such as previously recommended, will render the farmer comparatively independent of the ardour of the sun. In its absence he will have to be careful.

Armed with a suitable knife, gently turn up the bottom leaves of the plant, from which it is assumed all suckers, decayed leaves, and insects have been removed, and after bending it to one side, with a sharp blow cut close to the ground, on which lay it carefully down or invert with its butt towards the sun, where, in ordinary course if the latter is not too strong, it should remain until thoroughly wilted. It will then have acquired a toughness and pliancy that will enable it to be transported by cart or otherwise to the curing-shed, without injury if ordinary care is exercised, which it is very necessary should now and at all times be practised. In the soft and tender condition the plant has assumed, the tissues of the leaf are easily bruised, permanently injuring the affected part, and reducing the most perfect leaf to the low commercial and priced grade of "broken" tobacco.

At the risk of repetition, I also desire to point out and impress upon the reader, that seven-eighths of the defects found in New South Wales tobacco in the past, have been not only the result of imperfect knowledge in its treatment, but of a more or less deliberate carelessness in the handling of the plant from this cutting stage onwards. And I would urge, that if the very desirable improvement in appearance and quality which is possible in this commodity is to be effected, greater care and intelligence will have to be exhibited in its preparation than has yet been done, save in one or two instances.

The process of curing and preparing tobacco for market consists of a series of operations, some of them petty, but each and all important, and by the manner in which they are accomplished largely determining the commercial value of the crop. The finest variety of tobacco carelessly handled and badly cured will, as a rule, bring less cash return than a second-rate variety that has had justice done to it in field and curing-house. The principles embodied in the various operations are simple enough, and will become apparent as a description of the work proceeds. They are also applicable in various ways (in fact each country has its own peculiar methods), and when to their proper perception by the beginner, experience is added, it will be quite permissible for him to effect the end aimed at, viz., making good marketable tobacco by the application of other means than those laid down here, which I can, however, in the meantime, commend as being decidedly reliable.

The period a plant will take to wilt, depends upon the amount of sap it contains and the heat of the atmosphere. Light tobaccos have little moisture and wilt quickly, heavy tobaccos have much and take longer. This change, which occupies from about thirty minutes to two hours, according to circumstances, is really the first stage of curing, which in turn will be accelerated or retarded according to the efficiency with which wilting has been performed. In the event of a powerful sunshine at cutting time, which indeed usually prevails in the Central and Western Divisions during our tobacco harvest, cut plants require the closest attention, and should be removed, after a short exposure only, to the shade advised. The hot sun blazing from a cloudless sky will burn the leaves long before they are wilted, and of course make them valueless. Where hot winds are experienced the sides of the shelter should be protected to prevent the lighter-bodied plants or leaves drying prematurely. This must be avoided, as in that event they will remain green for all time. If the curing-house is in proximity to the tobacco patch the plants may be mounted on the sticks, in the fashion decided upon, carried straight in and hung up immediately. But, as oftener happens, the field is at some distance from the house, they will require to be carted there. A good and convenient method of performing this operation is to fit a waggon or dray with a single tier framework of parallel poles, similar to that in the field shelter or shed, that will carry the tobacco sticks laden with hanging plants, which may in this way be conveyed to the shed, with little risk of sunburn or heating at any hour of the day. The other and more common fashion, is by loading in a cart that has first had a good layer of soft grass or thrashed straw placed in the bottom, to prevent bruising—this is important—after which four, five, or more layers of plants may be carefully laid thereon, not thrown. On arrival at the shed they should be immediately unloaded in a clean place upon straw, grass, or bagging, and laid out one deep, from which they can be placed on the sticks. While performing this operation each plant should get a deft shake that will disengage any dust, straw, or foreign matter that it may have contracted in the field or elsewhere, and separate the clinging leaves so that they will hang freely and have their entire surface area duly exposed to the air. When leaves are left sticking together, discolouration and depreciated value are the least evils to be expected, decomposition and their complete loss the most probable. Green tobacco should on no account be placed in heaps for even a short period, save in the necessary case of carting, when the time occupied in loading and drawing should be as brief as possible. Newly-cut plants which have been warmed by the sun and contain a lot of moisture, will, under such circumstances, heat, sweat, and rot very speedily. The smallest amount of such green fermentation is injurious to the leaf and quite incompatible with making good tobacco.

Hanging Tobacco.

In finally hanging the plants in the curing-shed they should be placed on the sticks, and these in turn be so arranged on the tier poles that each plant will bear gently against its neighbour. In twenty-four hours from being so placed, having wilted more, they will hang separately, permitting a free passage of air between each individual and row of plants, which is essential to good, sweet curing. Heavy-bodied, sappy plants, and those having their leaves closely arranged upon the stalk, will require more air space in hanging. A very suitable plan which may be practiced with advantage in any part of the country is to hang the green tobacco when brought from the field on the lower tier first, where it should remain, save in the case of continued wet weather, until it has commenced to yellow, or the space is wanted for a fresh cutting. It should then "go up one" to a higher tier. As far as practicable this plan should be followed throughout the earlier stages of curing, instead of filling a house from the top tier downwards which, under adverse conditions of weather, would require more skill and care in its proper management than can be inculcated by aught but experience.

Curing.

That the reader may have a correct appreciation of the why and wherefore of all further manipulations of the plant until its final emergence from the curing-shed as the properly-prepared tobacco of commerce, I will briefly state what the various operations and their effects are, premising that a careful adherence to this procedure will enable a farmer to creditably prepare his crop for a home or foreign market, which degree of success can be still further amplified in the future by the observation and skill born of experience. The processes are—

1st. A partial decomposition of the leaves, the correct degree of which is indicated by the chlorophyl or green colouring matter disappearing by conversion into other elements and combinations, and the adoption by the plant of a yellow or reddish-brown colour.

2nd. The gradual and not too forcible evaporation of moisture from the leaves, under conditions that will permit of a slow fermentation of their constituents, and the attainment of a uniform and ageeable colour.

3rd. Fermentation of the stripped leaf in bulks or heaps, by which excessive fatty and glutenous matter is decomposed or expelled in a gaseous form. The colour and elasticity of the leaf are improved, and the true tobacco aroma, which has hitherto but slightly existed, are by this operation called forth and developed.

Note.—Very fine bright (golden leaf) tobaccos and the light, silky, delicately-scented growths of the seaboard of tropical Australia are injured by this operation, the good effects of which are attained by bulking in comparatively dry condition only.

4th. Conditioning and subsequent storage bulking, by which the leaf is brought into an order or condition containing the requisite minimum of moisture, and in which perceptible fermentation is not encouraged. Its benefits are a still further development or modification of the tobacco aroma, and a considerable improvement in the burning quality of the leaf.

The last two operations, which demand more skill, experience, and time than many farmers are able to bestow on it, are in foreign countries frequently performed by rehandlers (wholesale dealers), and in Australia, for obvious reasons, the locally-grown leaf is wholly treated by the manufacturers. Tobacco intended for the European or any over-sea market will, however, have to receive a complete preparation as above before despatch, to ensure its maintenance of condition and quality during and after the trying circumstances of ocean transit. It is, therefore, incumbent on every intending shipper to make himself familiar with the process of curing in its entirety, a detailed description of which I will now enter upon.

The first change in the plant, and known as "obtaining colour," will, in the case of ordinary full-bodied leaf and a moderately humid atmosphere, take place naturally in from six to twelve days, if hung in an open shed. The change will be proportionally quicker as humidity is increased or circulation of air checked, until, if these conditions are continued too long, a saturated atmosphere will be produced and the plants destroyed, which of course must not be permitted.

Excessive moisture may be combated—

1st. By its exclusion, shutting all wall (not roof) ventilation, save small openings at foot of doors or screens to promote draught.

2nd. By a more roomy adjustment of the plants on the poles, and raising them to the higher tiers where a more active circulation of air exists.

3rd. By artificial heat causing a more rapid draught, and consequent evaporation from the plant.

With a light-bodied tobacco or a dry atmosphere there is a danger of the plant drying up too quickly, before the necessary change in its constituents and colour has been effected.

In this case a free circulation of air, with its resultant escape of moisture from the leaves, must be sufficiently checked and humidity conserved until the alteration we desire has been obtained. This object will be promoted by shutting so much of the ventilators in roof and walls as may be found necessary, coupled with a closer arrangement of the plants upon the poles, care being again taken that the process is not carried too far, or houseburn (rotting) will occur. This decay generally begins at the fat part of the stem where it joins the stalk, appearing almost black, and emitting a peculiar odour which the experienced planter quickly recognizes, even when produced by only one leaf.

Poleburn is another casualty of the same character, through plants being jammed too closely against the tiers. Sticks containing such plants should be immediately taken away and exposed in an airy situation.

Every radical change of weather demands a re-arrangement and examination of the plants with a modification of the ventilation. As far as it is consistant with avoidance of the above extremes, *i.e.*, curing green through excessive exposure to a dry atmosphere, or sweating and houseburn from a similar degree of humidity, it is essential that all the air possible should be given to the plants, to promote their curing up into a good, sweet tobacco. Although the exact nature of the chemical changes now taking place are not well understood, still the appreciation and application of certain everyday truths bearing on this subject will help us to obtain the best results.

When vegetation is decomposed by the air at a moderately high temperature nitric acid is developed, which, when formed in the course of curing tobacco, partly combines with the potash of the plant and greatly improves its important quality of combustion. When, however, this decay of the plant takes place, under circumstances that preclude the easy access of air, such as are found in a closely hung ill-ventilated tobacco shed, the less agreeable compound of ammonia is more or less formed, giving rise to the pungent odour and other objectionable qualities found in some tobacco.

These faults are still more accentuated in the case of "green" cured or sunburnt leaf which carbonise, but will not burn in the pipe or anywhere else. The plants should still be shaded from the direct rays of the morning or evening sun, which before the middle of April remains powerful, and will blanch the leaf if it does not burn it. After that date its rays having less strength, and the plants by curing having become less pervious to its influence, a slight exposure will do no harm.

When plants have been cut at a proper degree of ripeness they will have attained a correct colour, part yellow and brown, and the necessary change in their juices, in from ten to twelve days from date of hanging. After this they ought to be raised to the higher tiers, allowing more space between the sticks, and permitted to dry gradually. A practical formula is "to encourage drying in damp weather and to retard it in dry." Continuous care must be taken not to subject the plants to either extreme or high winds, against which screens, doors, &c., ought always be closed. Every alternation, rapid or otherwise, of these first two conditions of weather, robs the leaf of some of its valuable but volatile properties, while the latter detracts from that silky appearance of the leaf which it is so desirable to preserve.

A moderate change of order (condition as to moisture) through absorption or evaporation—come and go—can scarcely be prevented in air-curing, nor is it advisable to do so, as it encourages the necessary chemical alteration in the leaf. And where imperfections of colour exist in certain leaves which have not kept pace with the mass, it enables them to gradually assume the proper tint.

Exposure to wind before the leaf has dried spoils its colour and appearance, and when crisp will completely wreck it by knocking it against its fellows or the poles.

Both change of colour and drying commence from the margin of the leaf, and proceed slowly towards the stem, which is the last to cure, and must be perfectly dried out before the leaf is fit to strip, which may be known by its brittleness at the junction with the main stalk. As this stage is reached by successive cuttings, the plants and sticks should be run closely together on the tier poles into a compact body occupying about a quarter of the space they formerly did, and in which position they will be less affected by changes of weather, or liable to injury from high winds. Such change should be carried out in the early morning or at any other time that the leaves have lost their crispness.

The time occupied in bringing the plant to this stage is irregular and varies according to climate, class of plant, and means of curing, from one to three months. With a good house six to eight weeks should be sufficient.

Bright Curing.

"Bright" tobaccos are chiefly prepared in a different way, the following being one of the modes of procedure:—The curing-house, fitted with flues or protected fires, which will prevent smoke or other products of combustion reaching the tobacco, is filled in the usual way with plants of any of the bright-curing varieties previously specified, hanging easy from the top tier downwards. When a yellow colour is obtained it should be at once fixed by artificial heat. The fire, which has been introduced a day or so before, is kept low until the whole houseful has attained a uniform yellow colour, when the temperature should be at once gradually and steadily raised to about 160° F., at which point it must be retained day and night until the leaf has been quite dried out. The temperature should then be slowly lowered to the normal state of the atmosphere to prevent condensation. A sufficiency of roof ventilation must be allowed during the firing process to carry off the rapidly evaporated moisture, while keeping doors, windows, and wall apertures carefully closed, as any irregularity in the temperature will prejudicially affect the colour. As above suggested, too great heat should not be introduced at the beginning or the curer's object will be defeated, and a dingy-coloured leaf, neither bright nor brown, and probably black, will be the result.

Experiments in a small way should first be undertaken with this system of curing, which, to be successfully performed, requires, apart from a certain amount of skill, an experience also of the house and plants to be dealt with. However, the trouble and expense, if any, are well worth undertaking, as bright leaf is always in demand at from 50 to 100 per cent. more money than can be obtained for the same grade of red tobacco.

The bright colour is also obtained in similar plants by sun-curing under certain conditions. These are, first, the attainment of a yellow colour, by close hanging in a field, shelter, or in the shade of trees, having screens to protect the sides, and their subsequent free hang exposure to a clear but not too warm sunshine, about 100° F., precautions being taken against dew, rain, or high wind.

Single-leaf Curing.

Single-leaf harvesting, by which individual leaves are taken off the plant when they have attained the proper degree of maturity, thus ensuring their most perfect condition and quality, is theoretically a better system than cutting down the whole plant. But, except in the case of very valuable tobaccos, it falls short in practice, chiefly on the score of cost, which it is apparent must be greater than when harvesting is done in the ordinary way. It has, however, a few points in its favour apart from that of condition which may recommend themselves, particularly to small and impecunious cultivators having an abundance of family labour. These are, greater economy in curing space and celerity in performing the work, which will enable the crop to be more speedily sold. From one-half to one-third of the cubic space required for hanging the whole plant will be sufficient for curing the leaves, while the drying is done in a comparatively short time. Indeed, if a dry atmosphere prevails and great care is not exercised, it will be done too quickly.

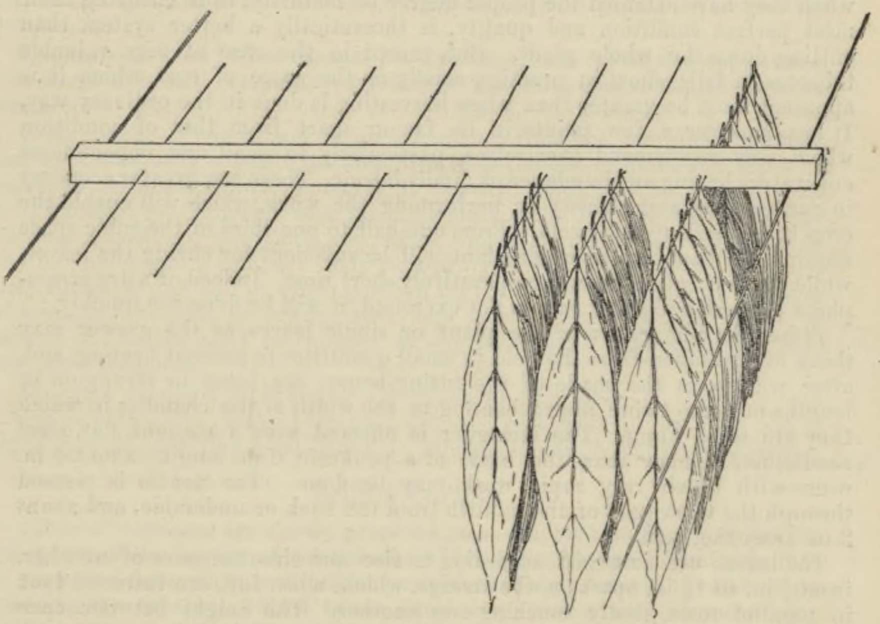
Either the ripe crown of the plant or single leaves, as the grower may think fit, are taken from the field in small quantities to prevent heating, and, after wilting in the shade of the curing-house, are laced or strung on to lengths of hemp twine, approximating to the width of the chamber in which they are to be hung. The stringing is effected with a straight, flat, steel needle, not thicker than the blade of a penknife, 6 in. long by about ¼ in. wide, with which very rapid work may be done. The needle is pierced through the thick part of the mid-rib from the back or underside, and about 2 in. from the butt.

The leaves are arranged according to size and circumstances of weather, from ¾ in. to 1½ in. apart on the strings, which, when full, are fastened taut in parallel rows, gently touching one another. The height between each tier will depend on the size of the leaves, which will have to go through exactly the same changes in curing as those of the full plant already partly described, and demand a similar careful observance of procedure in either air or fire curing, as may be respectively adopted.

The leaves on each string should be as uniform in size and quality as possible, which will much facilitate future work by rendering a later sorting unnecessary. The chief dangers to be guarded against in this form of harvesting, &c., are "green fermentation" before hanging or "drying up green" afterwards. This, however, only requires ordinary care and common sense to be successfully met. Leaf prepared in this way may be ready to take down and "bulk" in from three to four weeks of harvesting. This is done when it is in suitable order by snipping the twine into 12 in. or 14 in. lengths, on which the leaves are run together, tied into (hands) bundles, and immediately bulked.

Where maize is harvested two or three months later than tobacco, it may be feasible to utilise the "corn" shed for this kind of curing by making such slight modifications as will be necessary to regulate the admission or exclusion of air, the first crop being of course marketed in time to admit the latter.

There is still another system of single-leaf curing, which came into practice about thirteen years ago, and is, I believe, now in extensive use for the preparation of fine bright tobaccos in America, where it originated. It consists of a tight curing chamber, having communication with a furnace, and is fitted with tiers of light, tough, wooden stringers or strong galvanised wire at intervals of 18 to 24 inches in height. The lateral space between the tiers varies according to convenience from 4 feet to 6 feet. The leaves, sorted to size and grade, are strung an inch apart on fine flattened 8-in. wire spikes, projecting at regular intervals from both sides of a sufficiently stout lath, so that the leaves



of each group will just hang clear of one another, as shown in the drawing. The rods or laths similarly spaced are hung on the stringers or wire tiers, and when the chamber is full hot air is admitted at the level of the floor to the extent of maintaining a uniform temperature of about 90 degrees F. until the tobacco has yellowed. Then, by an arrangement of forced draught, the temperature is speedily raised and the tobacco quickly evaporated in much the same way as previously described, roof ventilation and the maintenance of a proper temperature being at the same time carefully attended to. In practising this system of curing, the leaves may either be gathered singly in the field or severed in the house from the whole plant which has been harvested in the usual way. It is claimed for this method that it is the quickest and most economical style of curing yet practised, while also producing the brightest and most uniform coloured leaf. As this system, in which some recent improvements have been made, promises to be a popular one, and we have large areas of country in New South Wales suitable for the growth of "bright" tobacco, an early opportunity will be taken of supplying through these pages a more complete description of the process as it is now worked.

The further preparation of "bright" tobaccos consists in stripping, sorting, and bulking in dry order to permit of only a very gentle fermentation, which will require to be carefully watched. Its undue prolongation or improper extent will destroy the valued colour so much care has been taken to obtain, besides prejudicially affecting that sweetness of aroma it should naturally possess. How this is performed will be explained later on.

Curing Cigar-leaf.

It should be understood that fire in any form is not used in the curing of cigar tobaccos, except in the contingency of excessive wet weather, when, to prevent sweating of green plants, or the formation of mould on partially-cured tobacco, artificial heat from flues, covered trench, or other protected fires, will require to be introduced. Care must, however, always be taken to move aside any plants hanging immediately above such fireplace to prevent scorching.

Mould.

The formation of "green mould" on half or wholly dried tobacco should be prevented at all hazards. Even when detected, dried, and brushed away, it leaves small, dark stains behind, which cannot be eradicated, and to the experienced buyer clearly betray their source of origin. The favouring influences for its development are a cold, damp, stagnant atmosphere, which in a curing-house always calls immediately for artificial heat for its dispersion.

Stripping.

As soon as possible after tobacco has dried up, a favourable opportunity should be taken to strip the leaves from the stalks and bulk them. To perform this operation, they must be brought into correct order, *i.e.*, a proper degree of pliancy, which will enable the leaf to be handled freely without breaking. This is generally obtained by opening doors, windows, or screens, and admitting a sufficiency of moisture—no more and no less.

Where a long continuance of dry weather prevails, the grower will either have to wait till it breaks, or the necessary humidity may be created by flooding or drenching the floor of the curing-shed with water. At Ghazipore tobacco plantation, N.W.P. India, steam from a portable boiler kept for this purpose was used; but these are extreme measures, the application of which are only likely to be required in the dry western country, where, however, that magician "Irrigation" may shortly be expected to make this crop not only possible, but popular.

Although it is both advisable and convenient to have another room contiguous to the tobacco-shed, and preferably with a boarded floor, for conducting this and the further operations of curing, it cannot be considered an absolute necessity, and as economy is an important factor in tobacco-growing as in other industries, I have not included such additional room among the curing accommodation recommended. An efficient substitute will be provided by unshipping the lower tier poles of one or more sections of the house as may be necessary. These should be laid down in one end of the house, at intervals of 2 feet, transversely on a few slabs resting on the ground. The floor is then formed on them with sheets of dry bark, or closely-laid tobacco sticks, covered in turn by a thick layer of dry straw, some of which should be also strewn on the ground between the slabs, making such platform impervious to any probable amount of damp from the ground. In the Central Division such a platform, when perfectly enclosed by surplus wall screens, which are not required for their ordinary purpose after the tobacco is taken down, will form an efficient curing-room. Moderately damp weather is best suited for the work of stripping, which is commenced by striking (removing from the sticks) the plants of the lower tiers or a section of the house. These should be laid on the platform in a heap (stalk bulk) arranged, two plants wide tip over tip, butts outward, about 2 feet high, and any convenient length, finally covering with bagging or straw to prevent a further access or escape of moisture. In the ordinary course, and particularly by beginners, no more plants should be "struck" at a time than can be conveniently stripped the same day. Although the leaves have dried, a considerable quantity of moisture still remains in the main stalk, which will be communicated to the leaves in the bulk if left there too long, and quickly cause an undesirable ferment or worse. When leaves are fit for stripping and bulking the mid-rib should be pliable enough to bend freely without breaking, the leaf be flexible but not wet. If it once reaches that condition in its stripped state it will cause infinite trouble to get it in right bulking condition again.

Take the plant in the left hand by the middle of the stalk, the butt pointing towards the body, and with the right hand seize and neatly break off the leaves at the axils beginning at the bottom of the plant, at the same time sorting the produce into four or may be five classes, exclusive of withered and much ground-damaged leaves. These latter should be heaped by themselves.

Sorting.

This classification of the leaves will, of course, be subject to a subsequent and more critical overhaul before shipment, say

1st sound bright (or any coloured) leaf			... ...	long.
2nd	do	do	do	medium.
3rd	do	do	do	short.
4th slightly broken or holey bright (or any coloured) leaf...				any size.

Radical difference of colour such as "bright" and "brown" are not to be expected in the same crop, as a rule, but should such occur casually they will form a 5th class.

The leaves as they are stripped and sorted should be made up into what are termed "bulking" hands of sixteen to twenty leaves, formed as follows:—Firmly clasp by the stems with the left hand the desired number of leaves, having their butts all level. With the right hand take a leaf of the same grade which after folding back on its *under* surface, wind firmly round the butts, commencing with the tip of the wrapper and making a tight band of 2 or 3 inches wide, tucking the last 4 or 6 inches through the middle of the hand, which should then be closed and the leaves straightened out.

Where tobacco is grown in a small way or through any cause stripping proceeds too slowly to furnish a heap at the end of a day's work, it will be as well to hang the hands in a safe place where they will maintain condition, until the grower has enough to build a fermenting bulk. For this, $1\frac{1}{2}$ to 2 tons is a handy quantity, and as little as the operation can be satisfactorily performed with.

Bulking.

Whether the "bulk" is made at time of stripping or later, the caution given regarding *order* must be carefully observed. Leaf possessing an excess of moisture will heat too rapidly, and if too dry, not at all, or only to such a slight degree that its aromatic and other properties remain undeveloped. The whole mass should also be in a uniform condition, otherwise one part of a bulk may heat up to the rotting stage, if permitted, before another has made any progress. In dry weather or when tobacco is laid down in comparatively dry order the heaps may, and require to, be made of much larger dimensions than as here suggested, and the drier the condition in which the leaf can be fermented, the better will be the flavour of the tobacco.

The bulk measuring about 4 ft. high, 4 ft. wide, and 10 ft. long should be formed on the platform over a good bed of dry clean straw or grass, by laying the hands closely alongside of one another. Except in the case of very large leaves, in which case two rows will be sufficient, they should be neatly and solidly built of four parallel rows of hands. The butts of the outer rows always compactly arranged facing outwards forming the sides and corners, which latter will have to be crossed by the end rows every alternate layer to bind the bulk together. The butts of the inner rows of hands also pointing outwards, should rest about the half length and between the shoulders of those of the outer rows, with their leaves over-lapping each other in the centre of the heap, except, at both ends where, the butts should face closely outwards. Each layer so arranged will be fairly level. In building the heap, the leaves ought to be kept perfectly straight and the hands, which are generally laid down in pairs after being placed in position, should be pressed down by the knee using a small board to equalise the pressure and keep them in their places. When the bulk has been raised to nearly its proposed height, it ought to be finished off by decreasing the rows of hands in each layer to three, two, and finally one row, the last one forming a ridge along the middle of the bulk, which will be completed by lightly covering the top and sides, first, with clean straw and next, with one or more tarpaulins. For this purpose the surplus wall screens where available will answer very well. Over all place three or four slabs or weighted planks which will give a uniform and steady, but not excessive, pressure. I have been in the habit of using in these bulks a primitive instrument that for want of a better name I call a "bamboo thermometer" which enabled me to quickly ascertain the temperature at any time without disturbing the heap. Although it does not entirely do away with the necessity of inserting the hand, it is very useful, particularly where tobacco is grown on a large scale and as such as been universally adopted by the planters of Sumatra. It consists of a hollow bamboo tube, 2 or 3 inches in diameter, its length being equal to the width of an ordinary bulk, say, 4 ft. It is closed at one end and has a dozen half-inch holes regularly distributed over its circumference, save for 6 in. at either end which remain intact. Into the open end of the tube an inch rod 3ft. 10 in. long is inserted, this is fitted with a suitable handle which acts as a stopper to the mouth of the tube, hermetically closing it. These are built into the bulks at intervals of 1, 2, and 3 feet in height by 2, 5, and 8 feet along the length, thus taking three tubes to a bulk, the heat of which may be ascertained by pulling out one of the rods, which, owing to the holes in the middle of the tube, will have received and correctly indicated to the naked hand the same heat as exists throughout that part of the bulk. If necessary, a thermometer may be attached to the rod which after a minute's insertion will furnish an exact reading of the temperature. Bamboos not being readily available in many parts of the Colony, 2 in. galvanised pipe perforated and served over with strips of linen could be made to answer the same purpose.

Fermenting.

The "bulk," which has been firmly built and well clothed, should be impervious to the air, and in a few days, from three to five, according to *order* and character, will begin to make heat. The proper limitation of this heat is one of, if not the most, important point in tobacco curing. Unfortunately, no arbitrary rule can be given that will apply equally to all kinds of New South Wales tobacco giving the degree of heat which should be allowed, or the time the same may be continued, to produce the best results. This will have to be more or less decided by experiment with the different classes of leaf as produced in the various parts of the country, guided by the general practice of planters elsewhere, for which the following will afford a reliable guide to the beginner. In the case of moderately heavy red or brown leaf, which at present forms our only variety of this crop, and will in the future be always the largest part, the temperature of a bulk may be allowed to rise to 110° F., allowing a proportionately lower maximum for lighter bodied leaf, making 98° F. a minimum. The heap should then be opened out, and after shaking the leaves of each hand apart, lay them down in small straight single rows or piles. When they have cooled off the bulk should be reformed, placing those which were formerly on top at the bottom of the new bulk with the former inner rows outside, and *vice versa*. By this arrangement each hand of the heap will pass through a uniform experience and give a similar result. If the bulk as first formed shows a disposition to heat up too rapidly the hands while cooling should be allowed to get a little drier before relaying, or less weight and covering be placed on the bulk. These tactics, or a combination of both, will have the effect of making the next ferment more gradual and, consequently, efficient, the converse being practised when opposite conditions exist. The second bulking, when finished, should conclude the process of active fermentation, except in the case of thick leathery tobaccos, which are turned over in fairly dry order until they will heat no more.

In conducting the ferment the heaps should be carefully examined once a day, if not oftener, by thrusting the hand into its centre at one or more places, or, when the grower is satisfied there are no wet leaves in the bulk, by the use of the bamboo or other tube above referred to, which will avoid any disarrangement of the heap. In judging with the naked hand the interior should be allowed to feel comfortably warm—never hot—in which condition it may remain one or two days. By that time the ridge which was formed on the center of the bulk will have disappeared, leaving the top perfectly flat, or, may be, with a depression.

Conditioning.

It should then be opened up and the hands loosely arranged, butts outward, in double row piles or windrows, about 2 feet high, on which a few sticks may be placed. In this position they will gradually cool and dry up into safe storage order. This operation may be spread over two or three days, during which the heaps should only be exposed to a cool and gentle draught, extremes of weather being injurious. In case of the weather being unpropitious for this windrowing, larger piles should be made and carefully covered, but not weighted. This process is known as "conditioning," and will enable the tobacco so treated to pass through prolonged storage without heating, moulding, or loss of aroma. Such storage is sometimes preceded by sorting for shipment, and consists in the formation of large bulks—say six rows wide, 6 feet high, and 10 or 12 feet long—arranged similarly to the first heap, butts all pointing outwards, each inner row resting on the half length of the next outer one, with the leaf in thoroughly dry order. It should be carefully and neatly covered, having some weight placed on top, and will require occasional examination. If heating is detected, the bulk ought to be opened out at once and relaid in the manner above explained. The effect of the two operations it has just undergone is to greatly improve the appearance and character of the leaf, which, if properly conducted, should now have a well-defined uniform colour, silky appearance and texture, coupled with an agreeable tobacco aroma, all of which have, however, been gained at some cost in weight. Careful storage as above will still further mature and mellow whatever growth may be so dealt with.

Bright tobaccos require much more careful handling than the foregoing, the finish, elasticity, and aroma being obtained by a more lengthened bulking in larger heaps. The condition of moisture permissible is very slight, and little more than will permit its safe handling, while the permissible heat, which it will take a longer time to attain, should not be more than 98° F. (for reasons already given), at which point it must be re-opened, and after windrowing as above described, it should be sorted and finally store-bulked or shipped to market.

Sorting for Market.

The active ferment having been finished off as described, the next operation that calls for our attention is sorting for shipment, which, like stripping, will be best carried on in a moderately humid atmosphere, when the leaf is pliable but not too moist. For all practical purposes such classing may be confined to the four sorts of each colour already suggested, viz., long, medium, short, and sound but slightly broken leaf, the first two only of which are likely to be in any demand for an export trade. On large plantations it will, however, be necessary to also grade the tobacco into two, or may be three, classes, according to body, the sorting being thus extended to—

1st. By colour—bright, red, and dark red or brown, with their modifications of tint.
2nd. Graded into heavy, medium, and light leaf.
3rd. Size—long, medium, and short.

Sound but broken and holey leaves, sorted according to colour and may be size, making another class. Withered and much-ground damaged leaf with immature suckers or second growth should be disposed of for sheep dip, or as already suggested; but on no account sent to market as tobacco, it having little claim to be recognised as such.

The bundles of leaves when now made up will have to be much smaller than formerly, viz., six leaves for long tobacco, seven for medium, and eight or nine for short, which are known as "shipping" hands, the object being to enable closer packing and economise space.

Strips.

As previously stated, a large quantity of the tobacco requirements of Europe is furnished in the form of strips. These are made by extracting seven-eighths or so of the mid-rib when the leaf and stem are both in a fairly pliable condition, as follows:—Carefully open and spread out the leaf with both hands, then double it forward on its upper surface, holding it so with the fingers of the left hand about 3 in. from the tip. At this point, with the forefinger and thumb of the right hand, seize and nip the stem, bringing the hand smartly down towards the body, then under and over the left hand once or twice, when the stem will be found to come clean away, leaving the rest of the leaf intact. The strips should now be arranged smoothly in hanks of six or eight, and brought into dry order for packing.

Packages.

The system of packing tobacco in bales at present practised in New South Wales is not a good one, the contents being subject not only to atmospheric changes, but also to considerable damage in pursuing its comparatively short journey to Sydney. This is particularly the case after long and indifferent storage, when every movement of the bale during its not too careful transit results in damage that will nullify the efforts that have with so much trouble been made to produce a good marketable article. For this purpose I would, therefore, strongly recommend the adoption of the American system of packing in hogsheads, tierces, or boxes, the possible contents of which approximately are: 1,400 lb., 700 lb., and 400 lb. respectively.

The hogsheads authorised by the Government of the State of Virginia, having no bilge, and measuring 4 ft. 6 in. high by 3 ft. 6 in. at one end, and 3 ft. 4 in. at the other, or the tierce of half this capacity, would well answer our purpose. The staves may be of ordinary ¾-in. deal dressed on one side, having 1½-in. ends of the same or harder wood, and hooped with iron strips; such could easily be set up and made by ordinary "bush" carpenters. Ready-dressed staves and ends may also be purchased second-hand, at presumably low rates, from the Sydney tobacco manufacturers. The difference in diameter at the ends of the hogsheads is to facilitate inspection when tobacco is being sold, at which time one or two hoops are knocked off the larger end and the package inverted. The hogshead can then be lifted away, revealing the contents to brokers' criticism, which, by the way, searches deeper than the exterior of the mass thus displayed. Boxes of 1-in. stuff, planed on the inside, with stout ends, battened or stayed at the corners, and hooped over all with iron strips, may also be conveniently used. A case of the following dimensions:—40 in. long, 30 in. wide, by the same depth, will hold about 400 lb. of tobacco. My own experience having been with the system of packing in hogsheads, I prefer them; but the requirements of the smaller grower demand proportionate packages, as if this industry is to be conducted in a healthy and progressive manner, each leaf in a hand, and every hand in a package, must be reasonably alike in colour, grade, and size. Such smaller cases will, therefore, be necessary to meet their wants.

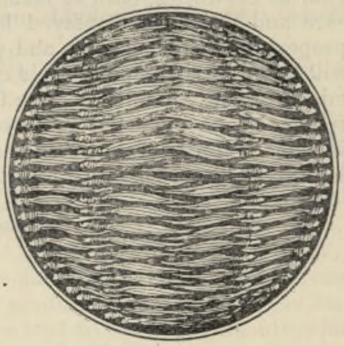
Prizing and Packing.

The means for applying the requisite pressure in packing may be the common "bush" lever or the more business-like American "prizing" screw, about 4 inches in diameter, with ¼-inch threads, fitted in a strong timber frame, within which the hogshead or other package is placed, marked with its tare weight.

If the tobacco is intended for oversea shipment, the greatest care must now be taken to "prize" (pack and press) it in the driest order consistent with its not breaking. This is particularly necessary in the case of "bright" and "coloury" tobaccos, which should also be subjected to less pressure in the case, otherwise they will become darkened, and of less value. For the local market, a little more margin in moisture may be permissible.

The method of packing in hogsheads, all the world over, is as shown in the accompanying diagram.

The sorted tobacco which has been brought into correct packing order, atmospherically or by artificial heat, is handed by a lad from the covered heap to a man inside the hogshead, who arranges the hands in three or four courses (lines) according to the size of the tobacco, beginning with a nearly straight line, the centre of which will be about 9 or 10 inches from the side of the cask, and in making which the amateur packer may assist himself with a stick, against which he should closely lay the butts of the hands. When the first line has been finished the stick should be lifted and placed immediately opposite, and the former process repeated. This will conclude the two centre lines as they appear in the diagram. The side courses are next laid down in the close and careful manner shown therein, butts towards the wood and the leaves all pointing straight. To effect this the packer should seize the hands in pairs by their heads, holding them in the left against his breast, then stroke the leaves straight down with his right hand, and so place in position, pressing them with the knee, at which time the smooth rounded board formerly recommended in bulk building will help towards neatness. Needless to say the "packer" should be in bare or stocking feet only, while both he and the "waiter" who hands him the tobacco should keep a watchful eye on its order, so that no damp leaves may find their way into the package which would certainly spoil the neighbouring contents. One layer having been finished the next should be laid down at right angles to the first, and so on until the cask is about half-full, when a movable lid, neatly but easily fitting the inside of the hogshead, should be placed on top of the tobacco, on which again some hardwood blocks 6 or 8 inches thick should be built up until the lever or screw pressure can be brought to bear on it, which should be done with a steady strain, and thus allowed to rest for from one to three hours until it has properly settled, when it may be removed and the process of packing proceeded with exactly as above. The number of fresh layers requiring occasional pressure gradually decrease until when near the top they become three, two, or one, as the case may be. The hogshead is then headed with the aid of screw or lever, and after having a lining hoop nailed inside the chine, should be weighed and marked with gross and net weight, when it is ready for market, or if stored it should be kept in a cool, dry position.



In packing tobacco in boxes the operation is somewhat similar, but easier, the hands being in every case closely arranged with their butts towards the wood and crossing at the corners in each alternate layer.

In the case of oversea shipment it will scarcely be possible to prevent the mass of tobacco, the packing of which has just been described, weighing 1,400 to 1,600 lb., from a very slight heating during the voyage, and a consequent trifling loss in weight. Such change, however, will have no permanently injurious effect on the quality of the article, which recovers itself after a a time, when cured and packed in the manner and under the conditions prescribed above. As the initiation of an export trade in tobacco comes more within the sphere of business of the plantation owner and merchant than the ordinary producer, it may be considered by the latter that some of the details just dealt with do not equally claim his attention and observance with that of the earlier work. This would be an unfortunate and limited view of his duties, both as farmer and citizen, as it will be by the continuous care and diligence displayed by him in furnishing a good sound tobacco, properly prepared, classed, and put up in an attractive form, that merchants will be induced to apply their capital towards the development of this promising industry which, by the time it has gained a foreign patronage, may reasonably be expected to have attained a greater position and following within the limits of our own shores. In this field we are eminently fitted, both by soil and climate, to be the chief providers of this commodity.

Comparative Values of Wheat and Flour in New South Wales and the Neighbouring Colonies.

By A. BRUCE-SUTTOR,
Department of Agriculture.

The prevailing cheapness of wheat has given the impression to some of our farmers who are obliged to transport their produce long distances by rail that the low cost of water carriage allows wheat to be imported into this Colony at a less cost, notwithstanding the duty of 10d. per cental or 6d. per bushel, than it can be marketed here, and that consequently they are placed at a disadvantage as compared with the farmers in the exporting colonies.

As a matter of fact the cost of importing the raw material is rather more than is being paid for the local wheat, and, assuming that the railway freights and other expenses of marketing wheat are equal, our farmers receive 6d., 6d., and 9d. respectively more per bushel than do the Victorian, South Australian or New Zealand wheat-growers, as the following will show:—

Cost of wheat imported from Melbourne:—

	s.	d.
Price per bushel f.o.b. Melbourne	3	0
Duty 10d. per cental or per bushel	0	6
Freight and other charges	0	2
	3	8

Cost of wheat imported from Adelaide:—

	s.	d.
Price per bushel f.o.b. Adelaide	3	0
Duty 10d. per cental or per bushel	0	6
Freight and other charges	0	3
	3	9

Cost of wheat imported from New Zealand:—

	s.	d.
Price per bushel f.o.b. seaports	2	9
Duty 10d. per cental or per bushel	0	6
Freight and other charges	0	3½
	3	6½

Cost of New South Wales wheat at Sydney:—

	s.	d.
Price per bushel, f.o.b. Sydney	3	6

The freight on wheat for 200 miles on the New South Wales Railways does not exceed 4d. per bushel, which leaves a return to the producer of 3s. 2d. on wheat sold at 3s. 6d. per bushel in Sydney. Take the Victorian farmer as an instance and compare his position with this. *He sells his wheat in Melbourne at 3s. per bushel*, and assuming that he has to send it the same distance and is charged freight at the same rate per mile *his return is 2s. 8d.*

per bushel, which leaves a difference of 6d. per bushel in favour of the New South Wales farmer. It is estimated by qualified millers that 3,000 lb. or 50 bushels of wheat will make 1 ton, or 2,000 lb. of flour, 600 lb. of bran, and 340 lb. of pollard, and that the cost of milling is £1 2s. 6d. per ton.

The duty on 50 bushels of wheat imported into this Colony is 25s., and the duty on 1 ton of flour is 20s. The following will show *the comparative positions of the New South Wales and Victorian millers* and the effect of the above prices of wheat and of the tariff—

Cost of flour manufactured in Sydney from local wheat :—

	£ s. d.	£ s. d.
3,000 lb. of wheat at 3s. 6d. per bushel	8 15 0	
Manufacturing expenses	1 2 6	
		9 17 6
Less 600 lb. bran at 8d. per bushel	1 0 0	
,, 340 lb. of pollard at 8d. per bushel	0 11 4	
		1 11 4
		£8 6 2

Cost of flour manufactured in Melbourne :—

3,000 lb. of wheat at 3s. per bushel	7 10 0	
Manufacturing expenses	1 2 6	
Duty on flour exported to Sydney 1s. per cental or £1 per ton...	1 0 0	
Freight to Sydney including wharfage 5s. 8d. per ton	0 5 8	
		9 18 2
Less 600 lb. bran at 8d. per bushel...	1 0 0	
,, 340 lb. pollard at 9d. per bushel	0 12 9	
		1 12 9
		£8 5 5

Owing to the fluctations in prices and charges the above figures may not be absolutely correct but are given approximately.

Flour manufactured in Sydney from wheat imported from Melbourne at a cost of 3s. 8d. per bushel would amount to 8s. 4d. per ton more than flour manufactured from New South Wales wheat at 3s. 6d. per bushel, and would give an advantage of 9s. 1d. per ton in favour of the Victorian miller exporting flour to Sydney, whereas if the New South Wales miller uses local wheat at 3s. 6d. per bushel the difference is reduced to 9d. per ton as above.

Victoria is mentioned as an example, as the largest quantities of wheat are imported into New South Wales from that colony.

The following are the importations as collected from the Customs of wheat and flour for consumption for the year 1892, and for the first six months of the year 1893.

Weights of wheat and flour imported into New South Wales, 1892—

Wheat.			Flour.
Tons.	cwt.	lb.	Tons.
25,264	5	80	48,183

1893. Weights of wheat and of flour for consumption imported into New South Wales from January 1st to September 30th—

Wheat.			Flour.	
Tons.	cwt.	lb.	Tons.	lb.
3,794	8	34	10,481	400

Lumpy Jaw in Cattle.

Actinomycosis.

The experience of our stock-owners and dairymen leads to the belief that not only does the disease known as "Lumpy-jaw" exist amongst our herds to a considerable extent, but that, unfortunately, it is steadily on the increase. These facts being known to the Department it was with considerable satisfaction that we received an exhaustive report on the subject which has recently been prepared by the U.S. Department of Agriculture, and which not only deals fully with the origin and nature of the disease, but gives what may be termed a certain cure under fair conditions, such conditions being easily discernible by any stock-owner who gives his herd ordinary care and attention.

The report above referred to, which is a voluminous one, is made to the U.S. Secretary for Agriculture, the Hon. J. M. Rusk, by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, and the actual experiments were conducted by Dr. V. A. Norgaard, a veterinary inspector connected with the Bureau.

In his review of the investigations, Dr. Salmon makes the following definite and satisfactory statement:—

"I am free to state that the disease with which these animals were affected when they were purchased for experiment—that is to say, actinomycosis or "lumpy-jaw"—cannot properly be considered as a contagious disease, requiring any such action to prevent its spread as is being taken by the Illinois board of live stock commissioners. If the disease is contagious at all, which is doubtful, it certainly is not contagious to the degree which requires measures to prevent its dissemination by animals in transit for slaughter. There is no satisfactory evidence that it can be disseminated by animals mingling with each other in cars or yards, and it is even doubted by recognised authorities if it can be transmitted by inoculation, on account of the many failures which have been recorded."

"In the International Congress of Hygiene and Demography, held at London a year ago, there was unanimity of opinion to the effect that there was no danger of the disease being transmitted to persons who used the flesh of animals so affected for food, and, so far as I remember, I was the only member of that congress who sanctioned the condemnation of carcasses of animals affected with this disease, except when it was disseminated throughout the body, and my position was that this was only justified when the malady had made such progress as to have affected the general health of the animal, as shown by loss of flesh or by large suppurating abscesses."

It would appear that the original cause of these experiments was a protest on the part of stock-owners to the action of the State Board officers of Illinois in quarantining, as unfit for human consumption, cattle which were in good condition, but which at the same time had lumps on the jaw of greater or less size. This protest naturally raised the whole question.

The report says: "It has been quite generally held by scientists who have investigated actinomycosis that it should be classed with those diseases which, like tetanus or lockjaw, are produced by vegetable parasites inoculated by hard bodies of various kinds which are infected, and which accidentally wound the skin, the mucous membrane, or other tissues, and thus gain entrance to the body." The hard bodies which are infected, referred to in the above extract, generally consist of ears of grain, to which are attached what are known as the actinomycosis fungus spores.

On the question of communicability the report says:—

"There have been a number of cases recorded in which actinomycosis has been experimentally transmitted by inoculation from diseased to healthy animals. A large proportion of the successful inoculations were made with rabbits and guinea-pigs—animals which are very susceptible to most kinds of infection. In some cases large animals have been used, and with these the disease has been sometimes transmitted, and in other cases no result has followed the inoculation. The methods employed have been to deposit infectious matter in the abdominal cavity or in the connective tissue, or to inject it directly into the blood vessels. The results in most of the cases are of theoretical rather than practical value, because it is not likely that animals would be accidentally inoculated into the abdominal cavity or into the blood vessels. It is also an admitted fact with other diseases that those which require wounds of the skin and mucous membrane for the parasites to gain entrance to the tissues only in exceptional instances spread from animal to animal under natural conditions. So with actinomycosis, it is theoretically possible, but not probable, that an accidental inoculation might occur by which the disease would be transmitted from a diseased to a healthy animal. This contingency is too remote, however, according to our present knowledge, to give any warrant for considering the disease as dangerously contagious."

"The Illinois board of live stock commissioners admits that before suppuration sets in, and there is a discharge, the disease is probably not transmissable, naturally, from one animal to another. (Rep. 1890, p. 20.) This conclusion is incontestable."

"Actinomycosis in people is a very rare disease, and but few cases are on record as having occurred in this country. If there were any great danger of its being communicated by the flesh of affected animals we should certainly expect that it would be more frequent. On the other hand, tuberculosis is one of the most common diseases of mankind, and is known to be communicable among animals, by taking tuberculous germs with the food, and yet, as appears from Dr. Norgaard's report attached hereto, the inspectors of the State Board and of the City Health Department pay no attention to meat that is covered with tubercles even when it is exposed to their view in the slaughterhouses. Tuberculous meat is incomparably more dangerous than that of animals affected with actinomycosis, and, hence, it is difficult to understand this inconsistency in the action of inspectors who claim to be so solicitous for the public health.

"Prof. Crookshank, in the course of an exhaustive review of our knowledge of actinomycosis, published in the Annual Report of the Agricultural Department, Privy Council Office, on the contagious diseases inspection, and transit of animals for the year 1888, says, by way of conclusion:

> The successful transmission of actinomycosis from man to bovines suggests intercommunicability, but the negative evidence as to infection of man from bovines supports the view that the disease is derived from some source which is common to both species. (S.C., p. 115.)

"In summing up the evidence as to the source of the disease in man, he says:

Many interesting observations have been made upon the origin of this disease in man. Two cases have been recorded in support of the theory of direct infection from the cow. Stelzner described a case of the actinomycosis in a man who had had the care of animals some of which had suppurating glands. Hacker had a case of the tongue in a man who had charge of cows, one of which had a tumor of the jaw, which he had opened. On the other hand, Moosbrugger found that out of seventy-five cases, fifty-four were in men and twenty-one in women, including two children. In eleven of these the occupation was not stated. In thirty-three their occupation did not bring them into contact with diseased animals. They were, for example, millers, glaziers, tailors, shop people, and students. Only ten cases occurred among farmers, peasants, and farm labourers. In one case only out of the ten had the patient been in contact with diseased animals.

Out of the twenty-one women there were only four peasants, and none of them had been associated with diseased cattle.

Infection by the flesh of diseased animals has also been discussed, but there is no evidence of the prevalence of the disease among slaughterers and butchers, who would be particularly liable to it if flesh were a source of infection. The chances of infection, by ingestion are minimised by the flesh being almost always cooked. Actinomycosis occurs also in pigs, and pork is often eaten in an uncooked state, but Israël has pointed out that this may probably be excluded, as many of the cases occurred among strict Jews.

The evidence points to the disease originating in man and lower animals from the same source, and there is a very strong suspicion attached to cereals. This view is supported by important observations with reference to the part played by cereals in inducing the disease in cattle, which have already been mentioned, and it gains additional support from a case described by Soltmann, where the disease resulted from swallowing an awn of barley. A boy, aged 11, accidentally swallowed an awn of *Hordeum murinum*. He became very ill and suffered great pain behind the sternum, extending over six intercostal spaces, and when opened the awn of barley was found in the evacuated pus. The pain, however, continued and fresh deposits occurred, and when the boy was taken to the hospital the ray-fungus was detected. Possibly the spores of the fungus can be conveyed both by air and water.

"Friedberger and Fröhner, in the last edition of their excellent Treatise on the Special Pathology and Therapeutics of the Domesticated Animals, published in 1892, give the following unbiassed opinions, which they form from the scientific investigations made up to the present time:—

Experiments to transfer the same to other animals have been made by several parties, but were always unsuccessful (Rivolta, Bollinger, Seidamgrotzky, Perroncito, Johne, Ullmann, Bodemer, Boström). Cattle, calves, goats, sheep, wethers, hogs, dogs, cats, rabbits, guinea-pigs, did not suffer after inoculation; only in some cases a granution, outlined by inflammation, developed as the reaction of the organism against the inoculated foreign bodies. The alleged positive results of inoculation of Ponfik, Israël, Rotter, and Hanau refer, according to Boström, only to inoculation material which remained and was encysted (encapsuled). It appears that the actinomyces fungus produces a pathogenic effect only in that stage of development reached in connection with the beards of grain; but when once introduced into the animal body it is no longer transferable, because it immediately assumes involution forms (calcification) after inoculation. The negative results of the inoculation experiments are of great importance for the solution of the question whether or not a transmission of actinomycosis occurs from animal to animal or from animal to man. All are of the opinion that an infection of this kind does not take place.

Inspection of meat.—As already mentioned in the article on "Pathogenesis," it must be considered as very improbable that the actinomycosis is a contagious or an infectious disease in the sense of its transmission from animal to animal or from animal to man. A case of infection of man from cattle affected with actinomycosis has never been observed which was free from all objections. At the most, such a transmission may be considered perhaps as possible from a theoretical standpoint, but not as probable. Experience is positive against the occurrence of a direct transmission. The actinomycosis, therefore, in relation to the inspection of meat, is by no means so important as tuberculosis, even setting aside the fact that the former usually represents only a local affection. The meat of cattle affected with actinomycosis may be commercially disposed of without hesitation after the affected parts have been removed; it is objected to only in the rare cases of a generalised actinomycosis (p. 592).

"Ostertag, in his Handbook of Meat Inspection, published in 1892, says, after reviewing the evidence at hand :

According to this, we are hardly justified in assuming that the use of actinomycotic organs as food is injurious to health. At any rate, we must deny the possibility of this for the meat of actinomycotic animals. The activity of the sanitary police should therefore be restricted to the detection of all organs affected with actinomycosis, and the withdrawal of them from the market as highly spoiled food products in proportion as the specifically changed portions cannot be certainly removed. In isolated lesions in the tongue this will usually be possible, and is further recommended, as the tongue is a valuable organ. In cases of generalisation the whole animal is to be withdrawn from the market, because the generalisation in actinomycosis seems to have entirely a typical cause, and the detection of the total lesions (in the bone, in the depth of the muscles) is much less easy than in tuberculosis, in which the regular lymph gland affection answers as an excellent guide for the discovery of the diseased areas.

"Prof. Thomas Walley, in the second edition of his very thorough Practical Guide to Meat Inspection, published in 1891, says, (pp. 135-387) :

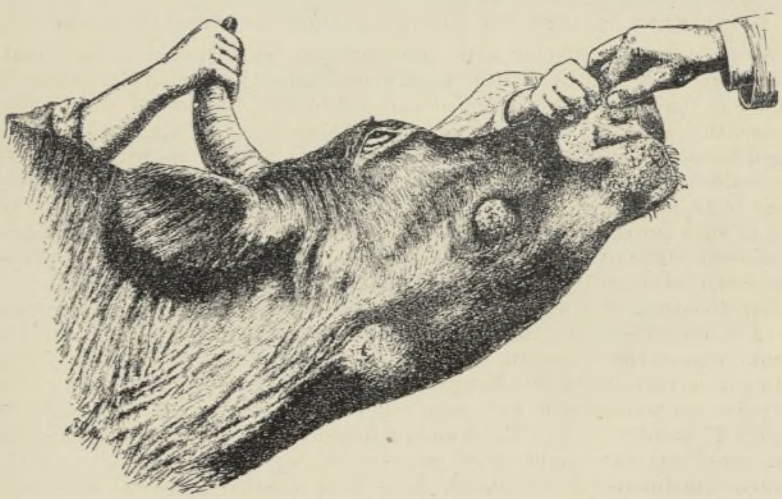
The malady affects man, and is in him known as *actinomycosis hominis*, and while it has been transmitted by inoculation from man to the calf (Crookshank), so far as I am aware there is no direct evidence of the transmission of the disease from animals to man. Nor indeed is such a contingency ever likely to arise, seeing that the vitality of the spores of the hyphomycetes is much inferior to those of the pathogenetic fungi, and that the changes produced by it in the organs attacked are so marked as to attract the immediate attention of even ordinary persons ; and what is of more importance, the lesions of the disease are seldom localised, except in the pig, in the muscular tissue of the body. * * * Although certain organs, such as the tongue, may be largely involved, there is not much accompanying fever or interference with the normal functions or with the nutrition of the blood, and any systemic changes that arise are due mainly to annihilation of the functions of the tongue, or of the particular organ involved, and as a result of this a state of poverty is induced. Seeing that the disease is rarely of a systemic nature, and that there is an absence of fever, the nutritive changes induced in the muscles are so slight as to do away, in the great majority of cases, with the question of nocuity of the flesh ; but, notwithstanding this, if there is any evidence of malnutrition of the blood or of the flesh, the carcass should be condemned for human food and in every instance the affected organ or organs should be effectually destroyed.

Experiment to test the Contagiousness of Actinomycosis.

"When the cattle affected with actinomycosis were placed under treatment twenty-one healthy cattle were placed among them in the stables in such a way that they would be most exposed to the infection of the disease. The healthy animals were tied between diseased ones, where they were obliged to eat food soiled with the discharges from the tumors, and where they could not but inhale the breath warm from the lungs. There would appear to be no way possible of making a more severe test, and yet after being in such proximity with diseased animals for four months not a single one showed signs of being affected either while alive or on *post-mortem* examination after they were slaughtered."

After disposing of a statement which had been published in the newspapers, to the effect that the iodide treatment drives the disease into the internal organs, the following results are given of the experiments with this treatment carried out by Dr. Norgaard. As to these the report says :—"The eighty-five animals which had been under treatment were slaughtered on January 27 and 28 . . . . The number found on *post-mortem* examination to be cured was sixty-eight, or 80 per cent. of the whole number. Of the seventeen condemned as not cured, there were internal lesions of actinomycosis in the lungs of three. About 4½ per cent. of this lot of animals, therefore, showed internal lesions. Of the whole number under treatment, which were killed and examined, viz., 185, there were found to be cured 131, or about 71 per cent. The number showing internal lesions was 7, or 3·8

Before Treatment—afterward Cured.



Before Treatment—afterward Cured.

(IIb 160-93.)

per cent. of the animals in the experiment. This result is extremely gratifying, and proves that a large proportion of the advanced cases of actinomycosis are curable by the internal administration of iodide of potassium. If taken in the early stages of the disease, there is no doubt that 85 or 90 per cent. would yield to this treatment."

"The Cost of Treatment.

"It has been repeatedly stated by those who opposed the Department in its effort to relieve the cattle-owners from the injustice which has been practised upon them at Chicago, by giving them a specific treatment for this disease, that farmers cannot afford to use a medicine for this purpose which costs $3 a pound. Let us examine this statement in the light of the facts.

"The result of the experiment shows that about two-thirds of the lumpy-jaw steers which come to the stock-yards can be cured. If they were taken in an earlier stage of the disease the proportion would be much larger. Taking, however, two-thirds as a basis of calculation, we will see what would be the result on twelve animals averaging 1,200 pounds in weight. If shipped without treatment and condemned they would bring $9 per head, or $108 in all. If treated with the same success as the animals in the Department's experiment, there would be eight cured ones, which would bring not less than 4 cents per pound in good flesh, or $48 per head. This would amount to $384 for eight head, to which should be added $36 for the four not cured, making a total of $420 receipts as against $108 if not treated. The medicine does not cost over 7 cents for each day it is administered, and no animal should receive over 1 lb. in all. Taking the largest figures and the medicine for treating twelve steers would cost $36. Deducting this from $420, we have remaining $384, a gain of $276 in all, or $23 per head over what would have been received if the cattle were not treated. It must be plain to every experienced cattle-feeder that there is no other known medicine, nor indeed any kind of food which can be given to his animals with a prospect of such returns for the money invested."

Private Successes with the Iodide Treatment.

As the result of a circular issued by the Bureau to stockowners, the iodide of potassium treatment was tried with remarkably successful results. Letters from all parts of the States are reprinted, and in almost every case they report success, some complete, others partial.

"Report of Dr. V. A. Norgaard, Inspector in Charge.

"The Medicine.

"It has already been mentioned that the medicine used in treating actinomycosis is iodide of potassium. This is a common drug and may be obtained at any drug store, the price being about $3 per pound.

"All the iodine salts have a faint antiseptic power, which is produced by the iodine getting free under a prolonged influence of various organic substances. A 5 per cent. solution of iodide of potassium will render tuberculous sputum inactive in about twenty-four hours.

"Iodide of potassium has a strong absorbing effect when given internally, especially on all pathological accumulations of cells. In connection with protoplasm, carbonic acid, and water the iodine will become free and combine with the cells in the pathological product, which will decrease their vital power and accelerate their absorption. It still remains to be explained in what that specific effect consists, which the iodine salts have on the actinomyces fungus. Several prominent authorities have investigated the subject, but all have given a different explanation. Nocard succeeded in cultivating actinomyces in gelatine containing 1 per cent. of iodide of potassium; but this proves nothing, as the salt in this case will remain unchanged, and in that form has not even a slight antiseptic power. It is not necessary, however, that the iodine should have a specific influence on the fungus to produce that remarkable effect, which the drug evidently exercises on all actinomycotic new formations. This effect may simply be attributed to the strong absorbing power which iodide of potassium exercises on all pathological neoplasms and waste products. The colonies of actinomyces, when living and possessed with regenerative power, are always embedded in a small amount of liquified tissue surrounded by a wide zone of inflammation. When an actinomycoma consists exclusively of granulomatous tissue and connective tissue, the fungus is dead, or at least dying (Bostroem).

"It will, therefore, be understood that the liquified tissue surrounding the parasite under the influence of the administered iodide of potassium will be absorbed, the soft granulomatous tissue when partly deprived of the necessary pabulum by absorption will undergo a degenerative metamorphosis, and the round cells be converted into spindle cells, and the whole actinomycoma in this way will be turned into an inert mass of fibrous tissue, inclosing the dead calcified actinomyces tufts.

"The yellow pus-like substance in which the living actinomyces is always embedded is not true pus, though it has that appearance, but is merely the product of a degenerative metamorphosis (necrobiosis). True pus must contain pus corpuscles and specific pus-producing micro-organisms (pyogenic cocci and bacilli) (Bostroem).

"Where iodide of potassium is administered in medium doses for any length of time it will affect not only the diseased parts, but the liberated iodine will combine with the normal cells in the body and produce a series of symptoms called iodism. This consists of a general emaciation, shrinking of the fat, atrophy of lymph glands, and of mammary glands, in connection with a chronic catarrh of nose and conjunctiva, and desquamation of the epidermis. When given in over doses, it will produce a catarrh of the stomach and intestines, and even cause hemorrhages. The manure will get dry and hard and coated with thick mucus, or eventually with blood. All these inconveniences, however, are easily avoided when the medicine is given in proper doses, care being taken that the animal gets plenty of nutritious and easily digestible food. It is not, however, advisable to administer iodide of potassium to milch cows, as it will reduce the milk secretion considerably or stop it altogether. Furthermore a great part of the drug is excreted through the milk, making it unfit for any use. When administered internally the drug permeates all the tissues in the body, even the muscles and bones, but it is, however, rapidly excreted again, especially through the urine and milk.

"In treating actinomycosis in cattle with iodide of potassium the dose should never exceed one gram (¼ dram) for every hundred pounds live weight, the proper dose being from 8 to 12 grams (2 to 3 drams), according to the size of the animal and the extent of the lesion. This dose may be given from five to six days, when the animal will show slight symptoms of iodism, viz., discharge of thick mucus from the nose and excretion of tears. The manure will become rather dry, but that is easily repaired by giving a dose of glauber salts and some bran mash. This will restore the appetite, and two days after the last dose was given the animal will be ready for another week's treatment, and so on until a cure is effected. If these precautions are taken, no ill effect will result from the treatment, and, if properly fed, the animal will gain in condition uninfluenced by the medicine. There is, however, a great difference as to the individual effect of the medicine on animals, but any farmer who takes an interest in seeing his stock doing well will easily perceive when it is time for him to stop and give the animal rest for two or three days.

"The medicine is best administered dissolved in water and given by means of a slender, long-necked bottle—for example, a common Rhine-wine bottle. One dose of medicine is dissolved in about a pint of water, the steer is seized by the nose to hold up the head, and the contents of the bottle are emptied into the mouth without fixing or securing the tongue in any way.

"Where a man has several head of lumpy-jawed cattle to treat, they may not be of the same size, and, therefore, not require the same dose of medicine. As the farmer or breeder is not usually in possession of a pair of scales sufficiently fine to weigh off such small doses as required, the most convenient way is to have the medicine, which is easily dissolved, prepared in a concentrated solution of the strength 1 to 2 (2 drams of the solution to contain 1 dram of iodide of potassium). The drug must be dissolved in distilled or rain water, as otherwise a precipitate will form from the salts present in common water. With such a concentrated solution and a measuring glass, it is easy to measure out the exact dose for every animal and pour it into the wine bottle, half filled with common water.

"Effect of Iodide of Potassium on the different Actinomycotic New Formations and their Tissues.

"To give a detailed description of the various forms under which actinomycosis appears in cattle is not necessary here, as there is an abundance of literature on this subject. It shall only be mentioned that, from a therapeutic standpoint, we may divide them all into two classes: (*a*) those where the bones are involved and; (*b*) those where only the soft tissue has become affected.

"Of the 150 head experimented on, about sixty had lesions where the bone was affected. These may again be divided into two classes: First, where the lesion is located on the lower jaw, which is by far the most common; and, second, those where the facial bones and upper maxilla have become affected. In both cases the lesion has been produced by an invasion of the germ, by means of a spikelet of barley or some other stiff vegetable particle, on which the germ has vegetated in nature. No other satisfactory explanation of the infection has been given so far, whether the invasion occurred through a decayed tooth or through some abrasion in the mucous membrane in the mouth, on the tongue, or in the pharynx. Bostroem has examined thirty-two cases of actinomycosis in the jaw bones minutely, and in every case he found some vegetable particle located in the socket of the decayed molar, or in the gums, or even as deep as in the centre of the swollen rarefied bone. Where the tongue is affected these foreign bodies may be found in almost every one of the nodules, and a microscopical examination will show them to be closely covered with actinomyces. In five cases of actinomycosis in human beings, this authority has traced the infection back to the same origin, and thereupon advises people who may have that habit not to chew a piece of straw or to put grain, especially those kinds which are armed with a spikelet, in their mouths, as he feels satisfied that this is the only way in which an infection can take place.

"Where the lesion has only affected the soft tissues, the most common appearance is in form of a hard round or egg-shaped tumour, lying loose in the connecting tissue under the skin, usually in the submaxillary, sublaryngeal, or parotid region. The tumour may vary in size and character, ranging from a walnut to a child's head, and from being hard and solid to soft and fluctuating. In almost all cases, bony or soft, the skin that covers the tumour or swelling is more or less indurated, and may on the large bony swellings obtain a thickness of 2 or 3 inches. These fibrous indurations, however, show a pronounced inclination to shrink where iodide of potassium has been administered for some time, and will, in most of the cases, disappear altogether, leaving the skin in its natural condition.

"The first step toward a medical treatment of actinomycosis was when M. Thomassen, of Utrecht, in 1885, announced that he had successfully treated actinomycosis in the tongue of cattle by giving iodide of potassium internally and applying tincture of iodide to the ulcers on the tongue, which he first scraped. Since then this experiment has been repeated all over Europe by many different authorities and practitioners with similar success. This lesion, however, is very seldom seen in this country, but seems to be rather common in Germany and certain parts of England. Of all the cattle in this experiment, not one had actinomycosis in the tongue, and the inspectors in the stockyards have only seen it two or three times. The reason for this may be that actinomycosis in the tongue has a comparatively acute progress, and that an animal so affected rapidly loses in flesh, if medical treatment is not adopted. Now we know, however, that we can always master a case like this, even if the tongue is swollen to such a size that it protrudes from the mouth and is as hard as a board. Give 10 grams (2½ drams) of iodide of potassium a day, in the above described way, care being taken to give the animal time to swallow the medicine, as deglutition is impaired considerably by the hard and swollen condition of the tongue. Feed the animal with gruel and other fluid food, with a bottle if necessary. In ten to twenty days the tongue will regain its natural size and condition, and the animal be enabled to eat hay.

"Though none of the cattle in this experiment had the lesion in the tongue, several of them had it in the mucous membrane in the mouth, especially on the inside of the lips, but not to any great extent. It appears as small, flat tumour formations, the size of a dime to that of a 50-cent. piece, of a reddish-gray colour, and only protruding a little over the surrounding parts. They will shrink and disappear completely in about two weeks when medicine is administered regularly.

"When a medium dose of iodide of potassium has been administered from three days to a week, symptoms of iodism will appear, and at the lapse of two to three weeks a desquamation of the epidermis will take place, especially on on the neck, shoulders, and rump. But there are many exceptions. Some animals will show only a slight catarrh of the nose and none of the conjunctiva, while the desquamation will not take place before a month or six weeks, or may not occur at all. Several of the steers experimented upon showed under the whole treatment not a single epidermic scale on their body, even if the dose of medicine was increased up to 15 grams a day. They would give a catarrh of the intestines, with constipation, but show no external symptoms of iodism. Such an insusceptibility of the constitution usually extends to the actinomycotic lesions, which would remain almost unaffected or only improve slightly. There are, however, also exceptions here, as one steer with a large tumour in the sublaryngeal space was almost completely cured without showing any epidermic desquamations.

"Individuals which show the most pronounced Symptoms of Iodism will Improve the Fastest.

"The effect of the medicine is rarely alike in two individuals, even if they are affected exactly the same way and to the same extent. The hard fibrous tumours lying loose in the connective tissue under the skin will require a treatment of from three to six weeks with proper intervals, according to their size. But in many cases a tumour the size of a child's head will shrink and disappear faster than a similar one located on the same place in an animal of the size and condition, but with the tumour only as large as a goose egg; the former will show a pronounced iodism, while the latter will show little or none at all.

"When one of those loose fibrous tumours become fluctuating and is left alone, it will break open after a while, and a comparatively small amount of pus will be evacuated. The pus cavity will rapidly fill up with the soft granulomatous tissue characteristic of actinomycosis, and when it is full it will grow out of the opening like a mushroom and form a granuloma, which will increase in size very fast as long as the supply of nutrition is abundant, after which the surface will begin to ulcerate.

"If the treatment is commenced at this time, say, with a daily dose of 10 grams of iodide of potassium, the rule is that the ulcerating surface of the granuloma will dry up, and the granuloma itself will gradually shrink, apparently as if it were drawn in through the same hole it had grown out of. Then the fibrous parts of the tumour will commence contracting until the whole tumour has disappeared, leaving a small white cicatrix where the granuloma was. But here there are also exceptions. In some cases the granuloma may remain unaffected, while the fibrous parts begin to shrink first, and after a while the granuloma will become dry, skrinking slowly, but not disappearing completely, although the actinomyces are killed or rendered ineffective by the treatment.

"When the disease affects the bony parts the periosteum will become covered with thick layers of connective tissue inclosing centres of soft granulomatous tissue, and when it penetrates into the internal parts the bone will increase in bulk in two different ways, either by a rarefying granulating ostitis or by an ossifying periostitis. The invading germ will cause an irritation, which will be followed by a formation of granulomatous tissue in the cancelli of the spongiosa and in the Haversian canals. The bony plates of the former and the walls of the latter will be destroyed and replaced by large pockets or alveoli filled with soft granulomatous tissue and with a creamy, viscid pus-like mass, containing numerous actinomyces.

"The proliferating granulomatous mass will finally penetrate the surface of the bone and infiltrate the covering tissues, and at last break through the skin, which will become thick and indurated, and form a bulky fibrous wall around the fast-growing granuloma. The picture here described is that frequently seen on the lower maxilla. These tumefactions may attain enormous dimensions, and even reach the size of a half-peck measure, with granulomas 6 to 8 inches in diameter. Several specimens of this kind were included in the experiment, though such extreme cases practically never will be submitted to treatment.

"Nevertheless, the effect of the medicine by far exceeded the expectations. With a few exceptions, they all showed wonderful improvement. Under the effect of a 12 to 15 gram daily dose, those large fetid ulcerating granulomas would dry up and shrink, most of them disappearing altogether, only leaving a white contracted cicatrix, while the fibrous parts of the tumefaction would become thinner every day, and finally leave the swollen bone directly covered by the muscles and the skin. The post-mortem examination of these bony tumours revealed similar improvements. An incision through them showed the internal parts to be spongy, but the alveoli and pockets only contained very little granulomatous tissue, and this was not soft, but of a more elastic and dense character, and only contained calcified actinomyces. In many of them no pus was found at all, while others contained small quantities. This remarkable improvement was seen in all those cases where the iodide of potassium had caused a well-pronounced iodism, while in those cases where the medicine had a less pronounced effect the improvement was equally small, and quantities of pus and soft tissue could be found in the alveoli. Similar to the loose-lying tumours, the medicine may in these cases have a stronger effect on either the granuloma or the fibrous parts of the tumefaction. The first is the most common, but in a smaller number of cases the medicine takes effect exclusively on the fibrous parts, making them shrink so rapidly that the thick fibrous wall surrounding the granuloma contracts to such an extent that the whole granuloma is expelled, partly by force and partly on account of obstructed blood circulation.

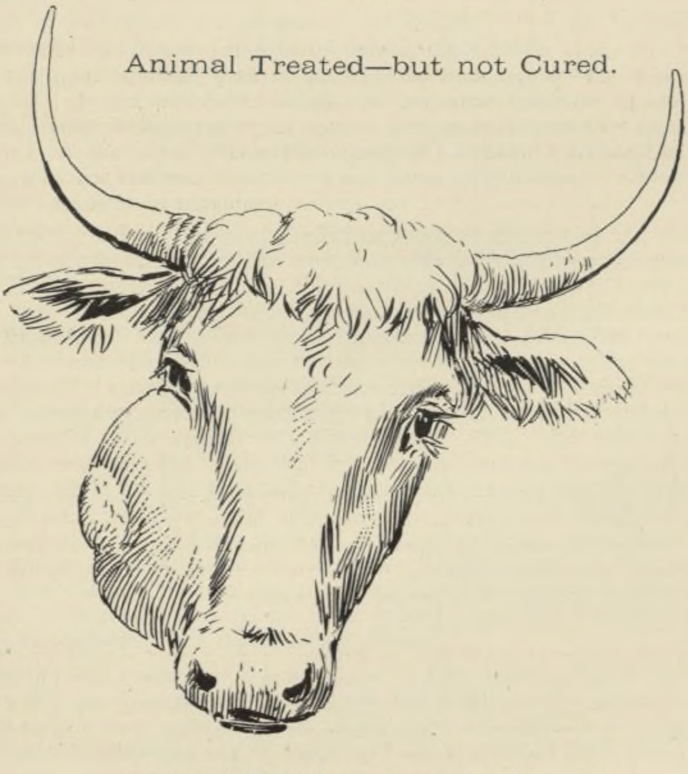
"There is no doubt that these results, obtained by a treatment which in no case lasted more than seven weeks, and, as an average, not exceeding five weeks, permit us to say that in iodide of potassium we have found a valuable remedy in treating actinomycosis.

"It now remains to decide which cases will prove of financial value for the farmer and breeder to treat, and this partly depends upon the facility with which the administration of the medicine can be performed. The amount of medicine used in a single case ought never to exceed 1 lb., equal to an expense of 3 dollars. We suppose any steer will be worth that much. If the affected animals are being kept in a stable, as, for instance, in distilleries, the trouble about giving the medicine amounts to nothing. But where the animals are running loose in a pasture and there is no convenient place to tie them up, it is no easy matter to catch them and secure them every day while the medicine is given. On ranges and similar places, where several hundred head of cattle are kept, the easiest way is to keep the affected cattle in a large pen, in the one side of which is built a narrow chute, into which the cattle can be driven one by one and treated. Such a chute may be constructed out of a few solid boards without much expense. To administer the medicine in the drinking water is not advisable, as it is then rather difficult to control the right dose. The cattle will not drink a paleful of water with a dose of iodide of potassium, except when they are very thirsty.

"As to the different lesions, it has already been said that when the tumour is not connected with the bony tissue, but is lying loose in the connective tissue under the skin, a favourable result may be expected in from two to five weeks, according to the size of the tumour and to the susceptibility of the individual toward the effect of the medicine.

"It is not necessary to continue the treatment until the tumour has disappeared completely; but it may be stopped when it has shrunk to about one-third of its original size, and the remainder will usually disappear without further treatment. When a small tumour about the size of a hen's egg is located on the cheek or on the outside of the lower jaw, it is usually very hard and can only be moved very little, so it is easily mistaken for a bony

Animal Treated—but not Cured.



Animal Treated—but not Cured.

(11b 160-93)

tumour. A careful examination, however, will soon prove that it is not bony, and when treatment is commenced it will rapidly decrease in size.

"When the bone is affected, treatment is only advisable when the swelling does not exceed a goose egg in size on the lower jaw or a walnut on the upper jaw, and has not penetrated the skin; but in any case the medicine will avert a further development of the disease if the animal is at all susceptible to its effect.

"Two cases as above described, and with a small bony tumour on the lower maxilla, were killed on October 29, 1892, after a six week's treatment. The bony swellings were then almost solid, contained no large cavities, and no traces of pus or soft tissue. In the centre of them was a bunch of white connective tissue, and from this extended a cord of the same material to the socket of the first molar. This was an obliterated fistula. The molar was not decayed, and was firmly embedded in the socket. This is a clear proof that actinomycotic lesions in the bony tissue can be successfully treated when they are taken in time.

"Post-mortem Examination.

"November 29, 1892, two lots of cattle experimented upon were killed· Each lot contained forty head, the one consisting of cattle that were supposed to be completely cured, while the second lot included all the old chronic cases, where a successful result could not be expected in the time limited for the experiment.

"In the special report of each animal the description of the post-mortem examination will be found. This is necessarily very brief.

"The forty cattle which were supposed to be cured proved to be so with the exception of two, which had small actinomycotic tumours in the lung containing living actinomyces. In nine other cases traces of the disease were found at the place where the tumours had been located; but these traces were so insignificant, ranging in size from a pin's head to a bean, that they did not amount to anything.

"The first lot were all in good condition, some of them very fat, and the greater part of the second lot also were in a very satisfactory condition, only a few of them being really poor. A noteworthy fact is that only two out of each lot had actinomycotic lesions in the internal organs, all cases in the lungs. This would hardly have been the case if the cattle had not been treated. In some cases a few small nodules, in size from a millet seed to a pea, containing a cheesy, greenish detritus mass, were found in the wall of the small intestines; but a microscopical examination of these lesions gave negative results with regard to actinomycosis. The final result of the investigation was that out of the first lot thirty-eight were passed as fit for human food, while the two cases affected with actinomycosis in the lung were condemned. Of the other forty only five were passed and thirty-five condemned, though many of them were big fat steers with the lesion located on the jaws and no internal lesion of any kind. The tumours on the greater part of these did not contain any pus, and the granulomatous tissue had undergone a fibrous metamorphosis, and subsequently did not contain any actinomyces possessed with regenerative power.

"December 2nd twenty more head of cattle were killed. These had been stabled in the same barn as the rest, and had been treated from three to six weeks each with proper intervals. They were all used to the distillery slops before the treatment began, and continued to grow in flesh while they were treated. They were all pronounced cases, but only the soft tissues were involved. The lesions were about the same as those in the first lot, hard, fibrous tumours, the size from a goose-egg to a child's head, located in the loose connective tissue under the skin in the submaxillary or sublaryngeal space. They all recovered completely, and at the *post-mortem* examination no traces of the disease were found, except in two cases, a hard, fibrous induration in the skin, where the tumours had been. They were all passed as fit for human food."

The Illustrations.

As a guide to owners in recognising the disease we give drawings of the heads of four beasts which were affected with lumpy jaw, and which also were included in the experiments. It will be seen that two of these were cured, and the other two not cured. These four heads have been selected from a large number given in the report as fairly typical of the variations exhibited by the disease.

Heredity in Bees.

By ALBERT GALE.

In the *British Beekeepers' Journal* of the 11th May, 1893, there is an article on "Heredity in Bees," based on a paper read before the British Beekeepers' Association, by Mr. Grimshaw, who asserts that the external organs and mental characteristics in worker bees are produced "by means of brood food."

The line of demarcation between the mother bee and the worker is so distinct that were we not so intimately acquainted with their domestic economy and natural history we should feel disposed to place such insects as members of the same genus, but separate species.

The subject of the difference of the constituents of the hive has occupied my attention for years past; and long since I have come to the conclusion that the food theory is wholly untenable. I was led to this conclusion by noticing that the efforts of nature to mature a queen bee are almost the opposite of those required to mature a working bee, and that the aids nature uses in the one case are almost entirely changed in the other. The same mother lays the eggs for both the queen and worker bee, yet the one egg produces an insect whose constructive intelligence and foraging instinct completely obscures that of the other; the other insect has a reproductive instinct that is so dormant in the worker bee that when it is roused into activity it is too weak and useless to perpetuate the existence of the species. The one is an outdoor worker and her life is terminated in two or three months, the other is an indoor worker and her life is extended into years.

What produces these, and a score of other differences? were the questions I asked myself, and nature gave me the following answers:—The queen cell is not made wholly of wax, but a large portion is built with a mixture of wax and pollen. The capping of the brood comb, both drone and worker, is built of the same material. It would appear from the porous nature of queen cells and brood cappings that a greater quantity of air is required to develop a drone than a worker, and a queen bee whilst developing must have all the air obtainable by both abdominal and thoracic spiracles. Abdominal respiration appears to be one of the chief agents in the development of the ovarium of a queen, while the contracted air space and the air-tight wax walls of the workers' cells are the cause of the non-development of the same organs in working bees. In a larval state respiration in insect life is performed equally by all the spiracles, but chiefly by the abdominal. On account of the air-tight cells of working bees, these abdominal cells are almost, if not wholly, prevented from working; but the thoracic spiracles come fully into play. The abdomen of an embryo queen bee is free from the encasement of the cocoon, and undoubtedly this is one of nature's reasons why the larval queen has only her head so shrouded. This absence of cocoon from the larval queen's abdomen; the extra size of the cell; the porous nature of the materials of which the cell is formed—its shape an inverted cone; the cavities in its exterior surface—the convexities being given to add strength to its tissue-like walls; the position of the young queen within—the abdomen being higher than the head, so that the heated air within the cell which has been imparted by the incubating bees clustering around the semi-detached and pendulous royal cell, have all more to do with the development of the generative organs of queen bees than feeding with larger quantities of food.

Newport has shown that the development of heat in insects depends on the quality and activity of respiration and the volume of velocity of the circulation. "Bees possess the voluntary power of generating heat by breathing faster." Huber observed in an article on insect incubation: "The manner in which the bee performs her incubatory office is by placing herself upon the cell of a nymph (pupa) that is soon to be developed, and then beginning to respire at first very gradually, and in a short time the respirations become more frequent, until at length they are increased to 120 or 130 per minute; the fluff on the bees aiding in retaining the heat. The bodies of the incubating bees soon become of a high temperature, and on close inspection are often seen to be bathed with perspiration. When this is the case the temperature of the insects soon becomes reduced, and they leave the cells, and others almost immediately take their place. When respiration is performed less violently, less heat is evolved, and the same bees will often continue on the cells for many hours in succession." This extreme amount of heat is evolved entirely by an act of the will of the bee. All observant bee-keepers know that the colder the weather the more restless are the incubating bees on the brood comb. The heated air produced by these bees clustering on the brood comb cannot affect the abdomen of worker larvæ to the extent it does their head and thorax, whilst, as before mentioned, the position of the royal cell, and the porous material from which it is formed; the position of the royal inmate, and its freedom from an entire cocoon covering; and the constantly changing position of the incubating bees that cluster around these royal chambers, are the agencies employed by nature to fully develop the ovarium at the sacrifice of the honey sac, and produce that most interesting inmate of the hive, a queen bee. The absence of these agencies from the cells of the worker larvæ causes the development of the honey sac, the wax pockets and pollen baskets with which the working bees are provided, at the sacrifice of the ovarium. From the foregoing it will be seen that the conditions exacted by nature for the production of the all-important mother bee are not confined to extra food, but embrace extra air, extra heat, extra space, and another position to that of the worker larvæ. These extra conditions produce female bees capable of fertility. Their absence produces female bees incapable of fertility. All bee-keepers know that a bee capable of fertility is perfected from the laying of the egg to the time it emerges from the chrysalis in sixteen days. But if all the conditions I have named be withheld the same insect would have taken twenty-one days to mature, or five days longer than is required for the development of a queen bee.

The conditions and agencies are hereditary, not the constructive and mental characteristics. These conditions and agencies transmit and produce the motherly instincts in the mother bee, the sexual love in the father bee, and the intellectual faculties in the worker bee that have placed her on the very apex of industry in the insect world.

M. De Candolle says, "We know that a variation in the quantity and quality of the nourishment (accompanied by another condition of minor importance—the size of the cell) results in the most marvellous differentiation of structure." Is the size of the cell of such minor importance? If this be correct, then why all the differences between the queen and worker cells and their inmates that I have mentioned above?

That there is a difference in the food fed to the larva of the queen and worker bee in the various stages of their development is unquestionable; but, that that fed to the embryo worker causes the honey bee to possess those admirable faculties that have placed her in such a high place in the scale of animated nature is neither impossible, illogical, nor unreasonable. Parallel cases are to be met with in other animated beings, although perhaps not to the extent of the differential organs of the insects under discussion. Let one such case suffice—the aphides, where winged oviparous parents produce wingless viviparous descendants, and after several generations of these, the last generation of wingless aphides produce a generation of winged oviparous aphides, and the circle from winged to wingless, oviparous to viviparous, again revolves. The difference between the winged and wingless aphides—both those of locomotion and reproduction—is as great or greater than the instincts between the queen and worker bee, and these differences are not brought about by a change of food in any degree whatsoever.

The food fed to the queen, the drone, and the worker for the first three days of their larval life is the same, and that the queen is not weaned, as is the case with the two latter, is well known, she being supplied with the semi-digested food up to the time her chrysalid metamorphosis takes place.

The foods given to larval bees are of two kinds. The earliest food is analogous to the milk supplied by the dam of a mammalian to her progeny for the first few days after birth, or that fed by the mother pigeon to her young for the same period (males are incapable of producing it). After a time these are fed with more solid materials, as their strength will admit. As the larval worker advances in development, she is very gradually weaned from milky food, and a stronger kind is substituted. This stronger food is composed largely of pollen, The larval queen is never supplied with this pollen food. Why? Pollen food gives muscle. Milk food, which is largely composed of honey, gives heat. The working bees require strongly-developed muscles for the active life they have to lead and the heavy loads they have to carry. To that end they are supplied with muscle-forming, strength-giving nourishment. The ovarium in the queen bee requires a greater effort of nature to produce it than that required to produce the external organs of worker bees, and a greater amount of heat-giving food is necessary to keep up the waste of the larval queen's system. A queen has not to lead the active outdoor life of a worker, therefore the muscle-supplying food is largely withheld, and she is supplied during her larval life with that highly-nutritious food—royal jelly. Neither the pollen food nor the heat-giving food produce any difference in the physical structure in either insect—queen, worker, or drone.

The conditions exacted by nature to evolve a perfect bee from the ova to the imago I have already stated, but time or rest must be added thereto. A drone requires more time to develop than a worker, and doubtless he is supplied with more food, but of this we have no proof. The heat-giving food he first receives is gradually replaced by a muscle forming nutriment. A worker bee requires less time to develop than a drone, but more than a queen—about midway between the two. The first three stages in the metamorphosis of a bee or other insect are infantile. When they enter the fourth or last stage they are adults, capable of almost immediately entering into all the adult duties required by nature. The procreative organs of nearly all females become receptive much earlier than is the case with the distributive organs of males of the same genus or class. This accounts for the various terms required for the development of the queen, the worker, and the drone. In the case of the worker the extra time she requires is not for the perfecting of sexual organs but for perfecting strength-giving muscles.

I know that it can be argued from the foregoing that as a drone is reared under nearly the same conditions as a worker bee he should have the same external organs—waxpockets, pollen baskets, &c., as she has; but it must be borne in mind that he is designed from the beginning to be a complete and perfect male. A working bee is designed for a complete but imperfect female. The altered conditions of her infantile life to that of the queen bee have produced such a female; her external organs are the result of the check given to her procreative ones.

If M. De Candolle says, as reported by Dr. Mettelis, "when the egg is still in the ovary of the queen, it shuts up within itself, in a latent state, the characters and instincts of the three elements of the hive—male, queen, and worker," he is undoubtedly in error. It has been proved over and over again that the eggs when in the ovary of the queen are all male, and it is only as they pass the spermathica in the ova-duct that the eggs become female, and *after* they are laid amid their contracted surroundings that the distinctive characteristics of working bees are given to them.

The egg whilst in the ovarium is masculine and at the will of the queen. Whether it shall remain masculine or become feminine the queen decides as it descends the ovaduct, according to the requirements of nature. Having decided it shall be a female, she fertilises it as it passes the spermathica. Whether it is to be a fertile or infertile female is decided at the point of the ova depositor as it is ejected into the large pendulous inverted conical cell or into the small horizontal hexagonal one. If in the former it will be fertile and its chief instinct, its only aim will be that of reproduction, and that instinct is hereditary and transmits an insatiable love for perpetuating its species. If it be ejected into the small horizontal hexagonal cell it will be infertile and its instincts will be that of a mother's love without the power to become one, and this love is lavished on the helpless children of her own parents. Her love for the reproduced is as great and as strong as the love of reproduction is in the mother bee. This instinct, this love for the reproduced, is equalled by her architectural or constructive love which she puts in force to prepare for the reproduction of her own species. Her foraging instinct is only her forethought, her providential, her maternal love. The worker's motherly love for the younger members of the hive, her constructive love, her providential love, and her maternal love are all hereditary. We know that the inmate in the queen's cell will have the *love* for reproduction and the *power* to reproduce. We also know the inmate of the worker's cell will have the love of reproduction but *not* the power. We know, too, that she has the love and power of construction, &c. The power to become constructive and to become a gatherer and storer of food are produced by the altered conditions of the cell in which she was reared. There is no doubt but that the inverted conical cell of a queen is the normal cell belonging to *Apis melifica*. The altered conditions and position of the worker's cell are abnormal. It must be so whether we take a creative or an evolutionary theory. The modification in the position and size of the worker's cell has necessitated the transposition of its inmate from its inverted erect position as seen in the larval queen, to that of the horizontal cell, its inmate lying longitudinally as in the case of the worker and drone.

We know that a worker bee has a mother's love without having the power to become a mother, and that love has been transmitted from the mother bee. Who is to say that the mother bee has not the constructive and storing love of the worker, but is debarred from the power to exercise it and yet has the power to transmit it. It is as reasonable that this should be so as that the worker has the love of offspring without the power of reproducing.

If it be "the variation in the quantity and quality of nourishment (accompanied by a condition of minor importance the size of the cell) results in the most marvellous differentiation of structure," how is it that a *working bee* can become fertile? The theory why some working bees become abnormally fertile is, that they have been fed for too long a period with chyle food; or, in other words, weaning has been more or less delayed, consequently this accidental supply of royal jelly has caused the embryo ovarium to develop until a sudden stop is put to it by the larval worker being fed with pollen food. All writers in stating the extra chyle food theory, causing the worker to become fertile, are very careful not to state it in positive terms. That such a theory is not trustworthy is very evident from the fact that a working bee never becomes fertile in a colony where there is a healthy laying queen. A worker only becomes a laying bee when the last avenue to procure a queen has been closed—when there is no egg or young larva from which to evolve a mother bee. The love of home may sometimes cause one of these hopeless survivors to make a final effort to continue the existence of the colony; it is the catching at a straw. The effort made by these laying workers prolongs the struggle, and there is something produced upon which to lavish their motherly instincts; something to nurse and to care for, if it be only drones. The *desire* to prevent the breaking up of the colony is a far more reasonable theory than the non-weaning one. She has the tongue, the eyes, the organs for secreting wax, and the useful appliances on the legs; in these respects she is as perfect a working bee as any in the hive and was produced exactly under the same natural condition as any other worker bee, yet her ovary becomes developed and in this respect she becomes as complete a queen as any hive ever possessed. She has all the characteristics and powers of a queen combined with the characteristics and powers of a worker, only her spermathica has not been impregnated. In this latter respect she is equal to a queen that has been supplied with all the aids that nature has designed, except fecundation.

Does "the variation in the quantity and quality of the nourishment" produce fertilisation? It cannot.

It may be considered that the facts that I have advanced relative to a fertile worker are equally faulty with the food theory, but it must be borne in mind that a queen's cell is built to evolve a complete and perfect female and designed to be such from the moment the egg comes in contact with the paternal influence as contained in the spermathica of the mother bee. The structural modification is not made in the queen's cell to produce a complete and perfect female; it is the worker's cell that is modified to produce a complete but imperfect female—a bee with a mother's love but whose reproductive organs have been sacrificed or replaced by a constructive and providential instinct. The ovaries in a worker-bee are always latent but are sometimes excited into activity. The sexual organs of fertile workers are never receptive and can never be excited to become so. The worker's cell in which she was reared was designed for the purpose of destroying or preventing the developing of sexual powers and it very effectively carries out that for which it was designed.

It is the conditions and agencies that are hereditary, these produce the modified structural differences as seen in the queen and worker. These conditions transmit to the elements of the hive the reproductive, the social, the domestic, the constructive, the energetic, the intellectual and the providential habits from generation to generation and from century to century.

Dairy Notes

Cheddar Cheese-making.

From a report* recently received from the Board of Agriculture of the United Kingdom we are enabled to present the results of recent investigations into the conditions essential to the manufacture of Cheddar cheese of high and even quality.

These investigations were conducted on behalf of the Bath and West Society by Mr. F. J. Lloyd, F.C.S., F.I.C., at the Society's cheese school near Forde (Somerset, England), who set himself to discover whether any definite chemical condition governed the various stages in the progress of the curd in cheese-making. As all experienced cheese makers are aware the tests at present applied by the cheese maker are empirical, that is they depend solely on experience and observation and not on scientific conclusions—practically on the senses of taste, touch, and smell. This being the case it will be admitted that the making of good cheese depends solely on the delicacy or degree of sensitiveness of these senses in the person engaged in the work. Mr. Lloyd found, however, that amongst students there were many in whom one sense was more developed than the others, and it is well known that the cheeses even of the best and most experienced makers vary considerably in quality.

Mr. Lloyd had ascertained that in the act of setting (coagulation), the milk loses a large proportion of its acidity, which by the time the whey is drawn has been again reproduced. "Thus," he says, "the average acidity of the mixed milks, &c., before renneting during August (February in Australia) was ·24 per cent., and the average acidity of the whey before breaking during the same month, was only ·16 per cent., but the average acidity of the whey when drawn was ·25 per cent., thus showing that, by all the operations to which the curd in the meantime had been subjected, the original acidity had only been slightly more than reproduced. At first this did not attract my attention, until, towards the end of the month of August I was struck by the fact that while on the 28th, when the time in scald was only one hour twenty-seven minutes, more acidity was present in the whey than in the milk to start with, yet on the 24th, although the curd had been in scald two hours, less acidity had been produced than was originally present in the milk. This led me to watch very closely the progress of the development of acidity from the moment the curd was cut to the time the whey was drawn, and it will be interesting to here produce from my note-book a copy of the observations taken on one such occasion.

* Report on the Distribution of Grants for Agricultural Education in Great Britain in the financial year 1891-92, with an appendix.

Development of acidity in whey—September 18.

	Per cent.
Acidity of milk before renneting	·25
Acidity of whey after cutting curd	·17
Before breaking	·17
After breaking	·18
Whey put aside	·19
During first scald	·20
Before second scald	·21
10 a.m. (after second scald whey put in)	·23
10 5	·25
10·10	·25
10·15	·25
10 20 (stirring finished, very good curd)	·27
Acidity of whey when drawn	·29

"It will be seen that no sooner had Miss Cannon (the head-teacher) obtained in the whey during scald an amount of acidity greater than that present in the milk before renneting than she pronounced the curd fit to settle, prior to drawing off the whey. She was not aware of my results and was guided solely by her sense of touch and taste. I repeated these observations occasionally, and always found the same result, namely, that the fitness of the curd to settle in scald was coincident with the whey attaining an acidity slightly greater than the acidity of the milk before renneting.

	Per cent.
In September the average acidity of mixed milk was	·224
,, ,, whey was	·232
In October the average acidity of mixed milk was	·214
,, ,, whey was	·217

"From the time of drawing the whey to the time of milling (grinding) the curd, every step in the manufacture, excepting the time the curd remains piled, proceeds by time stages of certain duration, and no special aptitude is required until it becomes necessary to judge whether the curd is fit for grinding or not. This, without doubt, is the time when the greatest demand is made on the cheese-maker's judgment, and when any large error will hopelessly ruin the cheese. An error in judgment at any previous stage may, by a skilful maker, be very largely counteracted in subsequent operations, but not so any error at this stage. At first it was hoped that the determination of the acidity of the curd at this stage would enable one to ascertain definitely whether the curd was fit for grinding, but this had to be abandoned. I have since come to the conclusion that the acidity of the whey which drains from the curd when in the cooler, if estimated after each operation therein, is a sufficiently accurate guide to the condition of the curd before grinding. The difficulty of judging the condition of the curd at this stage is great . . . . . If so skilful a maker as Miss Cannon is unable to judge of this stage with the same degree of accuracy as she is able to attain when judging the condition of the curd in scald, what, we may ask, would be the condition of the curd before grinding in the hands of an unskilful maker? Thus, on 30th August, the acidity of the liquid last coming from the curd before grinding was ·84 per cent., while three days before, on the 27th, it was ·93, and three days before that, on the 24th, it was as high as 1·05 per cent. Again, in September, we find the acidity ranging from ·87, on the 18th, to 1·10 per cent., on the 15th and in October it ranges from ·92, on the 22nd, to 1·15 per cent., on the 9th. And yet, as I shall subsequently show, the quality of the cheese when ripe will depend mainly on its condition when milled. We shall probably best estimate the requisite acidity by taking the average for each month. This in August was ·93 per cent., in September ·96 per cent., and in October 1·01 per cent.

"As, in my opinion, the two stages in the manufacture of Cheddar cheese most difficult to determine empirically are those which have just been referred to, viz., when to stop stirring and when to grind the curd, I determined to make a cheese myself without touching, tasting, or smelling the curd from commencement to end, and to be guided at these stages by the determinations of acidity alone. The following were the conditions which were to be observed:—

"1. The proportion of rennet to be one part of rennet by volume to 9,500 parts of milk by weight or 9,274 by volume.
"2. The curd to be allowed to settle in scald immediately the whey showed more acidity than that of the mixed milk before renneting.
"3. The curd to be milled when the drainings from last turning showed ·93 per cent. or more of acidity. (This figure was obtained as the average for August.)

"On the 10th September this cheese was made by me, and is probably the first cheese ever made with scientific standards whereby to estimate the critical stages in its manufacture.

"The mechanical operations, which of course require skill and experience that I do not possess, were kindly performed for me by Miss Cannon; but she offered no opinion during the making, so that I might not be in the least biased. The following is a copy of my notes:—

	Per cent.
Acidity of milk before renneting	·21
Acidity of whey when curd out	·14
Acidity after breaking	·17
10·12 (acidity after second scald put in)	·19
10·17	·20
10·23	·20
10·28	·20
10·33	·21
10·38	·21
10·43 (stopped stirring)	·22

"On the 31st December, when the cheeses were sold, Mr. Hill's opinion was particularly requested of a certain number of cheeses, among them being this one. It was considered excellent.

" . . . . It is most desirable not only that the experiment should be repeated, but that by a series of experiments the acidity at each stage which gives the best result should be determined for each month of the cheese-making season."

It is hoped that the success attending Mr. Lloyd's experiments will stimulate cheese-makers in this country in a similar direction, with a view to overcoming a difficulty which has so important an effect on the industry.

Poultry.

BY SAMUEL GRAY.
Sub-Editor.

THE LEGHORN FOWL.

THIS breed, though originating in the country surrounding the town of Leghorn in Italy, is still another of those which owes its present position to American breeders. Its history in America, according to Lewis Wright's book, dates from as far back as 1853, when the first trio was brought to that country. Even in those early days the laying qualities of these birds were noticeable, at any rate sufficiently so to attract the attention of American breeders to them. From 1853 till 1872 they appear to have received careful attention, as in the latter year the uninjured hen of a trio of "Browns" sent to England commenced to lay the day after landing, and continued to do so for some days afterwards.

The natural consequence of the appearance of a new breed is for breeders to begin to speculate as to how they were produced. This was the case on the introduction of Brown Leghorns into England. Without troubling our readers with the details of the controversy which followed, I think it best to state word for word the description given of them by Mr. Wright, who says: "We might describe the birds very briefly as combining the Spanish comb and type of head and body, with the colour or plumage of black-red game of a rather darkish type; the cock being a black-breasted bird, with hackles of orange-red striped with black, and the hen salmon-breasted, with the rest of the plumage partridge marked, or brown, finely pencilled over with dark markings." The white ear lobe is considered an important point both in "Browns" and "Whites," and in each case also the legs are bright yellow.

As already intimated, it is as a layer that the Leghorn will be chiefly valuable. This quality has of late years been so carefully developed that the hens have become veritable "laying machines." Moreover, from reliable data I have been able to gather, either variety will prove satisfactory in this respect. It is, therefore, practically a matter of taste whether "Whites" or "Browns" be kept. They both appear to be equally hardy, both feather rapidly, and both lay early and often. In build the whites are somewhat longer in the leg, and consequently do not present quite so compact an appearance as their darker brethren. It is somewhat difficult to obtain reliable figures as regards the laying of fowls, as the number of eggs will vary greatly according to circumstances. I have very good reasons for believing that a good Leghorn hen, under favourable conditions, will produce from 150 to 180 eggs a year. Reference to the table given in the *Agricultural Gazette*, Vol. III, page 1028 will show that nine White Leghorn pullets laid during the months of December, January, February respectively, 81, 112, and 124 eggs,—in all 317 eggs, or 35 eggs each, during the three coldest months of a Canadian winter. In our comparatively mild winter, there is good ground to anticipate that this number would be greatly exceeded, and I have no hesitation in recommending Leghorns as winter layers, provided they have dry and comfortable quarters and regular, seasonable feeding. The eggs, though only of medium size, are white and delicate in flavour.

There is one point in connection with them which must not be overlooked. When allowed full liberty they stray long distances from home, and I have had hens of this breed remain away all night, reaching home on the followng morning just in time for the early meal. On the other hand, they do fairly well in confinement, provided they are supplied with nature's demands in the shape of green food, grit, &c., and where gardens are unprotected I should recommend that they be kept in a nice roomy pen. It is important, however, that under such circumstances there be no over-crowding and that strict cleanliness be observed.

It has been abundantly proved that Leghorns do extremely well in the coastal districts of New South Wales, and I am also pleased to find from a letter recently received from Mr. J. E. Scantlebury, of Summer Hill, a well-known breeder, that they are bred with success in the drier districts west of the Dividing Range. I cannot do better than quote his letter, which is as follows:—"Although I have never personally bred Leghorns in the dry, western districts I think I can say this, that like all artificial breeds of fowls, such as is the Leghorn, they can be acclimatised anywhere without affecting their egg-production, health, or size. They are bred successfully in very dry districts, such as Narrabri and Wagga Wagga, in each of which places there is a well-known prize Leghorn breeder—Foxe, of Narrabri, and Cummins, of Wagga Wagga. Of course, you will know that it would be impossible to keep their lobes white in these hot places without their being kept in the shade all through the summer months, and I have no doubt the sun would prevent their combs being largely developed, and would also dull their plumage. As to legs, it would largely depend on the nature of the soil; if shaley they would be pale-legged, but if ironstone the legs would keep yellow."

I have implied that as a rule Leghorns would be kept principally for their laying qualities. While this is true, however, it must not be for a moment understood that they are not good eating. They are plump, juicy, and delicate in flesh, the bones are small and offal insignificant. What I desire to convey to the reader is that they are smaller than my idea of a table bird, and that the best returns commercially come from eggs. Of late years great improvement has been effected in their size and weight, and as in every yard there will always be a proportion of culls, these may be utilised for the table with highly satisfactory results.

In addition to the successful New South Wales breeders already mentioned there are Mr. T. Hall, Fairfield; Mr. Ambrose Hallen, Toongabbie; Mr. W. Binder, Balmain; Mrs. W. H. Webb, Bathurst; Mr. J. Gosling, Burwood; and Mr. J. Palmer, Newtown.

The accompanying plate is from a drawing by Mr. E. M. Grosse the departmental artist.

The following standard for judging Leghorns is taken from Lewis Wright's work on Poultry:—

General characteristics of Cock: Head and Neck.—General appearance of head resembling Spanish. Beak rather long and stout, but not heavy; comb very large, single, perfectly straight and upright, of a handsome outside arch or curve, with serrations symmetrically formed and disposed, and free from excrescences; wattles long, thin, and fine in texture; face fine in texture, and nearly free from feathers; deaf ears well developed and pendant,

(116 160-93)

BROWN LEGHORNS.

but not excessively so; thin, smooth, free from folds, and close to the head; neck long, well furnished with hackles, and carried upright. *Body.*—General appearance light and active, large at shoulders, and tapering towards the tail; back rather round and slanting to the tail; wings large, but tightly carried; breast full, round, and carried forward. *Legs and Feet.*—Legs and thighs rather long; shanks slender, perfectly free from feathers, hocks clear; toes thin and well spread. *Tail.*—Large, with full and sweeping sickles, carried high. (Some American breeders consider the tail should be upright, or even squirrel fashion, but we consider this spoils the fowl completely.) *Size.*—Medium, averaging about 6 to 7 pounds. *General Shape.*—Rather light and slender, otherwise like Spanish. *Carriage.*—Very alert and sprightly.

General Characteristics of Hen.—In all respects resembling those of cock, with the usual sexual differences, excepting that her comb falls over to one side, hiding one side of the face.

Colour of White Leghorns.—In both sexes.—Beak of bright yellow. Comb, face, and wattles, brilliant scarlet red. Deaf ears, pure, soft white, resembling white kid. Eyes red or pearl (red preferable, being a better constitution, and brighter looking). Legs a brilliant yellow. Plumage all over a pure and perfect white, the straw colour allowed in the cock by the American standard being very objectionable.

Colour of Brown Leghorns.—In both sexes.—Beak, comb, face, wattles, deaf-ears, and shanks as in White Leghorns. Eyes, bright red. *Colour of Cock.* Head and hackle rich red which may be striped with black towards the bottom. Back, shoulder coverts, and wingbow deep violet or crimson red, occasionally with a shade of orange. Wing-coverts a rich green black, forming a bar across the wing. Primaries black, with a bay edging to lower web. Secondaries deep bay on outer web, which is all that appears when wing is closed, and black on inner web; end of every feather black, forming a black edge to corner of the wing or upper side. Saddle red, ranging from bright red to rich deep red, with black stripes in the feathers—these not imperative. Breast and under-parts rich deep black, free from brown splashes. Tail black, glossed with green or purple; coverts black edged with brown. *Colour of Hen.*—Hackle rich golden yellow, striped with black, but not quite solidly. Breast a salmon red in upper part running off into a brownish ashy colour at the thighs. Rest of plumage a rich brown partridge marking, or light brown covered over with minute dark marking, except the true tail feathers, which are black. (The nearer the whole colour of the hen to the proper exhibition-colour of black-red game the better.)

Value of Defects in Judging Leghorns.

Standard of Perfection.		*Defects to be Deducted.*	
A bird perfect in shape, style, colour, &c., and in perfect health, and condition, to count in points ...	100	Bad shaped comb	12
		Ear-lobe folded, wrinkled, or duplicated	8
		Stain of red in ear-lobe ...	10
		Want of hackle	10
		Faults in colour	20
		Want of size	15
		" symmetry ...	20
		" condition ...	15

Disqualifications.—Cock's comb twisted or falling over, or hen's erect; ear-lobe entirely red; legs any colour, but yellow; coloured feathers in white, or white feathers in brown Leghorns; wry tails, squirrel-tail, or any bodily deformity; any fraudulent dyeing, dressing, or trimming.

Notes.

Feeding the Chicks.

This is a very important work, and one which is often carelessly performed by the inexperienced. The chief point to be remembered is that very young chicks consume only a small quantity of food at a time, and in order to push them along they should be fed often. After the first 24 hours, commence with bread soaked in sweet milk, squeezed out until it crumbles up easily, and feed every two hours for the first day or two ; later change the ration, giving a little coarse oatmeal, softened with sweet milk but not made too wet, an occasional feed of canary seed, some fresh green food, if there is no grass run, with an occasional addition to the soft food of spring onions or eschalots chopped fine. At night, when the chicks are about 15 to 20 days old, a little crushed corn may be added, as this stops longer in the crop, and helps to keep them warm during the night. It will save future trouble to give a little finely ground bone-dust occasionally. This will prevent leg weakness and generally strengthen the frame. It is most important that young chickens should have, at least four times a week, some finely chopped meat. When very young, and in the early spring, they are not able to find sufficient insect food for themselves, and this want the meat supplies. One great point in successfully rearing chicks is to start feeding them early in the morning, and for those who do not care to rise very early I would recommend that a saucer containing some suitable food be placed over night where the chicks only can get at it, so that they may start the day on a good foundation. It is a splendid help to give very young chicks a drink of warm fresh milk as early as possible in the morning. There is no doubt that the feeding of the first month or six weeks decides the question of vigour or debility, and, therefore, extra attention during that period will be well repaid. It is also very essential, in order to ensure that the mother hen pays proper attention to her brood, that she should be liberally fed immediately after leaving the nest, such feeding to be continued for the first three or four days of her brooding. Do not let the hen run at large for the first week, and if the weather is wet and cold it is better to keep her in a coop for a fortnight. Take care, however, that the coop is shifted on to fresh ground every day, and, if possible, have all the coops on an easterly or north-easterly slope, so that the broods get the morning sun.

Tobacco Growing in New South Wales.

By S. LAMB,
Department of Agriculture.

Monthly Reminders.

HAVING selected, with due regard to its quality, situation, and drainage, the land upon which it is intended to plant tobacco, having ploughed it fully 8 inches deep and left it to mellow and sweeten by exposure to the weather, and having decided upon and procured the seed you intend to sow, the next care is to prepare the seed-beds. There are many ways of doing this. One very successful grower raised seedlings for early planting in boxes in his drying-shed, some of these boxes were on wheels but most of them were on runners or sleds. On fine mornings he ran them out, on the approach of bad weather and every evening he ran them in again; he took much trouble and he became rich. Another planter raised plants for an acre in gin cases, covering each with a piece of bark to protect the seedlings from frost at night and from heavy rains or too hot midday sun, uncovering them whenever the weather was favourable. Neither of these planters suffered loss from Blue Mould (*Peronospora*) or the borer (*Lita Solanella*) in their seedlings.

Whatever is worth doing is worth doing well and the best way is always the best paying way. First then make your seed beds on or as near as possible the land to be planted and near to water supply. Make them not more than 3½ feet wide and 9 feet long, each should yield strong plants sufficient for half an acre. Dig the ground a full spade deep, taking out roots, grass, and weeds, but leaving it rough. Pile upon it trash, dry weeds, brush, and deadwood, in fact any rubbish that will burn, to the height of 4 or 5 feet, burn off with a brisk strong burn. After it has burnt out and cooled, rake off all unburnt ends and charcoal, leaving the ashes as a fertilizer; chip these in not more than 3 inches deep and water freely. When sufficiently soaked in, and the soil has become fit, work it very fine; rake as smooth as possible and quite level. Put slabs or boards on edge along both sides and ends of the bed, anything over 6 inches wide will do, but 9 or 10 inch are better. Stakes driven into the ground will keep them in position. At each end of the bed, at half-way across, drive uprights to carry a ridge pole 9 ft. 3 in. by 3 in. by 1 in. set on edge; prepare also two other battens of the same length but only 1½ by 1 inch. If sawn stuff is not at hand forks and saplings will answer the purpose. Purchase 3 yards of grey sheeting, price about 7d. per yard, fasten it with tacks down the middle along the length of the ridge pole, and tack the edge of the sheeting on to the two battens which will act as rollers. The sheeting can be rolled up very easily on them and secured by ties to the ridge pole whenever it is desired to admit air and sunshine, and when heavy rain or hail threatens or the sun is too hot at noon, by loosing the ties the sheeting will run down and screen the seed bed. Two or three stays from the ridge pole to the slabs front and back will make it more certain and quick in action. Some planters paint the sheeting with a coat of linseed oil, which is, however, not necessary.

The seed-bed is now ready for sowing, it is protected on all sides by the slabs and roofed, tent fashion, with a calico cover that can be rolled up and tied to the ridge pole or let down to overlap the slabs and tied there in three minutes. Dig a trench round the seed bed sufficient to carry off any storm-water that might otherwise flood it.

To sow the bed, roll up the sheeting, water the bed moderately with a fine rosed watering can, syringe, or sprayer. Mix a teaspoonful of seed with 3 pints of dry wood ashes, then add other 3 pints of fine sifted earth moderately moist; mix thoroughly, sow thinly and evenly; press firmly with the back of the spade or a board; water sparingly, and let down the sheeting. Do not on any account allow the surface of the seed-bed to become dry again until the plants are well up. Water regularly night and morning, and, if you are obliged to use tank or well water, be careful to take the chill off it before using. If there comes fine gentle rain roll up the sheeting to admit it but keep the beds covered against heavy rain or too much of it.

To make certain of even sowing the bed may be lined or marked off into six equal portions, a pint of the seed mixture scattered upon each. It is of great importance that the seed should be evenly sown.

To make certain of the germination of the seed, or if anxious to raise plants quickly, mix the seed, ashes, and earth a week beforehand, put it into a tub or bucket, moisten it with warm water and keep it near the kitchen fire where it will be kept at a uniform temperature of about 70 or 75 degrees. As soon as it swells and a tiny white line is visible on the seeds it can be sown as directed above. This will be in about from four to eight days, according as the seed is new or old.

If cold, harsh, or dry winds prevail it will be well to close up the ends of the seed beds with boards or bagging.

Liquid manure should be substituted for water twice a week, it can be made by dissolving poultry droppings, or pig dung, or well rotted cowdung in a tank or barrel of water, with chamber slops, but it must not be applied too fresh or too strong and the thick sediment should not be used but the clear liquid only.

If the seedlings come up too thickly which they often do when the seed is good, and they meet with no mishap, thin them out and prick out the thinnings into a nursery-bed about 2 inches apart protecting them as in the seed-bed.

As an insurance against accidents sow a second seed-bed fourteen days after the first; you may not want more plants for replacing misses—mending as some planters call it, but it is much better to have them and not need them than to need them and not have them; it is better to be safe than sorry.

A very learned judge, whose decisions were rarely appealed against, used to say that that was because he delivered judgments but did not give his reasons for them; but it is good to be able to give a reason for doing certain things in a certain way, and the reasons for this elaborate manner of making a seed-bed are as follows :—

Make the seed-beds near the place where the plants will be wanted to save the labour of carrying them and the exposure of the seedlings to drying or wilting whilst being carried.

Make the seed-beds near the water supply to save labour in carrying water to them.

Make the beds not more than $3\frac{1}{2}$ feet wide for ease and convenience of weeding, thinning out and lifting them.

Make the beds 9 feet long because slabs, battens, or saplings can be more readily split or cut and more easily handled of that length than if longer.

Dig the ground a full spade deep that it may hold a sufficient reserve of moisture available for the plants by capillary attraction when hot dry weather comes.

Burn brush, &c., to cleanse the soil, kill weeds and their seeds, insects and their eggs, fungus germs and spores.

Chip in the ashes only 3 inches to avoid burying their fertilising goodness deeper than the roots of the seedlings can reach.

Work the soil very fine to enable the tender roots of the seedlings to penetrate easily in search of plant food and also to make it possible to lift them for planting out withaut breaking the roots.

Water freely to restore the moisture that has been burned out by the fire; water before sowing because if done afterwards the water will wash the seed which has been evenly sown into patches, and some of it down into the hollows and cavities in the earth so that it will be late in coming up and very irregular.

Press down the earth firmly and water sparingly after sowing to bring the seed into close contact with the soil.

Put slabs or boards round the bed to keep out the fly (*Nysius Vinitor*) and also the little beetle which Americans call the flea,

Cover with sheeting for the same purpose and also to keep out the maize moth and the little gray moth, to prevent them laying their eggs on the leaves, which eggs would afterwards become grubs feeding on the tobacco, and further to save injury from frost, and later in the season to screen the young plants from the sun's too powerful rays at midday, which, especially after a shower, is apt to scald the seedlings.

Nail the sheeting to the top rail to prevent its being blown about by the wind, and nail the batterns to the edge of the sheeting for the same reason and to make it easy to roll up or let down as circumstances require.

Use liquid manure to invigorate the plants, because strong, well-grown, plants resist disease better than weakly ones.

Thin out the seed-beds to give room to develop strong healthy plants.

And lastly, devote all this time and trouble to save the loss of much more time and worse trouble afterwards.

It is undoubtedly the fact that thousands of tons of tobacco have been grown in New South Wales in open seed-beds without much of the elaborate care that here is recommended, but it is also true that, although, the Colony has been growing tobacco after primitive methods for seventy-five years, she has never been able to make a shipment of any of her surplus crops to any open market, and it is also a fact that she is now importing one-third of her total consumption from America, which has neither soil nor climate equal to our own. But she has planters who have carefully studied the arts of growing and curing the tobacco, and have adopted every means and appliance, however costly, to reduce the risks incident to the crop, and to improve the market value of the product, by which means they have secured the monopoly of the world's supply of certain sorts of leaf. Surely it will be wise for us to improve our methods, for to make seed-beds in the ordinary careless way, to cover them with long grass, and water through it, is to waste time and to court failure, giving mildew, blue mould, slugs, crickets, and other vermin a first charge on our labour.

The proper time for sowing seed varies according to locality. On the Richmond River, nature appears to favour autumn sowing, self-sown seedlings from 2 to 4 inches high being plentiful in May, and as these are the progeny of plants that have maintained themselves for many years without any kind of care or cultivation, it is reasonable to suppose that they are hardy enough to live through the frosts of an average winter in that district.

If experience shall prove that cultivated plants can be raised successfully in the winter there are several advantages to be gained by winter sowing, inasmuch as the plants will get a fair start before the grubs and grasshoppers become very troublesome and the tobacco will ripen at a time when really fine weather may be reasonably expected for harvesting and curing the first crop. This matter deserves and requires careful systematic experiment at the hands of the growers.

On the table-lands, however, and in the south it is not advisable to sow too early as the earth is not sufficiently warmed for the plants to be set out with advantage, until fully the end of August or begining of September. The great point to be gained is that the plants shall receive no check from start to finish. Young vigorous plants, set out under favourable conditions, should make rapid growth and early maturity. The longer the crop is in the ground the longer its exposure to the attacks of its enemies, insect and fungus; every check it receives weakens it and renders it more liable to disease.

In every locality there are special conditions which govern the time of sowing, these are best known to the older residents in each district and there are very few districts in the Colony which have not amongst their older inhabitants some who have had tobacco-growing experience.

Practical Vegetable Gardening.

Directions for the month of September.

In many parts of New South Wales the weather begins to get warm during September, and plants start into active spring growth during this, the most beautiful period of the year. If the ground has been properly prepared as recommended last month, by having it well drained, well dug, and broken up, and, if considered necessary, well manured with rotten dung, there will be but little other work to do beyond sowing seeds of the various kinds of vegetables it has been decided to grow, according to the suitability of climate, for it will not be advisable to sow seeds of tender vegetables in cold, late districts, which, at the same time, may be sown without fear in the warmest parts of the Colony.

It is strongly recommended that advantage be taken of the time of year to sow seeds of as many different kinds of vegetables as possible, and not to stick to one thing, such as the universal cabbage; for, although this particular vegetable is good and wholesome, it may, occasionally, with advantage be changed for something quite different, for instance, peas, French beans, and others.

Make it a rule to sow or plant in rows; to keep the rows equally distant apart, and always to use a line.

Arrowroot.

If you have sufficient space in your vegetable garden, plant out some tubers of arrowroot, provided your locality is in one of the warm districts of the Colony. This plant may be seen in patches in many gardens growing without the slightest care, and probably no use is made of it, possibly for a want of knowledge as to how to obtain the starchy matter from the roots. There should be no difficulty in making excellent arrowroot, for all that is needed is a good supply of clean pure water and a rough grater. The latter can be made from a side of a kerosene tin, bent into a half-circle, and nailed on a board; but before nailing on the board, knock as many holes through it as you can with a large nail or the sharp end of a file. The writer has used such graters frequently, and they answered admirably for grinding up the roots into a pulp. When sufficient pulp has been ground up it should be allowed to soak in water for some time, then rubbed about and strained on a fine sieve. The arrowroot will sink to the bottom of the water, which may then be poured off. Frequent washings will be necessary before the starch is sufficiently clean and white for use. It should be spread out on clean cloths in the sun to thoroughly dry, after which it can be put away in bottles or jars until required for use. Children can very soon learn how to manufacture arrowroot suitable for home use. The writer used to make quantities before he had attained the age of ten years. The best kind of arrowroot is made from a small-growing plant, *Maranta arundinacea,* which grows to a height of about 2 feet. This plant is not very plentiful in this Colony, and requires a warmer climate than the arrowroot, *Canna edulis.* Either of these had better be planted about the end of the month.

Beans, kidney or French.

A most useful, prolific, and easily grown vegetable, the seed of which should not be sown until frosts are all over. The ground should be well dug and made as level as possible. If artificial manures are used, those containing a large per centage of ammonia or nitrogen, such as sulphate of ammonia, guano, nitrate of ammonia, blood manure, or soot should be avoided, but superphosphate of lime, and potash, old lime rubbish, lime, gypsum, and bone-meal may be applied with every chance of their improving the yield of the beans. The seed should be sown in rows 2 feet 6 inches or more apart. Make drills about 3 or not more than 4 inches deep and drop the seeds along the bottom of the drills, 4 or 5 inches apart, cover with fine soil and firm down with the back of a spade. Seed, as a rule, is sown too thickly together, and the beans have not sufficient space to grow properly. Two rows of dwarf beans, 15 to 20 feet in length, will be quite sufficient to sow at a time. In about two weeks after sowing put in two more rows, and so on, in order to keep up a continuation of this excellent vegetable. It is advised to grow the dwarf kinds only, for the runners need to be supported, and this always takes considerable time and trouble, which might be better expended on other vegetables.

In the United States of America considerable attention is given, at the Government Experimental Stations, to the testing of varieties of beans, and authentic reports as to their respective merits are published from time to time. If it be possible, similar work may be done with various kinds of vegetables in New South Wales in connection with the Department of Agriculture, and doubtless such good work will prove of considerable value to all who cultivate them.

Bean, Lima.

This should be treated in the same manner as the kidney bean. The seeds, either in a green or dried state, are used, and not the pods. There is a tall growing runner variety, and also a dwarf; the first named bears the best beans. Sow the seeds wider apart than those of the French or kidney bean.

Beet, Red.

Sow a little seed of this useful vegetable in drills 1 foot or 18 inches apart, not deeper than 1 inch. As the seed takes some time to germinate or come up, it can be started into growth if put between damp flannel, or damp bags, in a warm place. As soon as the shells begin to burst, sow in the drills, and then water before covering with soil. As soon as the water has soaked into the soil cover up. Mark the ends of the rows with short sticks so that you can tell, when weeding the beds, where the plants shall come up.

Fresh manure should not be used for this vegetable.

Beet, Silver.

Manure the ground well for this vegetable, in order to induce the growth of good succulent leaves, for the leaves only are used, and not the root, like the red beet. A single row a few feet in length will be sufficient if the plants are well cultivated and sometimes supplied with a good soaking of liquid manure, made from the droppings of animals.

Cabbage.

Sow a little seed in a seed bed. Make little drills about a quarter of an inch deep with your finger, sow thinly, and cover with fine soil. Then get some old, dry cow-dung, break it up fine and scatter over the surface about a quarter or half an inch deep. This will be found exceedingly useful also for any other kinds of vegetable seeds. It acts as a mulch, and prevents the evaporation of moisture, when sometimes, and not infrequently, necessary watering is forgotten. Do not aim to grow immense cabbages, which are suitable only to feed to cattle, but grow small and medium sized kinds, which are much more palatable and better flavoured.

Plant out some young cabbages, if you have any large enough to transplant, to a well-dug, well-drained, and well-manured bed. Use a good dressing of dung, if possible well rotten. Plant in rows about from 2 to 3 feet apart according to richness of soil. If the weather is dry, water the cabbages well as they grow, and also give them occasional supplies of liquid manure. Cultivate frequently between the rows, and keep the plants quite free from weeds. The more cabbages are hoed between the better they will grow. They prefer a rather stiff soil, but will thrive with a little care and plenty of manure almost anywhere.

Cauliflower.

Will succeed best at this time of year in the coolest districts of the Colony. Follow the directions given for the cabbage. Plant out a few plants, and also sow a little seed in the seed-bed.

Carrot.

A useful vegetable for many purposes in cookery. Sow a few rows of the short as well as medium and long varieties. The ground should be dug up deeply, but not freshly manured. The best kind of soil for the carrot is a fairly rich, sandy, loam, well drained. The rows shall be about 1 foot to 18 inches apart. Be careful to separate the seeds before sowing, and cover them with about half an inch, to an inch, of fine soil. As the seed generally takes a long time to come up, care must be taken that the tender young seedlings are not crowded out by weeds.

Celery.

Sow some seed in a small seed-bed or box. The soil should be made very fine. If sown in a box take care to make holes in the bottom of the box, put in a layer, about 2 inches deep, of broken stones, crockes, charcoal or something similar as drainage, before putting soil into the box. Make little drills with your finger, as straight as you can, and sow the seed, which is very small, as thin as possible. Cover with fine soil, and spread broken up, old, very dry cow-dung. As the plants come up thin them out if they appear to be growing too close together. When they are about 2 or 4 inches high transplant to a well prepared small bed. Plant about 4 inches apart, so that they can grow into strong little plants for further planting out into trenches later on.

Cucumber.

In the warm districts seed may be sown towards the end of the month. The ground shall be thoroughly well dug up, well manured, and well drained. It is a general custom to make holes about 3 feet or so in diameter, and manure the holes, but it would be a much better practice to manure the whole bed set apart for the cucumbers. The plants may be raised in a seed-bed or box, and afterwards transplanted when their second leaves have grown.

This is, perhaps, better than sowing in the garden and more certain, but it takes a little more trouble. If the seeds are sown in the garden, put in at least half a dozen seeds in each place where the plants are to grow, and if all the plants come up they can be thinned out to one or two, and those thinned out planted in some other place if needed. It is always better to sow a good many cucumber seeds, as they are generally unreliable, and numbers fail to germinate. Although special holes need not be made for the purpose of being manured if the whole bed has been prepared as above suggested, it would be well to make shallow depressions or basins an inch or two deep in which to sow the seed, for this will be of assistance if watering the plants should be necessary.

Endive

Is a kind of chicory used as a salad generally, although it may be cooked as spinach. It is a good wholesome vegetable, but is not used as much as it deserves to be. It is a rather tender plant, being a native of the East Indies, and is consequently most suited for the warm coast districts of the Colony. Seed may be sown this month in a warm corner where frost cannot attack it. When the seedlings are large enough to handle they may be transplanted to a well-manured bed. Plant out in rows about 15 inches apart, and let the plants stand about 1 foot apart in the rows. Keep down weeds, and when the plants have grown to a good size tie up the leaves together in order to blanch, or make white, the inner leaves. All the plants need not be tied up at the same time, but a few now and then, as they are likely to be required for use.

Leek.

A most useful vegetable, and exceedingly wholesome, generally used in soups, but excellent boiled and served with white sauce. The plant is a most greedy feeder, and needs plenty of manure, in fact it may almost be grown in manure. The best kind of soil for the leek is a sandy loam, moist, but well drained, but it will succeed well on almost any kind of soil if it be well manured. The seed should be sown in a seed-bed, and when the plants have attained a height of 6 or 8 inches they may be transplanted to a bed that has been well dug and heavily manured. Plant deep in rows 18 inches apart, the leeks to be put in about 9 inches from one another. Water well, and from time to time apply liquid manure. The thick stems are generally blanched by "earthing up" the soil about each plant some time before they are required for use. A little experience will soon show the length of time required to blanch them.

Lettuce.

A most useful vegetable for salads. The seed is generally sown in seed-beds in a similar way to cabbage, but at the present time of year it is preferable to sow where the plants are intended to remain. Sow in shallow drills about 18 inches apart. When the seed comes up thin out the scullys to about 1 foot apart. The ground should be well manured with rotten dung, and as the plants grow give them frequent applications of liquid manure.

Melons, Rock.

Seed may be sown in warm districts, in the same way as was directed for cucumbers.

Melons, Water.

Sow seed also as above, but the plants must be allowed considerably more space.

Okra or Gumbo.

A vegetable bearing a succulent, gummy, or mucilaginous pod, which is used for thickening soups. Suitable for warm climates. Sow seed in a box or seed-bed, and when the plants are large enough to move shift them to a well-manured bed. Let the plants stand about 2 feet apart each way.

Onions.

A good supply of this vegetable is very desirable. The ground should be heavily manured with well-rotted dung. Take care to drain well and make the surface soil as fine as possible. Light, rich, sandy loam is best suited for the onion. Besides rotted dung, soot, blood-manure, ashes, and bone-meal may be used with good effect. Soot mixed with coarse salt is exceedingly useful as a top dressing when the onions have attained some size. Sow the seed in rows 6 inches to 2 feet apart, according to the size of onion it is required to grow. The seed should be merely covered with fine soil, in fact, hardly covered at all. When the plants are an inch or so in height thin them out and transplant, if you like, to another bed. Keep as free from weeds as possible, and stir up the soil occasionally between the plants.

Parsnips.

Sow a few rows in just the same way as was advised for carrots. They are very deep-rooting plants, and the soil be dug to a considerable depth.

Peas.

A few rows should be sown from time to time, especially in the cool parts of the Colony.

Pepper (capsicum).

A plant or two is all that will be needed in a small home garden. The seed may be sown in a box, and the seedlings transplanted when they are a few inches in height. They come to the greatest perfection in the warm climates.

Potato.

Every garden should have a few rows of potatoes if possible. Manure the ground heavily with dung, drain well, and dig deep. Use medium-sized, sound potatoes to plant. Discard small ones altogether. If you can only obtain large ones cut them into two or three sets, and let them dry a little before planting in wood ashes and a little lime or dry soil. Make the rows 2 feet 6 inches apart or wider, and plant the potatoes about 6 or 8 inches deep in the soil, 1 foot from each other in the rows. The best varieties are, Brownell's Beauty, Early Rose, and Kidney.

Pumpkins.

Sow a few seeds in ground to be prepared as for cucumbers, using plenty of dung. Sow the seed 6 or 8 in a hole; the holes to be about 8 feet apart, or even more.

Rhubarb.

The present is a good time to sow seed of this vegetable. Roots are generally obtained to plant out and time is thus saved, but in many localities it is difficult to obtain roots when they are required. Sow in drills in a seed-bed, and when the seedlings are large enough to handle transplant to a well dug and manured bed, where they may remain until large enough to plant in their permanent places. There is no necessity to sow much seed, as a dozen plants will suffice for an ordinary family.

Tomato.

Seed may be sown in the open ground in all the warm districts. The best plan is to sow the seed in a box or seed-bed and transplant the young tomatoes when they are large enough to move. Dig the ground well, but there is no occasion, unless the land is very poor, to apply much manure. This vegetable should on no account be forgotten, for it is useful for a variety of purposes. The small fruiting kinds are perhaps the best to grow, as their fruit has a better flavour than the large varieties. The latter are the most ornamental and useful for marketing purposes, perhaps because appearance only seems to be the general guide in the purchase of such things.

Turnips.

Sow a few rows in drills about 18 inches apart on well-manured ground. It is customary to sow turnips broadcast in vegetable gardens, but this is a mistake, for they can be better attended to, weeded, and thinned if sown in drills. Do not cover the seed with more than half an inch of fine soil.

Vegetable-marrow and Squashes.

Sow seeds in the warm parts of the Colony. The sowing will be the same as that recommended for cucumbers.

General Notes.

Honey-yielding Plants.

With a view to preparing a record, the Consulting Botanist (Mr. J. H. Maiden) will be glad to receive flowering specimens of the plants (indigenous or introduced) found to be the best yielders of honey. These should be, accompanied by notes on the plants from the point of view of the bee-keeper, such as the season of flowering, when and how often the bees visit the flower and other points of importance in such a connection. On receipt of these specimens the plants will be named, and together with the above-mentioned information, will be permanently recorded, such record being available for publication in the *Gazette* when deemed advisable in the interests of bee-keepers.

Storage of Maize.

A sample of maize was sometime since submitted to the Department which was described as having been kept for twelve months in an air-tight tank. It appears that the weevil was in the maize before it was stored but "after tanking there was no further damage." The air in the tank was exhausted by means of a candle. This sample was placed in a glass jar in order to see if any weevils came out of the grains after being exposed to the air, and on a subsequent examination it was found that over one hundred weevils were in the jar which had come out of the maize. It will, therefore, be seen that although the actual destruction may not go on while the maize is stored in an air-tight tank from which the air is exhausted by means of a lighted candle, such storage certainly does not destroy the weevil. It would, therefore, be advisable not to rely solely upon such means, and would be much cheaper in the end to ensure the death of any weevils which may be in maize intended to be stored by the use of bi-sulphide of carbon. This method is fully described in the *Gazette*, Vol. II, page 809.

Transportation of Sugar-cane.

In view of the proposed arrangements for carrying sugar-cane on the Lismore-Tweed Railway, the Department, at the request of the Byron Bay Society, have obtained from America particulars of the methods of transport adopted there. Replies have been received from Messrs. Oxnard and Sprague, of the Cypremort Plantation, Louisiana, and from M. W. C. Stubbs, Director of the Sugar Experiment Station at New Orleans. In both instances the information is the same. The cane is brought in waggons to the railway-yards. The waggons are driven up an incline on to a dumping platform where they discharge their loads and drive off. The platform is raised at one end by a wheel and pulley worked by one mule, and the load slides into the open car underneath. These cars have upright movable sides, and only one man is required in the car to adjust and straighten the cane after each load. On reaching the sugar house the cars are run alongside of the carrier and the entire load emptied by slow process so as to spread it evenly on the moving carrier. These cane cars carry about 15 tons, and the cost of transportation on railroad within 100 miles is 60 cents (2s. 5d.) per ton. There are a number of factories in the State which draw their supplies of cane from long distances—one over 200 miles.

Sorghum at the Hawkesbury College.

The Principal sends the following particulars of a crop of sorghum sown in December last on the College farm: "It was sown in drills with 3 cwt. of the Sugar Company's superphosphates to the acre. Notwithstanding the destructive hail-storm on the 18th January, when the sorghum was about 10 inches high, it grew splendidly, and attained a height of from 14 to 15 feet, and yielded about 25 tons to the acre. The land was thoroughly worked, and the weeds kept down with the horse-hoe during the period of growth. The area of the crop was 9½ acres. One hundred and sixty tons of this fodder, including some late maize destroyed by the storm in January, has been put away in fine condition into an ensilage pit, scooped out with a team of horses in a few days, the earth again put on the fodder with the scoop and brought to a peak to throw off the water. Supposing the average of the whole crop was 20 tons, few animals will consume more than 56 (fifty-six) pounds of silage per diem. Thus 1 acre will keep a cow 800 days, or with 2 tons of hay there will be ample food for three milch cows per acre per annum."

Sugar-cane from New Guinea.

The determination of the Queensland Department of Agriculture to obtain cuttings of sugar-cane from New Guinea, induced this Department to ask that a similar quantity might be obtained for New South Wales. This the Queensland Department willingly agreed to undertake, and as a result a consignment of New Guinea cane sets in splendid order has been safely received. They were collected in New Guinea by Mr. E. Cowley, Director of the Kamerunga State Nursery, Cairns (Q.), to whom the department is much indebted for the care and trouble which has insured so valuable and successful a shipment. The canes are of entirely different varieties to those growing in our sugar districts, and it is confidently expected that good results will follow their introduction. Their names are Arbora, Oiva, Mahoaovu, Chenoma, Mabuan, Na Oe, Moo Moo Boku, Ooraya, Iduari, Kikeria, and Batoe. The Colonial Sugar Company have agreed to take charge of these cuttings and grow them in their nursery on the Richmond River, they undertaking to supply the Department with cuttings from the plants. These cuttings will be distributed in due course, so that they may become disseminated throughout the cane-growing districts, when it can be ascertained for which particular district each variety is best suited. Every precaution has been taken to prevent the spread of insect or fungus pests in connection with these cuttings.

New California Fruit-grader.

The Department recently obtained from Messrs. Mosher, Chandler, & Co., of San Francisco, one of their latest pattern orange-graders with a view to giving fruit-growers in this country an opportunity of seeing it at work. The machine which is designed for grading ten sizes, was set up in the offices of the Department, and its working was exhibited and thoroughly explained by Mr. Benson, the fruit expert, to a large number of fruit-growers and business men who attended. The capacity of this particular machine is 25 tons daily. It can be worked either by means of a treddle or engine power. The fruit, after having been allowed to remain in the packing boxes from 3 to 6 days, is poured into the tray, and passes along into the narrower portion of the machine, on one side of which is an endless india-rubber band running from end to end of the machine. Parallel with this band is a graded roller which, in the case of the machine obtained by the Department, is reduced *seriatim* nine diameters. The largest diameter being at the beginning it will be seen that the smallest oranges drop into the first shoot, the next size into the second shoot, and so on until the very largest run right over the end into the receptacle provided. This roller turns slowly from the fruit, keeping it tight and not allowing it to seek the spout until there is ample room, thus guarding any possible injury to the ripest fruit. There is a properly protected shoot under each diameter so that the fruit drops uninjured into the cases placed for its reception. It should be mentioned that this grader can be adapted for many other fruits, and in view of its large capacity could be utilized on the co-operative principle. The agents for Australia are Messrs. Barron, Moxham, & Co., of Sydney, from whom all particulars may be obtained. It is hoped shortly to publish a drawing clearly showing the style of the machine and its method of working.

National Prize for Champion Orchards.

The report of the Judge (Mr. A. H. Benson) on the orchards entered for the Champion National Prize has been received and duly submitted to the Minister for Mines and Agriculture. In accordance with the Judge's recommendation the Minister has approved of the Champion Prize being awarded *pro rata* between Mr. W. G. Middlemiss, of Moona, Deniliquin, and Mr. J. C. Symons, of Tumudgerie Orchard, Deniliquin.

It is a fact worth remarking that, notwithstanding the entries came from all parts of the Colony, the comparatively new fruit producing district of Deniliquin should possess two orchards of such high merit.

National Prize—Oil Yielding Plants.

In connection with last year's National Prize Competition a new departure was made with a view to stimulating farmers to adopting a wider range of products. In this connection a prize was offered for the "best acre of commercial oil yielding plants." There was unfortunately only one competitor who entered, the particular plant grown being the earth or pea-nut (*Arachis hypogæa*, Linn.) This plantation has been inspected by the Judge appointed for the purpose (Mr. E. Seccombe, of Wollongbar, Richmond River), who recommended that a second prize should be awarded to the competitor, Mr. Shem Bartlett, of Rous, Richmond River, and this recommendation has been duly approved by the Minister for Mines and Agriculture.

AGRICULTURAL SOCIETIES' SHOWS, 1893.

Society.	Secretary.	Date of Show.
Condobolin P. and A. Association...	A. James	Aug. 1, 2
Corowa P., A., and H. Society	A. A. Piggin	Aug. 2, 3
Narrandera P. and A. Association	J. F. Willans	Aug. 2, 3
Forbes P., A., and H. Association	W. G. Dowling..	Aug. 10, 11
Grenfell A. and H. Society	G. Cousins	Aug. 16, 17
Horticultural Society of N. S. Wales	E. S. Sawtelle...	Aug. 23, 24
Northern Agricultural Association (Singleton)	C. Poppenhagen	Aug. 23, 24
Burrangong P. and A. Association	C. Wright	Aug. 24, 25
Cootamundra A., P., H., and I. Association	T. Williams	Aug. 30, 31
*Moama A. and P. Association	C. L. Blair	Sept. 5, 6
*Murrumbidgee P. and A. Association (Wagga)	H. T. Davidson	Sept. 6, 7
Albury and Border P., A., and H. Society	G. E. Mackay...	Sept. 13, 14
Burrowa P., A., and H. Association	J. H. Clifton	Sept. 14, 15
Junee P., A., and I. Association	M. H. Davis	Sept. 20, 21
Yass P. and A. Society	B. A. Nicholls...	Sept. 20, 21
Germanton P. and A. Society	G. V. Rahn	Sept. 20, 21
Upper Manning A. and H. Association (Wingham). (Spring Flower Show)	P. Doust	Oct. 24.

* These Societies get District National Prizes.

Report on the Condition of Growing Crops.

TABLE showing Average Condition of early sown Wheat, Barley, and Oats.

1st July, 1893.

100 representing a perfect crop, in condition or quality of growth, &c.

	Early Wheat.		Barley.	Oats.
	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.
North Coast Counties—				
Clarence...	*	*	57	55
Dudley	*	*	*	70
Fitzroy	*	*	*	*
Macquarie	115	100	97	100
Raleigh	*	*	80	90
Richmond	*	*	*	*
Rous	*	*	65	77
Averages	115	100	74·75	78·4
Central Coast Counties—				
Durham...	90	80	77	*
Gloucester	107	77	78	67
Northumberland	95	81	73	78
Averages	97·3	79·3	76	72·5
South Coast Counties—				
Auckland	80	†	70	77
Camden	*	*	80	90
Cumberland	†	80	75	80
Dampier	*	*	90	90
St. Vincent	80	†	*	*
Averages	80	80	78·75	84·25
Table-lands, North—				
Arrawatta	45	53	67	61
Buckland	80	†	70	77
Buller	*	*	*	*
Clarke	92	82	*	*
Clive	80	100	*	100
Gough	81	81	90	88
Hardinge	40	55	*	*
Inglis	100	95	*	*
Parry	75	80	*	*
Sandon	49	51	80	90
Averages	71·3	74·625	76·75	83·2

Condition of Growing Crops—1st July, 1893—*continued.*

	Early Wheat.		Barley.	Oats.
	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.
Table-lands, Central—				
Bathurst	113	91	95	90
Brisbane	91	78	91	75
Cook	100	90	90	85
Georgiana	102	87	85	89
Hunter	105	80	90	80
Roxburgh	105	85	80	85
Averages	102·6	85·16	88·5	84
Table-lands, South—				
Argyle	87	91	72	82
Ashburnham	110	87	92	79
Beresford	110	100	*	*
Buccleuch	102	92	80	95
Forbes	75	†	*	50
King	104	82	80	79
Murray	102	87	95	95
Wallace	100	97	100	97
Wellesley	115	90	100	90
Averages	100·5	90·75	88·4	83·375
Western Slopes, North—				
Burnett	80	70	70	...
Courallie	...	...	...	...
Darling	105	90	100	...
Denham	...	...	...	...
Gowen	100	70	*	*
Leichhardt	200	95	*	*
Murchison	48	82	95	95
Napier	...	...	...	...
Nandewar	126	92	75	79
Pottinger	173	83	78	75
White	110	97	*	95
Averages	117·75	84·85	83·6	86
Western Slopes, Central—				
Bligh	110	70	*	*
Cunningham	148	97	*	*
Gordon	110	85	*	75
Lincoln	95	90	100	*
Narromine	100	90	*	*
Averages	112·6	86·4	100	75

Condition of Growing Crops—1st July, 1893—*continued.*

	Early Wheat.		Barley.	Oats.
	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.	Average condition, 100 being the basis.
Western Slopes, South—				
Bland	105	77	90	75
Bourke	140	98	100	100
Boyd	120	90	*	*
Cadell	107	78	*	*
Caira	110	100	*	*
Cooper	120	87	85	85
Denison	139	94	98	99
Dowling	200	100	*	*
Goulburn	102	95	*	97
Harden	106	84	85	87
Hume	107	90	80	100
Mitchell...	105	97	100	100
Monteagle	103	85	100	100
Nicholson	125	97	100	*
Sturt	110	80	*	*
Townsend	155	83	*	*
Urana	130	90	60	97
Wakool	150	95	*	95
Wentworth	110	95	*	95
Wynyard	121	91	90	90
Averages	127·65	90·30	89·81	93·84

TABLE showing the Average Condition of early and late sown Wheats, Barley, and Oats.

1st August, 1893.

100 representing a perfect crop, in condition or quality of growth, &c.

	Wheat.			Barley.		Oats.	
	Early Sowing.	Late Sowing.					
	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.
North Coast Counties—							
Clarence	*	*	*	105	80	110	60
Dudley	*	*	*	*	*	30	90
Fitzroy	...	...	...	...	...	...	...
Macquarie	*	*	*	105	77	97	90
Raleigh	...	...	...	...	...	...	...
Richmond	*	*	*	50	†	50	†
Rous...	*	*	*	120	100	125	100
Averages	*	*	*	95	85·6	82·4	85

Condition of Growing Crops—1st August, 1893—*continued.*

	Wheat.			Barley.		Oats.	
	Early Sowing.	Late Sowing.					
	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.
Central Coast Counties—							
Durham	90	70	80	45	30	60	50
Gloucester	80	110	82	97	65	97	82
Northumberland	77	101	70	100	68	137	77
Averages	82·3	93·6	77·3	80·6	54·3	98	69·6
South Coast Counties—							
Auckland	*	*	*	100	80	102	80
Camden	75	100	75	100	100	91	87
Cumberland	85	102	78	100	90	95	93
Dampier	*	*	*	105	80	110	90
St. Vincent	*	*	*	*	*	†	70
Averages	80	101	76·5	101·2	87·5	99·5	84
Table-lands, North—							
Arrawatta	70	67	62	68	72	50	75
Buckland	...	...	...	...	...	...	...
Buller	*	*	*	*	*	*	*
Clarke	82	95	75	*	*	100	65
Clive...	70	70	†	*	*	120	†
Gough	80	94	80	100	85	97	85
Hardinge	100	*	*	*	*	*	*
Inglis	100	95	95	116	100	97	100
Parry	77	75	†	80	90	*	*
Sandon	68	109	70	110	70	97	†
Averages	80·8	86·4	76·4	94·8	83·4	93·5	81·2
Table-lands, Central—							
Bathurst	85	100	76	60	75	90	82
Brisbane	83	104	82	97	80	100	100
Cook...	90	100	90	100	85	100	95
Georgiana	81	94	75	85	90	102	85
Hunter	85	109	80	105	90	110	85
Phillip	95	100	95	90	100	100	100
Roxburgh	80	97	85	100	65	105	80
Averages	85·5	100·5	83·2	91	83·5	101	89·5
Table-lands, South—							
Argyle	75	90	72	102	87	110	72
Ashburnham	96	111	86	97	82	100	87
Beresford	100	110	100	*	*	100	100
Buccleuch	75	105	72	110	90	*	*
Forbes	100	105	100	*	*	85	85
King...	76	93	74	80	70	70	79
Murray	83	112	72	110	93	95	75
Wallace	90	155	90	150	92	112	98
Wellesley	60	110	90	...	...	...	...
Averages	83·8	110·1	84	108·1	85·6	96	85·1

Condition of Growing Crops—1st August, 1893—*continued.*

	Wheat.			Barley.		Oats.	
	Early Sowing.	Late Sowing.					
	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.	Acreage compared with last year, 100 being the basis.	Average condition, 100 being the basis.
Western Slopes, North—							
Burnett	...	...	...	...	...	...	...
Courallie	...	...	...	...	...	...	...
Darling	80	75	85	75	65	70	85
Denham	...	...	...	...	...	...	...
Gowen	...	...	...	...	...	...	...
Leichhardt	...	...	...	...	...	...	...
Murchison	77	70	77	105	90	100	90
Napier	...	...	...	...	...	...	...
Nandewar	97	200	97	100	99	100	100
Pottinger	81	200	100	87	87	65	60
White	95	...	...	*	*	110	90
Averages	86	136·2	89·7	91·7	85·2	89	85
Western Slopes, Central—							
Bligh	70	110	60	*	*	*	*
Cunningham	100	400	80	*	*	200	80
Gordon	95	105	95	*	*	*	*
Lincoln	75	125	75	110	50	115	50
Narromine	85	...	75	*	*	*	*
Averages	85	185	77	110	50	157·5	65
Western Slopes, South—							
Bland	75	122	85	...	...	...	...
Bourke	91	135	89	100	100	102	100
Boyd	90	120	80	*	*	*	*
Cadell	83	111	71	*	*	*	*
Caira	...	...	...	...	...	...	...
Cooper	90	160	80	...	...	...	...
Denison	85	80	80	...	...	85	90
Dowling	100	100	100	*	*	*	*
Goulburn	90	266	80	*	*	...	95
Harden	86	109	78	92	75	100	88
Hume	96	94	81	80	70	102	98
Mitchell	95	116	95	100	95	102	92
Monteagle	70	†	65	...	...	...	...
Nicholson	100	115	75	90	85	*	*
Sturt	...	...	...	...	...	...	...
Townsend	70	60	50	100	60	150	†
Urana	95	106	82	105	85	95	87
Wakool	95	150	85	*	*	100	90
Wentworth	...	...	...	...	...	...	...
Wynyard	87	117	79	80	75	99	84
Averages	88·1	122·5	79·7	93·3	80·6	103·8	91·5

* Indicates not raised in the County, or to so small an extent as not to be worthy of notice.
† Indicates an incomplete return. .. Indicates that the return has not been sent in.

[Four plates.]

Sydney: Charles Potter, Government Printer.—1893.

"The Agricultural Gazette."

NOTICE TO ADVERTISERS.

ADVERTISEMENTS will be received at this Office for insertion in *The Agricultural Gazette*, at the following rates, viz. :—

For each part of 4,000 copies—

	£	s.	d.
Full page - -	5	0	0
Half-page - -	3	0	0

The Government reserves the right to refuse to insert any advertisement.

All payments must be made in advance to the undersigned.

CHARLES POTTER,
Government Printer.

Government Printing Office,
Sydney, 1*st May*, 1893.