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DURBAN BOTANIC SOCIETY.

REPORT

ON

NATAL

Botanic Gardens

FOR THE YEAR 1897,

BY

J. MEDLEY WOOD, A.L.S.,

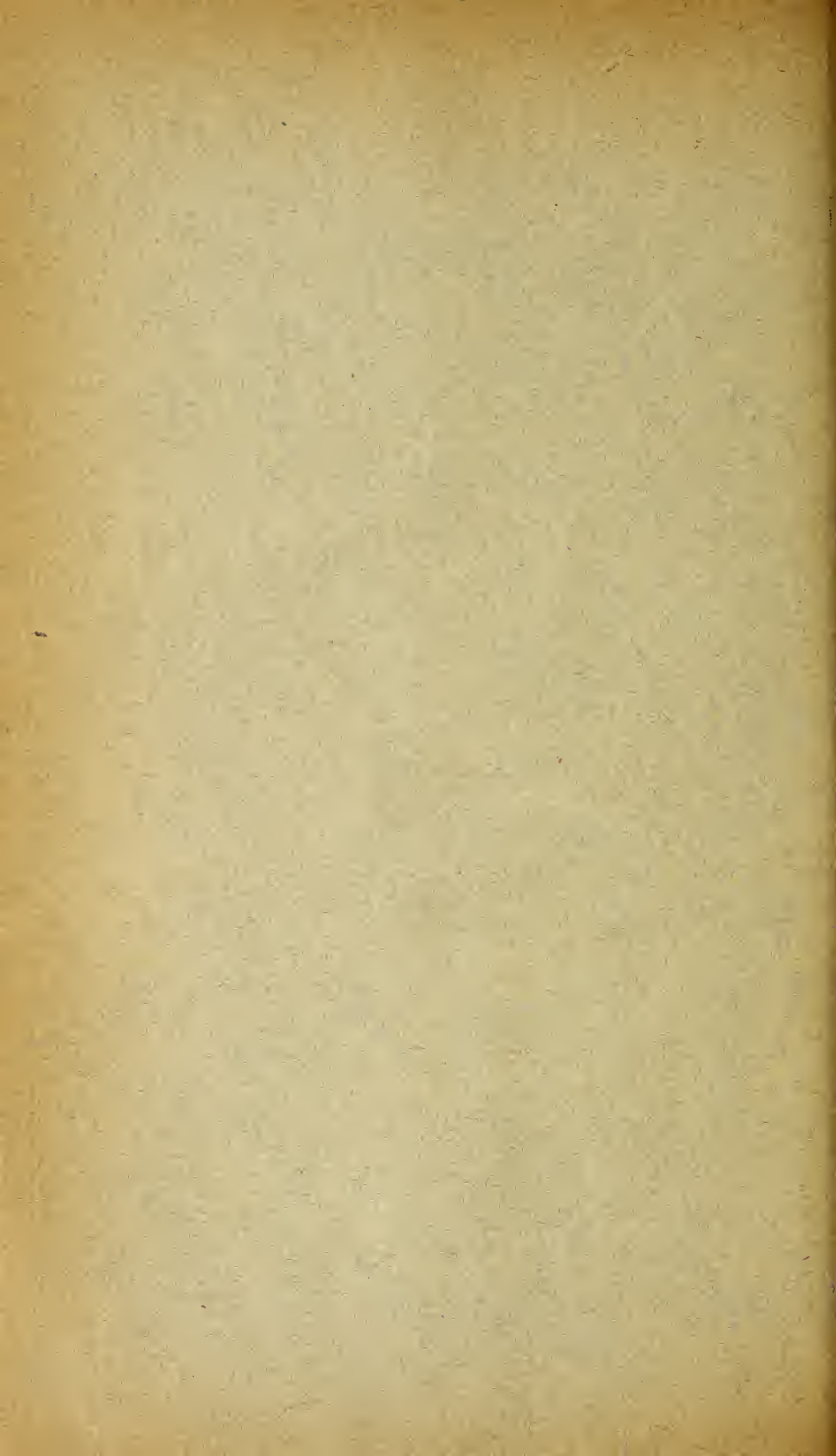
*Corresponding Member of the Pharmaceutical Society
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CURATOR.

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Durban Botanic Society.

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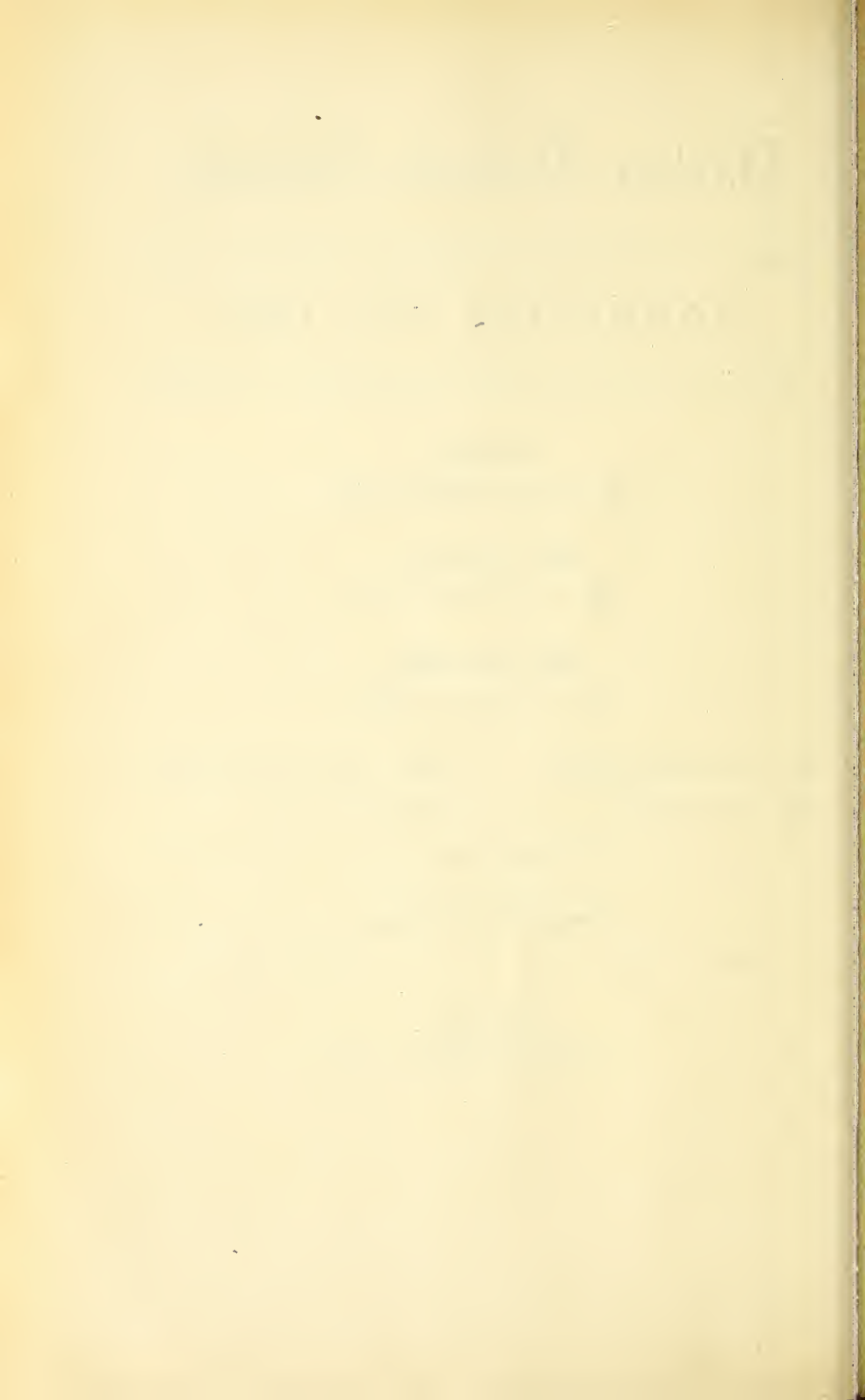
Government Members :

MR. J. S. STEEL.

MR. F. BUTTON.

Curator :

J. MEDLEY WOOD, A.L.S.



REPORT.



NATAL BOTANIC GARDENS,
BEREA, DURBAN, JANUARY 1898.

TO THE PRESIDENT AND COMMITTEE,
DURBAN BOTANIC SOCIETY.

GENTLEMEN,—

I have the pleasure of handing to you herewith this my sixteenth Annual Report on the Natal Botanic Gardens, and the work done in connection with them. I am pleased to be able to say that we have suffered no serious losses during the year, and that the plants both in Garden and Nursery are all that could be desired.

The year now ended has been a very busy one indeed, and the staff have been hard pushed to keep up with the work, especially during the latter part of the year, when native labour was almost unobtainable, and we had as many Indians as we were able to find accommodation for, so that for the first time in the history of the Gardens, which reaches back for 46 years, we have had to call in the services of a contractor with a gang of labourers to weed the ground, and do other necessary work. It is much to be hoped that this state of things will not be of long continuance. It has been suggested that Indians accustomed to the work should be obtained from India, and I hope that ere long this suggestion will be carried into effect.

In consequence of this great press of work and scarcity of labour, no alterations or other work of importance could have been attempted except as hereafter noted, though there are several things that will need to be taken in hand when opportunities occur, such as completing the fencing round the ground, hardening the main walks, clearing away superfluous trees, that is, those of which we have more specimens than necessary, such as the "Flatcrown" (*Zygia fastigiata*), Mangoes and a few others, thus affording room for planting out other and more valuable plants, some of which are already in stock and require attention.

The new Jubilee Conservatory, to the erection of which the Durban public have contributed so liberally, will we hope arrive by the end of February, and the ground where it is to stand has already been levelled by a contractor, with a gang of labourers, who has also widened and levelled the upper walk, which when the Conservatory is finished will probably be as much used as the present main walk, and it is our intention to plant on the upper side of this walk a row of Palms of different species, selecting, however, those only which have straight stems, and reach to a good height. I hope to be able to say in my next report that this work has been completed.

The forcing house which was erected during the year has proved a complete success, and we have been able to rear plants, that without it would have been a failure, such as *Theobroma cacao*, alluded to in another part of this report, and some others both useful and ornamental.

The "Guide" to the trees and shrubs in the Gardens has been found very useful, and by its aid visitors who take an interest in trees may spend hours in the Gardens with pleasure to themselves, and I venture to hope with some profit also. The copies are sold at 1s. each, which is below cost price, having regard to the comparatively limited demand, but a considerable loss was expected when it was decided to publish it, and I think that any loss which may accrue to the Society will be very fully compensated for by the increased pleasure given to intelligent visitors.

The gate at the entrance to the Gardens has become somewhat dilapidated, and it is intended to replace it with one of a more ornamental character, and I hope to see it in its place during the early part of the year. The Corporation have also been requested to improve the road in front of the entrance to the Gardens by widening and levelling it, as there has been already several accidents to rickshas, and I am in constant fear of a more serious one, especially when two persons in one ricksha are brought down the slope in front of the gate.

Additions have been made to the head gardener's house at the entrance to the Gardens, as it was not when built, intended for a family, but only for one or two single men; the additions were made at the close of the year, and were satisfactorily completed by the contractor. The Curator's residence has also received a coat of paint outside, and the inside portion will shortly require attention. It is satisfactory to know that the measures taken to keep out the white ants from the house have been quite successful, and since the first few months they have ceased to give any trouble.

If the suggestion to indent for Indian labourers is carried into effect it will be necessary to erect new quarters for them, and I would suggest that they should be located in the corner

of the Garden bounded by the Sydenham and Avondale Roads, an effectual fence being erected, so that their quarters shall be completely shut out from the Garden, as we have reason to know that some at any rate of the depredations in the Garden have been committed by our own labourers.

I regret to have to report that there has been several cases of depredation, chiefly fruit stealing, but occasionally plants have also been taken out of the beds, though nothing of any great value has been lost; still it will be necessary to make an example of some of the mischievous boys, who seem to take a delight in shifting and damaging labels, breaking off leaves, twigs, and flowers from the trees, and such like senseless practices.

A sub-committee has been appointed to revise the Bye-Laws, and when they are assented to by Government it is intended to have them painted on a board at the entrance, which will place us in a better position to check any infraction of them, as ignorance of the regulations cannot then be pleaded, as has been done on more than one occasion, when visitors have been checked for infringement of the rules.

An idea seems to be held by some people that the Gardens should do more of what they call scientific work, but I may be allowed to point out that the only botanical work yet done in the colony has been done in connection with the Botanic Gardens, and to refer enquirers to the reports on the Colonial Herbarium issued year by year in proof of it. What is actually required by many people, and what I feel that it would be desirable that they should have, is a series of experiments with different plants on such a scale as would give farmers an idea of the cost of producing a given crop, and the yield which might be expected from it; but such work as this cannot be done at the Gardens, and is really the work of an Experimental Station, and I have long thought it advisable that such a Station should be established; all that we can do is to import seeds and plants of economic value, and to report from time to time as to their suitability to the climate, and this is being constantly done, as a reference to my Annual Reports will at once show. I would point out that in the United States of America every State has its Experimental Station, and some of the States I think more than one; all are liberally supported, and regular and most valuable reports are distributed amongst farmers free on application, the whole of these reports being tabulated and arranged at a Central Station, so that information on any subject which has been taken in hand may be at once obtained.

I have received from England another importation of about 160 of the enamelled plant labels, but in consequence of the scarcity of labour already alluded to, they have not yet been

put into their places; I hope, however, that this matter will be attended to in the early part of the year. The trees and shrubs alluded to in the "Guide" and numbering 550, have all had a label either attached to them, or placed beside them, bearing a number corresponding with that in the "Guide," so that the plant can be referred to with ease; these labels are made of teak-wood about 3 inches by 4; the figures are large and easily seen. A writer in a local paper who visited the Gardens, and having apparently but a very vague idea of their use, likened the Garden to a country Church-yard, where the grave-sites are numbered in a somewhat similar way; had he purchased a "Guide" he would I think have altered his mind on the matter.

It is pleasing to know that at last one specimen at least of nearly every tree and shrub in the ground has either one of these labels or an enamelled label with the name attached to, or alongside it, and if any have been omitted the omission will be rectified as early as possible.

The catalogue of plants in the Gardens which was published in 1889, has now become almost obsolete, as since its publication a very large number of plants have been added to the collection, but I do not think it necessary to compile a new one at present, as the "Guide" includes virtually all the trees and shrubs, and in another year or two when the new Conservatory is filled, it may be advisable to compile a second Guide, to plants in Conservatory and Ferneries, and such other plants in the ground as are not included in the present work, and about which information might be of interest to the public.

PUBLICATIONS RECEIVED.

	NAME.	FROM.
Bulletin	Botanical Department, Jamaica ...	Director.
"	Agricultural Experiment Station, California, Nos. 116 and 117 ...	"
"	Agricultural Department, Malay Peninsula	"
Report	Royal Botanic Gardens, Trinadad ...	"
"	" " Hong-kong	"
"	" " Singapore ...	"
"	" " Calcutta ...	"
"	Botanic Gardens, Zurich	"
"	" " Graaf Reinet ...	Curator.
"	" " Mysore	Superintendent.

NAME.	FROM.
Report Botanic Gardens, Hamburg	Director.
" " " Saharunpur... ..	"
" " " Sierra Leone	"
" Cape Government Botanist	Prof. MacOwan.
" Albany Museum	Dr. S. Schonland
" Secretary of Agriculture, Nova Scotia	Author.
" Agricultural Experient Station, California,	Director.
Experiment Station Records, Vol. viii, Nos. 1-12.	
Vol. ix, Nos. 1, 2,	U.S. Government.
Agricultural Journal of Queensland... ..	E. Cowley.
Government crop Report, Nova Scotia	Sec. of Agric.
New Commercial plants and drugs, by Thos. Christy,	Author.
The Olive at the Cape, by Professor MacOwan	"
Cultural evolution of <i>Cyclamen latifolium</i> ,	
by Thiselton Dyer, F.R.S.	"
Plants reputed to be poisonous to stock in	
Australia, by J. H. Maiden	"
Anniversary address to the Royal Society of	
N.S.Wales, by the President, J. H. Maiden, F.L.S. ,,	
Die nomenclatur bewegung die letzen Jahre,	
by Dr. H. Harris... ..	"
Mayflower; current Nos.	Publishers.
Seed production and Seed saving, by A. J.	
Pieters	U. S. Government.
Superior value of large heavy Seed, by G. H.	
Hicks and C. Dubney	"
Year Book of Agriculture for 1896	"
Useful fibres of the world, by Chas. R. Dodge	"
Report on culture of Hemp and Jute by ,,	"
Grasses and forage plants of Iowa, Nebraska,	"
and Colorado, by L. H. Pammel	"
Notes from Botanic Gardens, Sydney	Director.
Catalogue of Drugs and minerals, by E. Mercke	Author.
Control of temperature in wine fermentation, University of Cal.	
Californian Walnuts, Almonds and Chestnuts	"
Bleaching nuts by dipping	"
Work of College of Agriculture	"
Remedies for Insects and Fungi	"
Californian Vine Hopper	"
Tree planting and the Rainfall, by A. Wilkinson	"
Prize Essays	Natal Agric. Soc.
Catalogue of plants in the Garden of Thos.	
Hanbury, by K. Dinter	T. Hanbury.

PURCHASED.

Gardeners' Chronicle. Tropical Agriculturist.
Farmers' Magazine.

Seeds were received during the year as under :—

	PACKETS.
Royal Botanic Gardens, Kew	63
" " " Jamaica... ..	1
" " " Grenada... ..	1
" " " Calcutta... ..	2
" " " Mauritius	9
Botanic Gardens, Bangalore	4
" " Sydney... ..	25
" " Najpur... ..	1
" " Madras	2
" " Melbourne	39
" " Baroda... ..	30
" " Buenos Ayres	5
" " Saharunpur	4
" " Port Darwin	15
Museum, Sydney	7
U.S. America Government Agrostologist ..	131
E. Cowley, State Nursery, Kamerunga, Queensland	2
Acclimatisation Society, Santa Barbara, California	23
Experiment Station Tarata, New Zealand ...	40
H. Dixson Esq., Sydney	1
F. Reisen Esq., Walhausen	100
Reasoner Bros., Florida	10
Max Cornu, Paris	1
A. Wagner, Germany	2
General Lowther, England	1
Dr. Thompson, Gazaland	7
M. Buysman, Holland	3
C. Grosse, Russia	40
Damman & Co., Naples	135
Dr. Penther... ..	1
H. W. Gittins	12
W. Armstrong, Port Elizabeth	1
R. W. Adlam, Johannesburg	4
Max. Leichtlin, Baden-Baden	2
Miss Crompton	4
Rev. C. H. Kilbon... ..	9
F. Button	2
W. W. Cato	1
Miss Rich	1
R. Jameson... ..	3
M. S. Evans	2
Jas. King	1
R. W. Adlam	4
C. A. Holwell	2
G. Thorncroft	1
J. A. Polkinghorne	24
Silberred & Sons, London... ..	1

	PACKETS.
J. Pegler	1
Forest Department, Zomba	4
Unknown	53
	<hr/>
Total	834

And the following plants were received:—

Royal Botanic Gardens, Mauritius.

6 <i>Cohnia floribunda</i> .	6 <i>Pandanus Eydouxia</i> .
4 <i>Hibiscus lillifloius</i> .	6 „ <i>Barklyi</i> .
2 <i>Trochetia uniflora</i> .	6 „ <i>spheroides</i> .
2 <i>Cyathea excelsa</i>	6 „ <i>drupaceus</i> .
2 „ <i>caniculata</i> .	6 „ <i>microcarpus</i> .
5 <i>Cycas carinalis</i> .	6 „ <i>montanus</i> (dead.)
7 <i>Ravenala madagascariensis</i> .	6 <i>Caryophyllus aromaticus</i> .
6 <i>Coffea liberica</i> .	1 <i>Dendrobium Dalhousianum</i> .
1 <i>Ouvirandra fenestralis</i> .	6 <i>Eugenia malaccensis</i> .
6 <i>Pimenta vulgaris</i> .	6 <i>Myristica moschata</i> .
6 <i>Theobroma cacao</i> .	6 <i>Spondias borbonica</i> .
1 <i>Antirrhæa verticillata</i> .	2 <i>Aphloia thaeformis</i> .
1 <i>Bombax edulis</i> .	1 <i>Carissa xylopicron</i> .
2 <i>Calophyllum inophyllum</i> .	2 <i>Diospyros tessellaria</i> .
3 <i>Dombeya punctata</i> .	1 <i>Doratoxylon mauritianum</i> .
1 <i>Dodonæa viscosa</i> .	1 <i>Diospyros chrysophylla</i> .
1 <i>Eugenia cotinifolia</i> .	1 <i>Erythroxyton laurifolium</i> .
1 <i>Olea lancea</i> .	1 <i>Eugenia glomerata</i> .
1 <i>Imbricaria maxima</i> .	1 <i>Olaæ psittacorum</i> .
1 „ <i>media</i> .	1 <i>Psiloxylon mauritianum</i> .
1 „ <i>petiolaris</i> .	1 <i>Randia heterophylla</i> .
1 <i>Tambourissa quadrifida</i> .	1 <i>Toddalea aculeata</i> .
1 <i>Trochetia triflora</i> .	1 <i>Fropiera mauritiana</i> .
4 <i>Eugenia malaccensis</i> .	1 <i>Trochetia Blacburniana</i> .
4 <i>Caryophyllus aromaticus</i> .	1 <i>Adiantum Farleyense</i> .

From R. Jameson Esq.—

A box of Orchids containg 23 plants, 5 of which were dead, and some unnamed.

In all 165 plants which will be reported upon next year.

During the year 1896, we received 1,029 plants, and 583 packets of seeds, which resulted as under:—

PLANTS.						
Dead on arrival ... ..	...	...	...	...	...	86
Died afterwards ... ..	...	...	...	...	...	20
Planted in Gardens, and Nursery	...	...	...	...	...	220
Still in pots... ..	...	..	...	...	...	200
Already in stock ... ..	...	...	...	...	...	503
						<hr/>
						1,029
						<hr/>

SEEDS.

Failed to germinate	...	...	...	...	126
Germinated but died afterwards	...	...	...	...	40
Distributed ..	...	...	...	...	146
Already in stock	...	...	...	...	151
Still in pcts...	...	...	...	...	100
Annuals and weeds	...	...	...	...	20
					583
					583

Packages of plants were sent away during the year as under:—

Royal Botanic Gardens, Kew	...	1 box containing	12 plants.
" " " Mauritius	...	3 cases	159 "
" " " "	...	1 box	52 "
Botanic Gardens, Port Darwin	...	1 "	33 "
" " Cambridge	...	1 "	10 "
" " Sydney, N.S.W.	...	1 "	10 "
" " Saharunpur	...	1 "	10 "
" " Madras	...	1 "	10 "
Experiment Station, Kamerunga, Queensland	...	3 cases	85 "
J. O'Brien, London	...	1 box	48 "
Damman & Co., Naples	...	1 "	36 "
Reasoner Bros., Florida	...	1 "	24 "
J. C. Harvey, California	...	1 "	24 "
Max. Leichtlin, Baden-Baden	...	1 "	10 "
General Lowther, England	...	1 "	10 "
M. Buysman, Holland	...	1 "	22 "
			Total 556 "
			556 "

Packets of seeds were sent away as follows:—

Royal Botanic Gardens, Trinidad	...	24 packets.
" " " Hong Kong	...	24 "
" " " Jamaica	...	24 "
" " " Grenada	...	24 "
Botanic Gardens, Saharunpur	...	24 "
" " Madras	...	24 "
" " Najpur	...	24 "
" " Sydney, N. S. W.	...	24 "
" " Paris	...	24 "
" " Hobart	...	24 "
" " Adelaide	...	24 "
" " Port Darwin	...	24 "

Experiment Station, Kamerunga, Queensland	24 packets.
L. Cockayne, New Zealand	21 „
Damman & Co., Naples	21 „
Reasoner Bros. Florida	21 „
Schaff, Shorting & Co.,	21 „
M. Buysman, Holland	21 „
Max. Laichlin, Baden-Baden	12 „
J. C. Harvey, California	21 „
Dr. Franceschi, California	21 „
General Lowther, England	6 „
A. Wakefield, Verulam	12 „
De Pass & Co., Reunion Estate	1 „
Trapa bispinosa to 5 applicants	5 „
	495 „

And one box of seeds in quantity to Germany.

Sweet potato tops to 4 applicants, and dried leaves of *Monsonia biflora* to 8 applicants, in all 19 pounds weight of the plant when dry; two of the applicants were outside the colony.

Plants have been supplied free during the year as under:—

Railway Station, Newcastle	£1 4 0
Episcopal Church, Eshowe, Zululand ...	2 5 0
Government School, Addington	2 7 0
Durban Hospital... ..	2 2 6
Jewish Cemetery, Durban	2 3 0
Wesleyan Cemetery	2 10 0
Church Ground, Illovo	1 4 0
	£13 15 6

The following were planted out during the year—

<i>Alpinia spicata</i>	received from	Mauritius.
<i>Amaryllis aulica</i>	„ „	Sander & Co.
<i>Asteracantha longifolia</i>	„ „	Damman & Co.
<i>Bocconia frutescens</i>	„ „	„
<i>Crinum sp.</i>	„ „	Sander & Co.
<i>Haemanthus Kalbreyeri</i>	„ „	Madras.
<i>Hedychium flavescens</i>	„ „	Mauritius.

The following plants of interest have flowered in the Gardens during the year, most of them for the first time.

<i>Albuca Nelsoni</i>	received from	Mr. Nelson.
<i>Angraecum carpoporum</i>	„ „	Mauritius.
„ <i>pectinatum</i>	„ „	„

<i>Asteracantha longifolia</i>	received from	Damman & Co.
<i>Bulbophyllum prismaticum</i>	„ „	Mauritius.
<i>Canas</i> , 20 new varieties	„ „	Damman & Co.
<i>Cattleys Leopoldi</i>	„ „	Sander & Co.
<i>Castanospermum Cunninghamii</i>	„ „	?
<i>Cecropia peltata</i>	„ „	Damman & Co.
<i>Cereus nycticalus</i>	„ „	Adelaide.
<i>Crhysobalanus icaco</i>	„ „	Kew.
<i>Citharexylum</i> sp.	„ „	M. Colpepper.
<i>Clusia rosea</i>	„ „	?
<i>Convolvulus floridus</i>	„ „	Kew.
<i>Dendrobium bigibbum</i>	„ „	H. Dixson.
„ <i>fimbriatum</i> . var	„ „	Madras.
<i>Ficus repens</i>	„ „	„
<i>Gleditschia japonica</i>	„ „	Kew.
<i>Haemanthus Kalbreyeri</i>	„ „	Madras.
<i>Hovenia dulcis</i>	„ „	Saharunpur.
<i>Hura crepitans</i>	„ „	India.
<i>Kirkia acuminata</i>	„ „	G. Thorncroft.
<i>Lysiloma sabicu</i>	„ „	Kew.
<i>Melaleuca genistifolia</i>	„ „	Melbourne.
<i>Melia azadirachta</i>	„ „	Calcutta.
<i>Monetia barlerioides</i>	„ „	Kew.
<i>Myristica surinamensis</i>	„ „	„
<i>Nandina domestica alba</i>	„ „	Damman & Co.
<i>Nuxia floribunda</i>	„ „	Collected.
<i>Ochrosia elliptica</i>	„ „	Kew.
<i>Rhynchospermum reptans</i>	„ „	Calcutta.
<i>Schubertia grandiflora</i>	„ „	Sander & Co.
<i>Sterculia discolor</i>	„ „	Bull.
<i>Zingiber d'Arceyi</i>	„ „	Sander.

FIBRE PLANTS.

Boehmeria nivea. Rhea or Ramie.

A parcel of seed of this plant was received from the Commissioner of Agriculture with the request that we should test it and report on the result; the seed proved to be perfectly good, and we have a few plants which will be available for distribution in the spring; the remainder of the seed was returned to Agricultural Department; I may say that I have little hope of this plant being a success commercially in the colony, as in some other countries three or even four crops may be reaped in in the season; in Natal I think that two are as many as we could fairly expect to get, which would place us at a considerable disadvantage in competing with more favourably situated places, where heavier crops could be got, and where labour is more plentiful and cheaper.

Furcraea Lindeni.

Two plants bearing this name have been in the Gardens for more than 12 years; the species is closely related to *F. gigantea*, which is the plant yielding what is known as "Mauritius Hemp," and the leaves of our plants contain a fibre which cannot I think be distinguished from the Mauritius Hemp of commerce, and in as large a quantity; our plants have attained a large size, each of them having at least 150 leaves, but what is most singular is the manner of inflorescence; instead of what is called "polling," that is sending up a large flowering stem from the centre of the rosette of leaves, our plants have thrown out a number of small, but long flowering stems from the axils of the lower leaves, and from them produced flowers and seeds in abundance; the growth of the plants being therefore not stopped by "polling," it will be interesting to know how long they will continue to bear leaves fit for cutting, and how high the trunk will reach. I had photos of these plants taken by Mr. Middlebrook, and have sent a short account of the plants to the Gardeners' Chronicle, and also to Kew Gardens, in each case accompanied with photos; the Director of Kew Gardens asks for botanical specimens to be sent, and this request will be complied with as soon as possible. Though this plant yields fibre as previously noted, it has the disadvantage of bearing a few prickles on the edge of leaves, which would perhaps render them difficult to handle. Mr. Watt of the Umgeni Fibre works kindly offered to put some of the leaves through the machine, so as to test the yield, but we have been so busy, and so short of labour that we have not yet been able to send them.

FORAGE PLANTS.

Atriplex canescens.

In my last Report I stated that the seeds of this plant had been received from the United States Agrostologist. It is a native of Western Texas, and Arizona, but has in consequence of over grazing and neglect become almost extinct. One half of the seed was sown, but unfortunately the young plants "damped off" when quite young; the second portion was then sown, and the plants are coming on fairly well, more than that I cannot say at present; so far none of the genus *Atriplex* have succeeded here; we have reared the plants and had them planted out, but after a time they have all damped off; those hitherto tried, have, however, been Australian species, but the present one having a very different habitat is at any rate worth a trial, as these plants are excellent for stock. The whole of them prefer I think a saline soil, and there is for that reason some doubt as to their chance of success in Natal; of several of the Australian species we have for several years past

distributed seed amongst coast and up-country farmers, but I have not yet heard of any single instance in which they have met with success.

Peucedanum sp. "Koono."

A packet of seeds of this plant was also received from the same source as the last named one, but I regret to have to say that not a single seed germinated, nor do I think that we shall rear a single one, as the seeds have been a long time in the ground. The plant belongs to the Order umbelliferae, an Order which is not noted for yielding forage plants, though the present one seems to be highly esteemed in North America.

Desmodium tortuosum. "Beggar Weed."

Seeds of this plant were also received from the United States Agrostologist, and grew vigorously, producing plenty of seed. It was noted in my last Report, and it is therefore only necessary now to say again that from accounts received "It produces a fodder of fine quality in large quantities, and grows best in soils containing lime. It is also used for green manuring." Nothing could be better than its growth here, and it is possible that it might become a troublesome weed; it will propagate itself without much attention; there is, however, little or no demand for it. So far as the coast districts are concerned, nature seems to have dealt so bountifully with us, that forage plants which require attention are scarcely required.

Polygonum sacchalinese. "Sacaline."

This plant has been noted in my previous Reports, and has been very highly thought of in some places as a forage plant; it has long been cultivated as an ornamental plant at Home, but it is only within the last few years that it has been recommended as a forage plant. I regret to have to say that it has not been found suitable for this purpose, at any rate on the coast lands of Natal, and what is said of it in the Report on the Saharunpur Botanic Gardens, is exactly our experience here. The Superintendent says "The opinion expressed in the last Annual Report on the apparent unfitness of this plant for successful cultivation in this climate has been confirmed by its behaviour during the past season. The greatest length of stalk produced did not exceed $2\frac{1}{2}$ feet, and as each plant only yielded a few such stalks, the plant may be looked upon as utterly worthless for forage, so far as this climate is concerned." This is almost exactly our experience with it, but I am told that in the higher districts of the colony, and in the Transvaal, much better results have been obtained; it is evident therefore that the plant is not suited for cultivation in a tropical, or sub-tropical climate.

Poterium sanguisorba. "Burnet."

In my Report for 1895 it was stated that seeds of this plant had been given to us by Mr Woods of Estcourt, who advocated it strongly as a pasture plant; how it may have succeeded in the higher parts of the colony, I do not know, but here it has proved a total failure; plants were reared and put out in the Garden, but they gradually dwindled away, until now not a single one is left.

Medicago denticulata and *M. laciniata.*

Specimens of these plants have several times been sent to me for identification, usually with the idea that they were weeds which were spreading on the farms, and which might be injurious to cattle. These plants belong to the same genus as the Lucerne, or Alfalfa, which is *Medicago sativa*, and their growth on grazing farms should in my opinion be encouraged; many species of the genus are good pasture plants, and none of them so far as I know are injurious. These two species, though perhaps not really indigenous, have become quite naturalised in many parts of the colony.

MISCELLANEOUS PLANTS UNDER TRIAL.

Cola acuminata.

This is the tree yielding the "Cola nuts" of commerce; several plants of it have been reared from seed, and are now about 18 inches high, but have not yet been planted out in the Garden, but some of them will be put out during the present year, and will therefore be reported upon more fully at a future date. I understand it is a tree of very slow growth, at any rate in the early stage.

Dipteryx odorata. "Tonquin" or "Tonga" bean.

Three of the plants were received from the Director of the Kew Gardens, but have not been planted out; this also is apparently a tree of very slow growth. It is perhaps needless to state that this tree yields the "Tonquin Bean" of commerce, which is used for scent, and perhaps for other purposes also.

Swietenia mahogani. "Mahogany Tree."

These trees were planted in 1887 and are therefore now 10 years old; one of them is about 20 feet high, with a stem of about 3 inches in diameter, but has perhaps suffered from having too many of its lower branches pruned away so as to procure a straight stem; the other one has not been so much pruned, and is now about 18 feet high; and both of them are looking fairly well. This I think is fairly satisfactory, and shows that the tree would be likely to succeed in the coast districts, and is worth the notice of our forest department when established.

Carya olivaeformis. "Peccan Nut."

Plants of this tree were received from Dr. Addison, Senr., and are growing fairly well; they are about 18 inches high, but grow very slowly; we have some seedlings also, which are perhaps likely to make better trees. Any reliable report on this plant must be reserved for the present.

Rumex hymenosepalus. "Canaigre."

I have nothing to add to previous reports on this plant, except that fair sized roots have been raised in the Mooi River district from the seed supplied by us; and that our plants have seeded freely. The head gardener, Mr. Wylie, is of opinion that better plants are produced from seed than from cuttings from the roots; and it will give a crop in less than a year from the time of sowing the seed, but it requires a moist situation, and would not I think succeed well in very dry soils. The roots are used for tanning leather, and as a crop it would probably pay as well as "Wattle Bark," or perhaps better. Since writing the above a number of the "Pharmaceutical Magazine" has come to hand from which I extract the following:—

"The subject of new tanning materials has from time to time cropped up as one possessing considerable importance. As a proof of this we need but point to the interest which centred a few years ago around the canaigre, the root of the *Rumex hymenosepalus*, and in connection with which a Foreign Office Report on the trade and Agriculture of California issued during the past year states that the value of canaigre as a tanning agent, either alone or in connection with other tannins, has been proved beyond question. For light leathers it gives great tensile strength, and is far better for split leather than Gambier, oak, or hemlock. It is a quick tanner, and the yellow colour absorbed by the hide in the process of tanning is considered highly desirable for certain leathers. The sliced and dried tubers, containing an average of 30 per cent of tannic acid, are worth from £8 to £9 a ton. A yield of from 7 to 10 tons per acre would give $2\frac{1}{2}$ to $3\frac{1}{2}$ tons of the dried product, for which there is a constant demand in Europe and America. In consequence of the rapidity of the growth of this plant in countries suited to its cultivation it has been recommended to the notice of farmers of small means."

Theobroma cacao. Cocoa plant.

Fruits were received from Grenada, and some plants from Mauritius, and thanks to the new forcing house, a number of the plants have been raised, and will soon be ready for distribution. I doubt, however, whether it will be a com-

mercial success in Natal, as our climate is in my opinion not sufficiently tropical; the winter temperature falling too low to suit it. It will be well to note that I have been informed by Mr. H. Bisset that this plant is peculiarly liable to be attacked by white ants, more so, I think he stated, than any other plant he knew of; so in putting it out care should be taken to give it protection of some kind, and I can recommend nothing better than a flower pot with the bottom sawn off, or a piece of earthenware pipe, of say 18 inches long sunk in the ground, leaving about 3 inches above the surface, and then placing the plant in the centre. Roses planted in this way in the Garden several years ago, are still alive, while without this protection they would scarcely have lived three months.

Pistachia vera. "Pistachia Nut."

A paper on the cultivation of this plant, and its commercial value was forwarded for my information by the Commissioner of Agriculture. The trees are of different sexes, and are usually grafted on other species of the genus, one of which, viz. *P. lentiscus* is flourishing in the Gardens, and I thought it therefore quite likely that the true species would do equally well; I therefore took steps to obtain seeds of it, and am pleased to say that I have been successful, two small bags were received at the close of the year, and were at once sown.

In the meantime some little doubt exists as to whether the plant we received and have cultivated as *P. lentiscus* is really that plant or not; the head gardener has pointed out that it appears to be the same species as another plant which we have received as *Schinus terebinthifolia*, and this matter cannot well be decided until the flowers appear, which will be early in the year. Plants of our *P. lentiscus* have been reared from seed with the intention of grafting the *P. vera* upon them, as soon as scions can be obtained; but if our *P. lentiscus* should turn out not to be the right plant, seeds of another species will have to be obtained, and in the meantime the plants of *P. vera* will be grown on, until stocks can be got ready for grafting upon.

Manihot utilissima. "Cassava" or "Manioc."

In my last Report I gave a short account of the manner in which the roots of this plant are generally used in Mauritius; since then I have received from Mr. Bijoux, and afterwards from Mr. Le Vieux, some of the biscuits made from this root for trial, and I have found them very pleasant, though some people profess not to like them; they are slightly sweetened, and one good property they have is that on being dipped for one instant into any fluid they at once become quite soft. We have had no applications from persons in the colony for

cuttings of this plant, though it flourishes well here. In other countries it is highly esteemed, for use in the family, food for labourers and cattle, and it is said that animals of all kinds will eat it with avidity, when they become accustomed to it.

This plant is said to yield a large crop in suitable soil, 10 tons of roots per acre being only an ordinary yield. Cuttings for propagation may be had on application by any person who wishes to give it a trial, and will take ordinary care of it. I may say there are two varieties or perhaps species of the plant, both of which are used, they are known as the "Sweet" and the "Bitter," the last named being the one used in the West Indies as the preserving agent in the "Pepper Pot" well known to all who have resided in the West Indies.

Widdringtonia Whytei. M'langi Cedar.

A good supply of seed of this valuable timber tree has been received from Zomba, in return for a number of economic plants which were supplied to Mr. Whyte the last time he visited Natal. The seed has proved to be quite good, and the young plants are now coming up thickly; if we are fortunate enough to get them over the early stage of their growth we shall have a quantity of plants for distribution in the coming spring. The tree so far is doing very well in Natal, especially in the midlands; it is said to be one of the most valuable trees we have in Africa, and it reaches a very large size. In the Gardens the white ants seem to be very partial to it, and have taken every plant that has been put out; but on the ridge of the Berea one gentleman has a very fine specimen obtained from us, which is doing so far very well. This is another tree which should have attention from our Forest Department, as soon as it is established.

Dioscorea spp. "Yams."

This food plant which is so common and popular in other and similar countries does not appear to find much favour in Natal, at which I feel somewhat surprised. We have in the Gardens two species both of which yield abundantly, and when properly cooked the tubers are very palatable; one planter to whom I mentioned the plant as likely to be suitable for cultivation on his farm told me that "Sweet potatoes were good enough for him;" but the Director of the Royal Botanic Gardens, Trinidad, a country where the Sweet potato grows luxuriantly, says of the Yams "The results obtained in our Gardens show fully that the growth of the Yam as a garden crop, pays the cultivator better than many that are more popular. The returns published of the crop taken from a small piece of ground, have, I learn, caused no little surprise to

cultivators. The question of the Yam crop is one of no little importance, as these tubers "are well known to furnish a major portion of the food supply to the labouring population, and also to be an important article in the diet of the "well-to-do."

I can say from experience that the plant succeeds well here, the largest tuber dug having weighed 34 lbs.; cuttings and tubers have been supplied to a few applicants, but I have no report on the results.

Moringa pterygosperma. "Horse-Radish tree."

This tree has long been in cultivation in the Gardens, but is I am afraid now dead. Many years ago I tried it as an oil bearing tree, but the pods were only sparingly produced, but I left the farm directly after it came into bearing, and have not heard of it since that time, though I think that several trees are in existence on private lands in the colony. It seems now that a new variety of it has been produced whose immature seed pods yield a very palatable vegetable, and as in India the pods are said to be produced all the year round, it may be worth while, and an attempt will certainly be made to obtain seed of this variety. Baron F. v. Mueller says of this species "Fruits in Eastern sub-tropic Australia copiously." . . . "The long pods are of culinary use; the seeds are somewhat almond like, and rich in oil which has no perceptible smell, and is esteemed by watchmakers particularly." The succulent roots are also used as a substitute for "Horseradish," hence the popular name.

Perennial Cabbage.

We have received from Baron Mueller a few seeds bearing this name, but reared one plant only. The last Report of the Botanic Gardens, Saharunpur, says of it "Plants of a perennial variety of cabbage were received from the Superintendent State Gardens, Gwalior. It is of unknown origin, but it was first noticed in the district of Darhanga, from whence it has spread to other parts of the country. It has the habit of throwing out offshoots or sprouts which, if separated from the old plants and planted out as cuttings yield small but compact heads of cabbage. As this goes on all the year round, cabbage may always be had in season by means of this variety, if attention is paid to the separation and planting of the offshoots as they appear." Our plant has not done very well, and has suffered much from attacks of insect pests; we shall, however, try to propagate it though it scarcely looks promising.

Monsonia biflora.

In March last I received a letter from Mr. Thos. Christy, F.L.S., asking me to try to obtain for trial at Home leaves of this plant, which has been very favourably reported on by Dr.

J. Maberly, M.R.C.S., as a remedy for diarrhoea and dysentery. The plant is not found near Durban, and I was quite unable to meet with anyone who knew it. I therefore went with my native attendant to the vicinity of Charlestown, where I felt sure I could get it in quantity, and I was fortunate enough to meet with it in good order, and to secure both the plant for drying, and also seeds for sowing. The greater portion of the dried plant was sent to Mr. Christy, but several small parcels have been given to medical men both in Natal and also in the Transvaal for trial. A large number of packets of the seed have been sent to correspondents in different parts of the world, and from one or two of them I have since heard that the seed has germinated, but I have no report of the trial of the drug at Home, in due course I shall no doubt hear more of it. It is somewhat singular that though the plant is undoubtedly indigenous, the natives do not appear to have any specific name for it, nor do they use it in any way, so far as I have been able to learn. My first information as to its virtues came to me many years ago from Mr. Rushby, of Estcourt, who had formerly resided in the Free State, and he pointed out *M. biflora* as the plant which was used by the Boers, with as he said much success; but the one mentioned by Dr. Maberly is *M. ovata*, which is not I think found in Natal, but we have a variety which is said at Kew to be intermediate between the two; it is quite likely therefore that both species are similarly used, and very probably *M. attenuata*, our only other species, may have similar properties. In Natal *M. biflora* is the most common, and is the one which has been pointed out to me by two persons as the one used in the Transvaal and Free State.

Sweet Potatoes.

The three varieties which were imported from Florida as stated in last year's Report, have done very well, and a large number of cuttings have been given to applicants, some of whom have expressed themselves as very much pleased with them.

Zea mays. Mealies.

The four plants reared from seed received from Mr. Thos. Christy as stated in last year's Report, grew to about 16 feet in height, but as this variety evidently requires a long time to mature, and was planted rather late in the season, only one cob was produced, and that but a small one; we have, however, several plants reared from the seed, which were sown earlier than in last year, and so will have a fairer trial. In consequence of the time that this variety takes to mature seeds, it will I fear not be fitted for the higher districts of the colony.

Eucalyptus leaves.

From the Report of the Saharunpur Botanic Gardens for 1897, I note the following: "The demand for leaves of the *Eucalyptus* for cleansing the boilers of locomotives still continues; 84½ maunds were supplied to various railways for this purpose." I am not aware whether the leaves of these trees are used for this purpose in Natal; if not it is worth the notice of the authorities.

A large demand has been made during the year for grafted plants of the Citrus family, and numbers of trees are being planted out; it will I think therefore be of interest if I add to this Report, a copy of an article on the manuring of the Orange family, and another shorter one on their propagation, especially as an idea seems to be industriously circulated that Lemon stocks are not the best for grafting, or that seedlings are preferable to grafted plants, the latter is however too absurd to need further comment. We have tried stocks of the common Orange, Seville or Sour Orange, and Shaddock, but have found that Lemon stocks give by far the best results. -We are always, however, willing to supply plants grafted upon other stocks to order, if sufficient notice is given, but for Natal we strongly recommend the Lemon stocks.



MANURES AND ORANGES.

By H. C. Webber, Assistant in Division of Vegetable Pathology, U.S. Department of Agriculture.

Probably the most important question which concerns the orange grower is how to fertilise his trees. In Florida, where the orange soils are mostly very sandy and sterile, and require to be fertilized regularly, it is highly important to understand what elements should be used in fertilisation, and in what forms it is best to use them. No plant will long withstand improper treatment. In case of slow growing plants like the orange, where proper treatment prolongs growth and productiveness for centuries, it becomes particularly necessary that correct methods of manuring be used. The condition of the tree reflects largely the cumulative treatment of years; in crops that are replanted each year, however, the effect of improper fertilisation is probably less noticeable, especially so far as the development of disease is concerned.

In growing annual plants one can early notice results and may profit by experience. A few seasons will suffice to determine about the kind and quantity of fertiliser necessary for

them on a particular soil. In the fertilisation of the orange, however, the matter is not so easily determined; only the observations of a series of years will give results which can be depended upon. An orange grower may fertilise with one element one year and get good results, but this is no evidence that the same element used the next year, or year after year, will prove beneficial; it may, indeed, in prolonged treatment, lead to deterioration and disease. It is this difficulty in experimenting and drawing correct conclusions that accounts for the present poor understanding of rational methods of manuring the orange.

The orange appears to be very sensitive to methods of treatment and fertilisation, and several of the most serious diseases are either caused or aggravated by errors in these. The present paper is based largely on the experience of intelligent orange growers and upon such observations as the writer has been able to make in the course of investigations of orange diseases.

FERTILISING FOR GROWTH AND FRUIT.

Primarily the orange grower desires to know how to fertilise so as to stimulate either growth or fruit production. With oranges as with many other agricultural plants, one may fertilise in such a manner that excessive growth is stimulated at the expense of fruit production. A strong nitrogenous fertiliser results usually in much growth and little fruit. This seems to be particularly true if ammonia is added in an organic form. While trees are young it is probably well to favour the growth of wood principally, but at the age of seven or eight years from the bud, the tree, if it has grown properly, will have attained sufficient size to begin to produce a fair quantity of fruit. It should then be given a slightly modified fertiliser, containing more potash and phosphoric acid, and less nitrogen, to stimulate fruit production as much as possible. The so-called chemical manures appear to be much more active in stimulating fruit production than organic manures.

EFFECT ON QUALITY OF FRUIT.

The experience of many orange growers indicates that the quality of the fruit may be largely controlled by fertilisation. As oranges are purchased very largely on their appearance and quality, this becomes an important consideration in manuring. Many intelligent growers are coming to believe that the best results can be obtained by giving the trees an application of that element only which seems to be lacking, and not using, as

the majority do, a complete fertiliser, in definite proportions, regardless of whether all the elements are needed by the plant or not. If it can be determined by the appearance of the tree and fruit what element is lacking, this would seem to be the most rational way to fertilise. It seems reasonable to suppose that by careful study pathological characters induced by starvation might be found, which would serve to indicate clearly the lack of any particular element. Some growers claim to be able to recognise these characters now, and are fertilising largely on this modified plan, taking advantage of what we might call the sign language of the tree. Some of these characters will be mentioned below under the consideration of the different elements used.

EFFECT ON SOIL MOISTURE.

In fertilisation, at least two factors must usually be considered, the element of plant food supplied and the effect of this upon the soil as aiding it in supplying the plant with moisture. The heavy application, in late fall or early spring, of an organic manure, like blood and bone, which is extensively used in Florida, is liable to lead to injurious effects during the spring drought, if the trees are on high and dry land. On the other hand, such soils might be ameliorated by using substances which attract water and increase the surface tension of the soil moisture. Nitrogen for instance, used in the form of nitrate of soda, and potash, in the form of kainit, would tend to draw up the subsoil moisture and probably aid largely in supplying the necessary moisture during this trying season. The use of organic manures, on the contrary, only exaggerate the damage produced by drought. If groves are on very moist land, as is frequently the case in Florida, where the necessity is to lessen the moisture rather than to increase it, some form of organic manure, as muck or blood and bone, might be found of benefit.

EFFECT OF FERTILISERS ON THE ORANGE IN HEALTH.

The elements which need to be supplied in fertilisation to most Florida orange groves are nitrogen, potassium, and phosphorus; or using the terms in which they are expressed in most analyses of fertilisers, ammonia, potash, and phosphoric acid. The application of lime would also prove of benefit to many groves. Probably no element of plant food used in the fertilisation of orange groves should be more carefully considered, with respect to form and quantity, than nitrogen. It is the most costly and at the same time the most dangerous element to use, as excessive applications are liable to result in extensive dropping and splitting of the fruit, or in the production of the serious disease known as die-back, which will be discussed below.

EFFECT OF NITROGEN.

A grower may with considerable certainty determine by the appearance of his trees the condition of his grove in respect to the supply of nitrogen available in the soil. An abundance of nitrogen is indicated by a dark green colour of the foliage, and rank growth. The fruit shows the effect of an abundance of nitrogen by being, in general, large, with a thick and comparatively rough rind. If the trees have a yellowish foliage, with comparatively small leaves, and show little or no growth, there is probably a lack of nitrogen. In this case there is but little fruit formed, and that formed is small and usually colours early. If the tree is starving from a lack of nitrogen, the foliage will become very light yellow and sparse, and small limbs will die, as will also the large limbs in extreme cases. If the starvation is continued, no fertiliser being added, the tree will finally die back, nearly to the ground, and probably die entirely. The extreme symptoms of general starvation from lack of elements are probably nearly the same. The nitrogen used in fertilisation is commonly derived from mineral or organic sources. Of the former, sulphate of ammonia and nitrate of soda are the forms most used; of the latter, muck, dried blood and bone, cotton seed meal, tankage, fish scrap, stable manure, etc., are the forms most commonly employed.

INJURIOUS ACTION OF MUCK.

Muck is very commonly applied in considerable quantities either in a raw state or composted with sulphate of potash, etc. Many growers rather fanatically hold to what they term natural fertilisation. By this is usually meant giving the tree nourishment in the form in which they suppose it to be derived in nature. It is contended by many that muck is principally decaying vegetable matter, and that as this is the form of nourishment which the trees obtain in nature, it must be a good fertiliser to use in cultivation. But it must be borne in mind that orange trees as we cultivate them are decidedly not in a state of nature, except that by the cultivation of centuries we have made cultivation and manuring natural conditions which the plant demands. Trees in nature bear fruits for seed to reproduce the species; on the contrary we grow fruits for market, and favour a seedless variety. We want a smooth, thin-skinned, tender, juicy fruit that will sink in water. Nature does not pay particular attention to these characters, so we watch for freaks and sports, abnormal plants, which have the characters we desire, and when found we render these characters permanent by budding. Our aim in cultivation is not to produce the fruit we find in the wild state, but to modify that fruit to suit our purpose. One of the most efficient

methods of accomplishing this is to vary the fertilisation. While it cannot be denied that muck has in some cases given excellent results, it must be conceded that its extensive use has usually been of a doubtful benefit, and has often done positive injury. Groves which have had liberal dressings of muck are frequently much diseased and produce light crops; the oranges are usually coarse, thick-skinned, and sour; the productiveness is often lessened by extensive premature dropping of the fruit; the tendency seems to be to bring on "die-back," a disease which is of frequent occurrence in the groves heavily fertilised with muck. What has been said of muck applies to a greater or less extent to the various forms of organic nitrogen used. The tendency of all organic manures rich in nitrogen is to produce a large growth which is weak and sickly. Growth and not fruit is stimulated, and the fruit resulting is usually of poor quality, inclined to be large and rough, with a thick rind, and abundant rag.

STABLE MANURE OF DOUBTFUL UTILITY.

Barn manure is largely used by many growers, who still hold to the tradition that chemical manures are injurious to the plants. The benefits of barn manure in an orange grove are in serious question. The fruits produced by nitrogen from this source are, as above stated, usually large, coarse, thick-skinned, with abundant rag, and of inferior flavour. If barn manure is used—and most growers have a limited quantity and desire to use what they have—it should be spread over the grove lightly, so that each tree receives only a small amount. Where much manure is depended upon as the main element of fertilisation, liberal dressings of potash should be occasionally applied; this will tend to correct the evils of an over-balanced nitrogenous fertiliser. What has been said as to the effect of muck and barn manure on the quantity of fruit applies equally to the effects produced by cotton-seed meal, blood and bone, tankage, etc.

In general, organic fertilisers do not stimulate fruiting to the same extent as the mineral fertilisers. It is probably better economy to apply such fertilisers to annual crops, cereals, garden truck, etc.

MINERAL NITROGEN.

The mineral nitrogen manures, nitrate of soda and sulphate of ammonia, apparently stimulate production of fruit more than organic manures, and yet promote a fair general growth. The fruit produced by fertilisation with the salts, used in correct proportions with the other elements which it is necessary to apply, is usually of good quality, being solid, juicy, and rich,

with thin skin, and little rag. Sulphate of ammonia has the effect, growers testify, of sweetening the fruit to a considerable extent. There seems to be little doubt as to the correctness of this view, but why it is so, remains a question. The sweetening is probably more marked if there is a slight deficiency of potash. The use of very large quantities of either sulphate of ammonia or nitrate of soda may result disastrously, acting as "chemical poison," killing the trees outright and causing them to throw off their leaves. Here again the exact action is not, to my knowledge, understood. The following may be the explanation:—It is well known that plants growing on the sea-coast, in soil saturated with the salty sea water, are, in some respects, under almost the same condition as in the deserts, having great difficulty in obtaining sufficient water, though surrounded by water. The root hairs have difficulty in extracting the water from the salty solutions. The plants thus have various devices to prevent excessive evaporation or transpiration of water from the leaves, similar to those developed by desert plants.

The injurious effect of the nitrogen salts may in this case be caused by simply producing such a strong solution of the salt in the vicinity of the plant that the roots are not able to absorb the necessary moisture, and thus the plant is compelled to cut off its leaves to prevent the transpiration of the water which cannot be replenished by further absorption. Sulphate of ammonia has been very widely used among orange growers. Nitrate of soda has been but little used thus far, but is apparently growing in favour. Its insecticide and water-attracting properties are probably much greater than those of sulphate of ammonia.

POTASH FERTILISERS.

In fertilising the orange, potash is most frequently used either in the form of the sulphate or of wood ashes. While sulphate of potash has been most widely used, there is apparently little evidence that it is in any way superior to other forms. Muriate of potash, containing the equivalent of about 50 per cent. of actual potash, the form probably used in the apple and peach orchards of the North, has been little used in orange groves. Apparently those who have used this form have uniformly obtained good results. Kainit, or German potash salt, which is a crude double salt of magnesium sulphate with calcium chloride, containing the equivalent of 12 to 14 per cent. of actual potash, is a form much used in Northern orchards, and is promising for use in orange groves. Its very active effect in increasing the surface tension of the soil moisture, and thus attracting water to the trees, might make it an excellent form to add in early spring to aid the plant in withstanding the

spring drought, which is so frequently injurious to the orange tree, and sometimes fatal to the fruit crop. Growers not supplied with facilities for irrigation would, undoubtedly, find it profitable to consider carefully points of this nature in fertilisation. The noticeable effects of potash on the orange tree appears to be its aid in completing and maturing the wood. Apparently an insufficient amount of potash is shown by an excessive growth of weak, immature wood, which does not harden up as winter approaches and is liable to be injured by frost. An abundance of potash, in the form of sulphate of potash, or tobacco stems, is said by many growers to produce excessively sour fruit. That potash is necessary in fruit production is shown by the fact that the fruit contains a large percentage of this element. An average of fifteen analyses of different varieties of Florida oranges shows 52.05 per cent. to be about the usual amount of potash in the ash of the orange fruit. The ash in these fifteen analyses averaged 0.916 per cent., or less than 1 per cent., of the total weight of the fruit.

PHOSPHORIC ACID.

Phosphoric acid, which is a very necessary element of fertilisation on Florida orange lands, is mostly used in the form of dissolved bone-black, acidulated bone or phosphate rock, soft phosphate, raw bone, guano, etc. The immediate effect of phosphoric acid on the orange tree and fruit is little understood. Several intelligent growers claim to be able to recognise the effect of phosphorus starvation by the appearance of the new growth of leaves. If these when they first push out, or while they are still young and tender, present a slightly variegated appearance, mottled with light and dark green, it is claimed that they are suffering from lack of phosphorus, and that if a liberal application of some soluble phosphate is applied, this appearance may be checked. If this can be shown to be true it will prove a valuable index to the available quantity of phosphoric acid in the soil. A similar appearance may, however, appear in light cases of the so-called "frenching," a disease, or more probably a symptom of disease, which is not uncommon. Phosphorus starvation, it is true, may have some effect in inducing this disease.

LIME.

Lime, it is usually supposed, is present in sufficient quantities in most of our soils. It may be questioned, however, whether the common high pine land and scrub land, and indeed much of the flat woods and hummock of the interior of Florida, might not be benefitted by dressings of lime. From the superiority of oranges grown on soils which are known to be rich in lime it would seem that this is probably a very desirable and necessary

element for the production of superior fruit, The fine, smooth-skinned, and deliciously flavoured Indian and Halifax River oranges, with their characteristic aroma, are grown largely on soils rich in lime from shell mounds, and coralline, and coquina rock. The oranges produced in the noted Orange Bend Hammock, which are of distinctive quality, with delicate, rich aroma, and thin, smooth rind, are produced on a soil underlaid by a marl rich in lime. Lime soils are in many orange countries considered superior for orange growing. Dr. A. Stutzer, in his work on the Fertilisation of Tropical Cultivated Plants, writes; "The orange and citron fruits desire a deep, porous, dry soil, rich in lime. If sufficient lime is not present the fruit will be thick-skinned, and not have a fine aroma." It appears also that the effect of abundant lime is to hasten to some extent the time of ripening. Fruits grown on soils rich in lime appear to colour and become suitable for shipping somewhat earlier than those grown on soils containing but little lime. To secure a good quality of fruit the regular application of lime may be found very desirable in many groves.

FERTILISATION AS AFFECTING DISEASE.

Probably the most common cause of injury to orange trees is a lack of fertilisation, yet it is not frequent for disease to be induced - or aggravated by excessive or improper fertilisation. This may, indeed, be of much more importance than we are at present inclined to believe. One of the forms of Die-back, a common and destructive disease of the orange, is quite evidently due to errors in fertilisation. In other cases the disease appears to be caused by planting in improper soil.

DIE-BACK.

Die-back manifests itself by a number of striking characters. The foliage becomes very dark green, the vigorous growth remains angular and immature and frequently becomes strongly recurved, and the tips turn up slightly, forming S-shaped curves. In the spring, trees affected with this disease start out a very vigorous growth, which may continue for several months. Finally a reddish brown resinous substance exudes on the twigs forming the so-called die-back stain, which is very characteristic, and they begin to die back. This death of tissues may include the entire new growth or only a portion of it. Under the bark of the young limbs gum pockets form and burst out, causing large, unsightly eruptions on the twigs. Larger gum pockets frequently form at the nodes, producing large swellings. If a tree is badly affected, no fruit is formed; if moderately affected an abundance of fruit sets, but the larger portion of this turns to a lemon-yellow colour before half

grown, becomes stained by the characteristic reddish exudations like that occurring on the branches, and prematurely falls. Fruit which hangs on the tree till nearly ripe is large and coarse and is frequently stained. It usually splits and falls before thoroughly ripe. The fruit on a slightly affected tree is very large and coarse, with a very thick, rough rind. Much of it is rendered unsaleable by the reddish Die-back stain. It is very prone to split and fall before mature. Frenching, or variegation of the foliage, frequently accompanies die-back and seems to be a symptom of the disease. The very dark green colouration which some growers believe to be an indication of a healthy grove, may, on the contrary, denote a condition verging on die-back. A lighter green would probably indicate better general health.

DIE-BACK A DISEASE OF INDIGESTION.

Die-back appears to be a form of indigestion, due to an overfed condition of the plant. It occurs apparently wherever excessive quantities of nitrogenous manures from organic sources are applied or become available to the plant. Trees near closets or barns or in barnyards almost invariably have die-back. When chickens roost on a tree for any length of time, so that the dropping fall on the soil beneath, the disease usually results. Many cases are known to the writer where it has apparently been caused by excessive applications of cotton seed meal, blood and bone, barn manure, etc. Indeed all organic fertilisers in excessive quantities appear to give rise to it. If organic fertilisers are used they must therefore be applied with considerable caution to avoid an excess. No safe rule can be given as to the amount of manure that can be used with safety; this depends upon the size and condition of the tree, previous treatment, and soil conditions.

Whether the chemical manures, nitrate of soda and sulphate of ammonia, will produce the disease if used in excessive quantities, is questionable. We have not been able to learn of any instance where this has occurred. Several cases are known where nitrate of soda was used of sufficient strength to cause the leaves to fall without producing any sign of this disease. Frequently the method of cultivation has considerable to do in causing die-back, excessive cultivation appearing to aggravate it very greatly.

MAL-DI-GOMMA.

The much dreaded disease of foot rot, or mal-di-gomma, is probably not produced primarily by improper methods of fertilisation, but seems to be considerably affected by the use of fertilisers and methods of cultivation. Groves in which cow-

penning has been practised to a considerable extent, are frequently affected with foot rot. This is so generally the case as to admit of little doubt that this practice has considerable to do in inducing the disease. The extensive application of organic manures appears also to aggravate the malady to some extent, and their use in infected groves should be discouraged.

INSECT DISEASES.

With regard to the effect of fertilisation upon insects which infest the orange, it may be said that the question is little understood. A general impression exists among the growers of the State, that groves fertilised with blood and bone or barn manure are more liable to be badly infested with injurious insects than those fertilised exclusively with chemical manures. This appears to be especially true in the case of the six-spotted mite (*Teranychus 6-maculatus*) and the purple scale (*Mytilaspis citricola*); judging from observations on many groves which have been fertilised with chemical manures only, it seems that this belief is well founded. There is some evidence that the muriate of potash aids to some extent in preventing the ravages of the rust mite. Dr. Smith, of New Jersey Agricultural Experiment Station, has found nitrate of soda and kainit to be very active insecticidal fertilisers. These have not been used to any extent in fertilising orange groves in Florida, and no data have been obtained as to their effect on orange insects. It is improbable that they would prove more effective than sulphate of ammonia, or sulphate and muriate of potash, and they should be thoroughly tested to determine their value as fertilisers for the orange.

SUMMARY.

Summarising it may be said :

(1.) By a proper combination of the various elements used in fertilisation, one can undoubtedly largely govern the quality and flavour of the fruit.

(2.) To obtain a fruit with thin rind, use nitrogen from inorganic sources in moderate quantities, with considerable potash and lime.

(3.) To sweeten the fruit, use sulphate of ammonia in considerable abundance, decreasing the amount of potash.

(4.) To render the fruit more acid, increase the amount of potash and use nitrogen from organic sources.

(5.) If it be desired to increase the size of the fruit, as is sometimes the case, apply a comparatively heavy dressing of nitrogen in some organic form and slightly decrease the other

elements. In the case of the Tangerine and Mandarin, where a larger size is usually desired, a heavy dressing of nitrogen fertilisers would favour this end, and is not objectionable unless carried to excess.

(6.) Fertilisation has an important bearing on diseases.

(7.) Die-back, a serious malady, is in all probability the result of overfeeding with nitrogenous manures from organic sources. These manures, if used at all, should be applied with great caution.

(8.) Foot rot, although not primarily due to improper methods of fertilisation, is no doubt considerably influenced by this cause.

(9.) Insect diseases are also apparently influenced by the use of fertilisers, organic manures rendering the trees more liable to injury from this source than chemical fertilisers.



(EXTRACT.)

Method of propagating the Orange and other Citrus fruits.

By Herbert J. Webber, Assistant, Division of Vegetable Physiology and Pathology, U.S. Department of Agriculture.

STOCKS.

The kind of stock used for budding has considerable influence on the health, vigor, and productiveness of the tree. As some stocks will not do well on certain soils, and some varieties grow well only on certain stocks, it is desirable that the stock used for planting any given tract be carefully considered. The orange and pomelo, or grape fruit, are commonly budded on sweet orange, sour orange, lemon, or pomelo stocks. If planting is to be done on rich, moist lowlands (low hammocks, and flat woods) which are subject to foot rot, or mal-di-gomma, stock which is immune from this disease should be used. Sour orange stock is the most resistant variety that has been found, and usually gives the best results. Pomelo, or grape fruit stock, is also quite resistant and is probably the best stock in foot-rot regions where the soil is droughty at certain seasons of the year. It is a more vigorous grower than the sour orange and resists drought better. Foot rot is common also on some flat woods and high pineland soils which are dry and well drained, and in such localities the pomelo is probably the best stock for general use. In the case

of high and dry lands not much subject to foot rot, sweet orange, lemon and pomelo, are probably the best stocks. On dry lands, sour stock, although much used, does not always give satisfaction. Lemon Stocks, particularly the Florida rough lemon, is a very excellent stock for dry sterile lands, as it is a very vigorous grower, doing fairly well in soil where the sweet orange would perish. It is so easily injured by cold, however, that it is safe only in southern localities. Pomelo is also a more vigorous grower than sweet orange, and is probably a better stock for dry lands, but it is more tender, and should be budded near the ground or its use limited to southern regions. In regions where foot rot is prevalent, sweet orange and lemon stock should never be used, as they are very particularly subject to this disease. The lime, which is a very vigorous growing stock, similar to the lemon, is used to some extent in southern Florida as a stock for the orange, and is said to be excellent for barren scrub and rocky locations. The hardy trifoliolate orange is used to limited extent as a stock for the orange, but has not always given thoroughly satisfactory results. Tangerine and China (Mandarin) do well on any of the stocks used for the common sweet orange, but as the grower usually desires to increase the size of these varieties it is probably preferable to bud them on rough lemon stock. The Satsuma, which is a hardy variety, is very extensively budded on the hardy trifoliolate orange, on which it is said to do well. It also gives good results on sweet orange, which is probably the best stock to use in southern locations, but does not do well on sour orange stock, the rough lemon being considered the most desirable, as it is the most vigorous grower. In selecting stocks it is also important that the latitude and local climate be carefully considered. The various Citrus species used as stocks for grafting or budding vary greatly in their resistance to cold. The following is a list of stocks commonly or sometimes used, and is arranged in order of hardiness, the hardiest being placed first:—Taifoliolate orange, sour orange, bitter sweet orange, sweet orange, pomelo, rough lemon (or lemon) lime, and citron. In localities where there is danger of severe freezes, no matter what stock is used, the point of union should be placed near or below the surface of the soil, so that the buds may be saved in case of freezes.

In regard to the effect of stock on the character of the fruit, it may be said that while some growers claim to have observed that the fruit is rendered coarser and thicker skinned by budding on vigorous, rapidly growing stocks, like the pomelo and the lemon, yet it is certain that the difference is very slight, and in most cases hardly perceptible. In this connection all that needs to be considered is, that stocks of this nature tend to

produce rather larger fruits. While in some varieties this character is a disadvantage, it is on the other hand an advantage to have a vigorous stock, as in certain varieties this is necessary to insure fruitfulness. The varieties of the Navel orange are unfruitful on sweet or sour stock, but usually they are normally prolific if budded on rough lemon."

In conclusion I wish to thank the members of the Committee for their kind and unfailing courtesy on all occasion connected with the work of the Gardens. My hearty thanks are due to Mr. Wylie, the head gardener, for his skilful co-operation through a somewhat trying year. Mr. Harman and Mr. Rutter still remain with us, and have quite justified the praise given to them in previous reports. Mr. W. Thorpe arrived in January with excellent testimonials from the Director of Kew Gardens, and has proved a valuable addition the staff. Mr. A. Blunden commenced work at the beginning of the year, at first temporarily, but he still continues with us, and gives every satisfaction.

I have the honor to be,

Gentlemen,

Your obedient servant,

J. MEDLEY WOOD.



DURBAN BOTANIC SOCIETY.

Statement of Receipts and Expenditure for the year 1897.

1897.	EXPENDITURE.	£	s.	d.	1897.	RECEIPTS.	£	s.	d.
	To Labour	1365	9	0		By Balance in Bank at 31st	894	10	2
	Maintenance	670	9	6		December, 1896	2297	19	10
	Rations	115	2	6		Produce sold	350	0	0
	* Interest on loan	40	5	0		Government Grant	100	0	0
	Colonial Herbarium	137	19	10		Colonial Herbarium Grant	191	11	6
	Commission	8	15	0		General Subscriptions... ..	£3834	1	6
	New Propagating House & Frame	317	7	8			£3834	1	6
	Printing	45	2	6					
	Bonns to Employés	67	10	0					
	Loan to Jubilee Conservatory	400	0	0					
	Preparing new walk and } Conservatory approach }	90	0	0					
	Balance in Bank	£3258	1	0					
		576	0	6					
		£3834	1	6					

Examined and found correct, Durban, Natal, February 11th, 1898.
 MAURICE EVANS, Hon. Treasurer.

(Signed) W. MURRAY SMITH, A.S.A.A. (Eng.), Auditor.

* There is a Bond on the Property of £700 @ 5 per cent. per annum.



