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### DIVISION OF FORESTRY.

#### FOREST AND ORNAMENTAL TREE SEED AND SEEDLINGS FOR SALE AT THE GOVERNMENT NURSERY.

The Division of Forestry keeps constantly on hand at the Government Nursery, seed and seedlings of the important native and introduced trees. These are sold at prices just covering the cost of collection or growing.

The list includes both forest and ornamental trees, such as Silk Oak, Koa, various species of Eucalyptus, Golden and Pink Showers, Pride of India, Poinciana, Albizzia, etc. The price of the seed varies from 10 to 50 cents per ounce. The seedlings may be had for 2½ cents each, except a few kinds which are 5 cents. Seed of the various palms is also for sale; the price per 100 varying from \$1.00 to \$2.50. All seed is tested before being sent out, which insures its being good.

All communications in regard to seed or trees should be addressed to David Haughs, Forest Nurseryman, Box 207, Honolulu, Hawaii.

**RALPH S. HOSMER,**  
Superintendent of Forestry.

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### DIVISION OF ENTOMOLOGY.

To give information about insects free of charge is one of the duties of this Division, and Hawaiian readers are hereby invited to make inquiry in person and by mail. In order to be able to advise intelligently or send the right kind of useful insects for relief, we like and sometimes it is indispensable for us to see the insects suspected or caught in the act, also specimens of the injury. In a tin with a hole or two, or a wooden box specimens may be mailed by parcels post. When specimens are not accompanied by letter always write your name and address in the upper left-hand corner of the package. Address all communications SUPERINTENDENT DIVISION OF ENTOMOLOGY, P. O. BOX 207, HONOLULU, HAWAII.

**EDW. M. EHRHORN,**  
Superintendent.

# THE HAWAIIAN FORESTER AGRICULTURIST

VOL. XI.

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## *A FENCE POST TEST PROGRESS REPORT.*

A year ago a letter regarding a fence post test was published in the Forester, that elicited a good deal of interest. The following progress report adds to the information then given. It speaks for itself:

Another year has elapsed since the eucalyptus cornuta fence posts were set at the College of Hawaii farm with a view to testing their durability under various preservative treatments, also in comparison with redwood posts. The test has now completed its third year, the posts having been set about April 1, 1911.

Reporting the condition of the posts in the order recorded a year ago, [see Hawaiian Forester and Agriculturist for May, 1913, Vol. X, No. 5, pp. 113-114,] our findings are as follows:

Charred posts—Average decay 1-12 inches below surface of ground,  $\frac{1}{4}$ - $\frac{1}{2}$  inch.

Tarred posts—Average decay 1-12 inches below surface of ground,  $\frac{1}{8}$ - $1\frac{1}{4}$  inch.

Creosoted posts—Average decay 6-12 inches below surface of ground, trace.

Posts set in concrete (no treatment)—Average decay 6-12 inches below surface of ground, badly decayed, possibly half way through.

Untreated posts—Average decay 6-12 inches below surface of ground,  $\frac{1}{4}$ -1 inch.

It will be noted from the above that the order in which the various treatments resisted decay was as previously recorded, i, e., the creosoted posts being best preserved, showing only a trace of decay; the tarred posts (dipped in hot tar) being the second best preserved. The charred posts appear to have undergone but slight if any decay since the last experiment. On the other hand the posts set in concrete show rapid disintegration, and as noted in my last report, this appears a very undesirable treatment. The untreated eucalyptus posts show some variation in their power to resist decay; the largest amount of decay noted was about 1 inch in depth and the least about  $\frac{1}{4}$  inch.

The posts from which the bark had not been removed at the time of setting have now shed practically all the bark and aside from the marred surface which resulted from the work of the

borers during the first year, no injury seems to have resulted. Good sound untreated redwood posts set with the eucalyptus posts show very slight decay at this time.

The writer recognizes that the results reported in these tests are obtained under rather insufficient data to be exhaustive. In the first place there are too few specimens available for examination and secondly the method of examination is hardly adequate. As in these examinations the posts were bared of the first foot of all soil and the condition as there noted recorded, contemplated changes in fencing during the coming year will require that the posts will be removed bodily, thus permitting of a thorough examination.

On the whole, I think the experiment as it stands demonstrates the value of creosoting over all other methods tried. Not alone is this material a very effective preservative, but it is easily applied, and the cost is not prohibitive. I should certainly recommend creosoting at the cost of 12½ cents per post. It is somewhat doubtful whether the cost of peeling at 5 cents per post is justifiable except it be for appearance. Especially since little damage was done the posts other than marring the surface.

I trust that the Division of Forestry may see fit to cooperate with the college in planning a more exhaustive experiment along this line as was suggested some time ago. This would seem an especially opportune time as the college farm contemplates an extensive system of fencing in the near future.

F. G. KRAUSS,  
Professor of Agronomy.

The College of Hawaii, Honolulu, Hawaii, March 30, 1914.

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### HINTS TO ONION GROWERS.

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Some hints on the growing and shipping of onions are given by the *Agricultural News*, being mainly from a circular prepared by the curator of the botanic station, Antigua, Leeward Islands. The article says in part:

"As regards seeds, these should not be kept in paper parcels, though they may be stored in air-tight receptacles for a period of a few months. In connection with the nursery work, beds should be prepared before the arrival of seed in order that the soil may 'cool out'; to keep ants away from seed, kerosene should be applied to the bed before germination, not after. As regards watering, a good soaking every three or four days gives better results than daily sprinkling, and the water should not be applied after 8 a. m. In transplanting, the laborers must be carefully watched to prevent their damaging the young plants by careless handling.

"Onions are liable to the attacks of caterpillars. To check this,

dusting with Paris green and lime should be resorted to, but the grower must not dust with any insecticide when the bulbs are nearing maturity.

"Coming to the establishment of the crop in the field, the planter should remember that sowing seed *in situ* will give a crop from three to five weeks earlier in maturing than when the transplanting method is adopted; but it appears that a large proportion of the onions raised in this way may be of indifferent shape. In collecting the crop, the bulbs must not be left in the field for any length of time after pulling, though a few hours in the sun is a good thing. The bulbs must not receive the slightest injury, nor must the necks of the bulbs be twisted to hasten ripening if it is the intention to ship. Onions deep in the soil often rot before they are thoroughly ripe: these should be used to meet local demands; they are unfit for export."

Some American and Canadian markets, it is said, disapprove of onions with thick necks. In the case of produce going to the north, it is advised that the caution, "Keep from frost and boiler," should be put on the crate. The *Queensland Agricultural Journal* is quoted as pointing out "that onions when pulled should not be stored away at once but should be left on the ground for a few hours to dry. They require constant looking over to sort out any bad ones for, as in the case of fruit, a single rotting onion will infect all those in its immediate neighborhood. Reference is made, in continuation, to a very interesting manurial experiment in connection with the effect of chemical fertilizers upon the tendency to sprout. It was found that the produce from plots deprived of sulphate of potash were exhausted by a too hurried vegetation, while that which had received the potash manure was perfectly preserved. The writer advocates the application of 1 cwt. of sulphate of potash per acre."

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Six or seven years ago, an exchange says, the output of coconut butter in Austria was about 40 tons a day. It is now approximately 300 tons. The price has increased from \$18.25 to \$26.40 for 200 pounds, and the factories claim they cannot keep up with the demand. The market is controlled practically by two firms, one in Vienna and the other in Aussig.

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According to the *Gardeners' Chronicle*, there are indications that the realization of the long-thought possibility of employing electricity in horticulture and agriculture will soon be achieved. Lemstrom, it was pointed out by Thorne Baker in a paper read before the Royal Society of Arts, long ago claimed to have demonstrated that an increase of 45 per cent. in a crop is produced by the agency of high-tension electricity applied to the land through overhead wires. Sir Oliver Lodge, Mr. Newman and

Prof. Priestly, working with overhead discharges, have also obtained encouraging results. It is stated that the cost of the Lodge-Newman apparatus—which, by the way, has been adopted by the departments of agriculture of the United States and Egypt—works out at \$1000 for 25 to 30 acres, and for the treatment of double that area only a small increase in cost is entailed.

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Rascality in handling old rice is exposed by the *Queensland Agricultural Journal*, which mentions the fact that powdered talc is used in the renovation of damaged rice. Old, discolored, worm-eaten rice is said to be so treated that it takes on the appearance of new grain, which is said to be very injurious to native laborers in tropical countries where rice is the staple food.

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Hawaii is probably nearly ripe for the introduction of an agricultural bank or banks. Homesteaders and small ranchers ought to be placed in position where they could obtain long term loans at moderate interest rates on the security of their land. J. R. Cahill, who investigated the German system of rural credits for the British board of agriculture, in the prefatory note to his report says that in no modern state does organized effort for safeguarding and promoting the economic interests of agriculture appear to have been so persistent and successful as in Germany, more especially in the direction of providing the farmer with facilities for obtaining credit, for acquiring the instruments of production, and for disposing of his produce on the most favorable terms. In Germany landowners can obtain mortgage loans through a variety of special institutions for mortgage credit. At present the total outstanding loans obtained through such agencies may be estimated at approximately two billion dollars. The goal of a coöperative bank loan in practically every parish of the whole monarchy has now been nearly reached. There are in Germany 17,000 agricultural coöperative banks, with a total membership of over 1,500,000. In 1910 the total turn-over of 14,729 such banks amounted to about \$1,273,000,000. In the sixteen years, 1895 to 1910, only nineteen rural credit societies were involved in bankruptcy.

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Mr. Thorne Baker's account of electrified chickens (in a paper presented to the Royal Society of Arts) reads more like a chapter in romance than in technology, says the *Gardeners' Chronicle*. The mortality of birds hatched in electrified incubators is said to be extremely small, and the chickens are ready for market in five weeks instead of three months. They thrive on less food, lose their shyness, sparks fly from their beaks when they peck at a finger held out to them—the owner of the finger feels a distinct shock, but the birds seem unaware that they are other than just ordinary chickens.

"Who says rubber does not pay?" *Tropical Life* asks, answering that "Ceylon certainly cannot when conditions are favorable and the estates well managed." As evidence it cites the Ceylon papers received February 28, which show that the "Rubber Plantations of Kalutara" had declared 110 per cent dividend, besides placing to reserve and carrying forward a total of \$45,000.

The *Experiment Station Record* is quoted by the *Agricultural News* as saying: "In the manuring of rice, Japan is very far in advance of any other rice-growing country; in the manuring of mulberry Japan has no equal; in the manuring of tea she is behind Ceylon and in advance of China, and in the manuring of sugar cane considerably behind Hawaii and in advance of the Philippines."

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## DIVISION OF ANIMAL INDUSTRY.

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Honolulu, April 7, 1914.

The Honorable Board of Commissioners of Agriculture and Forestry.

Gentlemen:—I beg to report on the work of the Division of Animal Industry for the month of March, 1914, as follows:

### *Glanders.*

As mentioned in my last report an outbreak of glanders among a bunch of horses and mules running in a pasture belonging to the Wailuku Sugar Company, but owned by various employees, laborers and residents of the district, caused considerable alarm in the neighborhood and especially on the plantation in question, the pastures infected being the rest pasture where the plantation work animals as a rule were turned in from Saturday noon to Sunday evening.

In this same pasture an aggregate of 35 to 40 privately owned horses and mules were allowed to run, the majority of these animals being worthless superannuated scrubs and cripples, useless for any kind of work, but which the respective owners, with the pronounced local characteristic, cannot make up their minds to have destroyed.

The plantation management unfortunately, in some instances at least, is compelled to pasture some of these animals, but, in view of their run down condition and their liability to harbor or carry any kind of parasites or any infectious or contagious disease, it would seem unwise to place them in the Sunday rest pasture, to infect grasses, posts and watering places throughout the week, and then mingle freely with the plantation work stock during Saturdays and Sundays. In this way an old mare with

a colt at foot was turned into the pasture, and, whether due to the change in feed, the drain on her system in suckling the colt or to the exposure to the then prevailing cold winds and rain, she promptly developed acute glanders and proceeded to scatter it broadcast over the pasture. Her condition was noticed shortly afterwards, but not until one of the plantation mules had developed the disease. The mare was then removed from the pasture and was later found only with difficulty. On post-mortem examination she was found to be a typical "carrier" with old characteristic scars in the nose, and numerous calcareous nodules in the lungs, the lesions indicating that the disease had remained dormant in her system for some considerable time and had only recrudesced with the change to the open pasture. The local deputy, Dr. Fitzgerald, immediately upon locating and destroying this animal, rounded up all horse stock with which she had come in contact since developing the disease, submitting them all to the mallein test and destroying six, which gave typical reaction, all of them being animals of little or no value and some of which showed old lesions in the lungs, indicating previous infection. All of these animals belonged to the same owner as the mare in question.

That only one plantation mule should have become infected speaks well for the natural resistance possessed by animals kept in the prime of condition, which was the case with all of the plantation work animals, and there can be little doubt that had they been covered with open harness galls and raw chain sores, such as was frequently the case a few years ago on this as on many other plantations, the infection would have gained entrance into many another animal system. Not until three weeks after it was believed that the outbreak had been completely suppressed did one more mule show suspicious symptoms, when at the request of Dr. Fitzgerald and with the Board's permission I went to Kahului to look over the situation. This case proved, however, to be one of epizootic lymphangitis, a disease in every respect as dangerous as glanders, except that it cannot be transmitted to man, but otherwise absolutely independent of this disease and non-reacting to the mallein test. It is the same disease which some years ago caused such heavy losses to the H. C. & S. Co. and to the Maui Road Board, but which since has been encountered only in scattered and very rare cases in the Islands. It was nevertheless decided to submit the entire Waihee plantation stable to the mallein test, and also to retest the outside animals still running in the rest pasture.

As not a single reaction was obtained, even though the extremely sensitive intra-dermal method was used, it is safe to conclude that the glanders outbreak was suppressed with the destruction of the reactors to the first test, and that the appearance of the later case of epizootic lymphangitis was merely a coincidence. It was nevertheless recommended that the Waihee stables be

thoroughly disinfected and whitewashed, and that the top layer of the stalls be removed and replaced with fresh sand. A most thorough disinfection is always required when dealing with this disease as the specific infection, a fungus of the *saccharomyces* group, is very tenacious to life and much more persistent than the glanders bacillus. In both instances, however, there seems to be local conditions tending to vitiate their original virulence as the simultaneous decrease in the number of outbreaks of both diseases fully demonstrates.

*Tuberculin Control Work on Maui.*

I am pleased to report that the suppression of bovine tuberculosis on the island of Maui has progressed to a further extent than I felt justified in concluding from the reports received. To this may be added that the H. C. & S. Company has established the best equipped, sanitary and hygienic dairy that I have seen anywhere in the Islands, milking about sixty head of tuberculin tested cows and delivering the cooked and aerated milk in sealed sterilized bottles. Dr. Fitzgerald has tested some 2500 head of cattle and feels certain that little if any milk is being sold or provided from untested cows unless it be in some distant localities or in private families. All reacting animals have been branded and immediately segregated until butchered under his inspection. From his observations it is evident that bovine tuberculosis is much less prevalent than was the case on Oahu four years ago, and which seems to be the case on Kauai. These observations are borne out by a statement from the Board of Health physician on Maui, Dr. McCorsky, who upon inquiry informed me that infantile tuberculosis in any form is very rare and seems to have become more so of late. There is therefore every reason for encouraging this work so well begun, especially considering that no charge has been made for any tuberculin testing or other work connected therewith (meat inspection, for instance) even though his transportation over hundreds of miles in carrying it out has been provided by himself.

In regard to the bovine tuberculosis situation on Kauai, conditions do not seem quite so favorable. A letter received from Dr. Glaisyer and pertaining to this subject is herewith appended and is self-explanatory. The same may be said of the Island of Hawaii from where the correspondence of Dr. Elliot is appended. I shall, however, continue to keep the matter before the respective deputies and will only recommend at the present time that they be provided with the requisite ear tags and pincers as well as with tuberculin and syringes and needles with which to carry out the work without actual expense to themselves.

*Honolulu Quarantine Station.*

During the past month an addition consisting of two rooms has been added to the keeper's quarters, thereby enabling him to

keep his family living with him. The total cost to the Board of the extension has been \$175.00, all labor having been provided by the regular employees. In order to meet the requirements of the Board of Health it will, however, be necessary to ask for an additional \$15.00 or \$20.00 for sewer pipe vent and trap. This expense was unforeseen, the extension of the one-room covering the old cesspool and necessitating its relocation. But as the health inspector had frequently complained about the old arrangement the change would have had to be effected anyhow before long, as with children living in the house it would have been insisted upon.

The appended report of Dr. Case is interesting in so far as it describes a new method of administering the intra-dermal tuberculin test, evolved by himself, and which seems promising in being less dangerous to the operator as well as more convenient and cleanly, the field of operation being changed from the sub-caudal folds to the lower eyelid. With the cows in the stanchions the operator's place is changed from the gutter behind the animals to the feed alley and the constant danger of being kicked is done away. Besides this the method offers many advantages as described in the doctor's report.

Respectfully submitted,

VICTOR A. NORGAARD,  
Territorial Veterinarian.

March 31, 1914.

Dr. Victor A. Norgaard,  
Chief of Division of Animal Industry,  
Honolulu, T. H.

Sir:—I have the honor to report as follows for the month of March:

*Tuberculosis Control.*

The cattle in the following dairies have been tested during the past month:

	T.	P.	C.
T. F. Farm.....	29	29	0
I. Nagaki .....	27	27	0
Chas. Bellina .....	156	144	12
Alex. Young .....	39	39	0
S. Tsuda .....	15	15	0
H. E. Cooper.....	16	16	0
W. P. Alexander.....	6	6	0
F. Andrade .....	102	96	6
Oahu College .....	14	14	0
College of Hawaii.....	16	16	0
Mills Institute .....	15	14	1

	T.	P.	C.
John Gomes .....	46	46	0
Joe Gouviera .....	33	33	0
M. F. Brazon.....	19	19	0
R. Compos .....	69	68	1
M. Nishimoto .....	10	10	0
John Alias .....	6	6	0
R. A. Franco.....	15	15	0
A. Pacheco .....	16	16	0
M. M. Pedro.....	32	32	0
M. K. Young.....	30	30	0
S. Hiarata .....	19	19	0
K. Yamashita .....	22	20	2
S. I. Shaw.....	31	26	5
J. L. W. McGuire.....	25	25	0
Victorino Souza .....	4	4	0
Capt. Hartman .....	5	5	0
M. Riedel .....	10	10	0

The above tabulated list shows that 827 head of cattle were submitted to the test of which 27 were condemned and branded. Out of the total number tested 167 received the test for the first time. Practically all of these new cows had been brought over from the Island of Hawaii.

In the last seventy-five or more cows tested I have used the fold of the lower eyelid of the left eye as a more convenient place to make the injection than the sub-caudal fold. The advantages of making the injection at this point are: 1st, the field of operation is clean, there being no possibility of infection from feces or urine and although I have always regarded infection from these two sources as practically nil it is better to do away with any chance of it; 2nd, there is no opportunity for any of the serum to be squeezed out of the tissues as might readily happen in the sub-caudal fold by strong depression and switching of the tail; 3rd, the reactions are as a rule larger, some reaching the size of the closed hand; the view is unobstructed and offers easy comparison with the opposite side; 4th, the head is far more easily fixed and held in the desired position than the hind quarters, thus greatly facilitating the proper injection of the serum and doing away with all injury to the operator from vicious or highly nervous animals.

#### *Importation of Live Stock.*

March 2—Sierra, San Francisco: 13 crates poultry.

March 3—Hilonian, Seattle: 2 Berkshire hogs, A. & B. (Kaanapali).

March 3—Matsonia, San Francisco: 6 crates poultry.

March 3—Dix, Seattle: 32 horses, Q. M. Dept.; 1 coach dog, G. Edwards.

- March 5—Shinyo Maru, Orient: 1 crate Jap games.  
 March 10—Lurline, San Francisco: 26 mules, Schuman Carriage Co.; 10 Merino rams, Hind, Rolph & Co.; 7 crates poultry.  
 March 11—Mongolia, San Francisco: 1 crate ducks, W. F. X Co.  
 March 13—Virginian, Seattle: 262 butcher hogs, 5 mules, 2 horses, A. L. McPherson.  
 March 16—Sonoma, San Francisco: 1 English bull dog, J. M. Kelley.  
 March 17—Wilhelmina, San Francisco: 13 crates poultry; 1 box rabbits, W. H. Hoogs.  
 March 24—Manoa, San Francisco: 3 parrots, E. O. Childs; 13 crates poultry.  
 March 27—Chiyo Maru, Orient: 14 crates Chinese pheasants.  
 March 30—Hyades, Seattle: 1 Berkshire sow, A. & B. (Kaanapali).  
 March 30—Sierra, San Francisco: 14 crates poultry.  
 March 31—Matsonia, San Francisco: 17 crates poultry, 3 bxs. rabbits, 3 bxs. white mice, U. S. L. Station; 2 Dachshunds, E. Duisenberg; 1 cage canary, G. A. Marshall.

Respectfully submitted,

L. N. CASE,  
 Assistant Territorial Veterinarian.

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DIVISION OF ENTOMOLOGY.

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Honolulu, March 31, 1914.

Board of Commissioners of Agriculture and Forestry.

Gentlemen:—I respectfully submit my report of the work performed by the Division of Entomology for the month of March, 1914, as follows:

<i>Disposal</i>	<i>Lots</i>	<i>Parcels</i>
Passed as free from pests.....	1227	23,911
Returned to shipper.....	7	166
Fumigated . . . . .	2	3
Burned . . . . .	86	91
Total inspected . . . . .	1322	24,171

Of these shipments 23,785 packages arrived by freight, 262 packages by mail and 124 packages as baggage of passengers and immigrants.

*Rice and Bean Shipments.*

During the month 17,872 bags of rice and 2366 bags of beans arrived from Japan and having been found free from pests the various shipments were passed for delivery.

*Pests Intercepted.*

Sixty-five packages of fruit and 23 packages of vegetables were found in the baggage of passengers and immigrants from foreign countries, all of which, being prohibited from entry, was seized and destroyed by burning.

One hundred and sixty boxes of wormy apples were returned to the shipper at San Francisco and 363 cases containing apples had to be overhauled as a few worms had spun their cocoons on the boxes, but we found the apples free from worms. No doubt these shipments have been standing in a packing house where a lot of wormy fruit has been handled.

A shipment of various species of Yam tubers sent here by the U. S. Experiment Station at Manila for trial in these Islands arrived on the S. S. Siberia. The yams were in good clean condition. However, in the packing we found a nest of our common black ant (*Prenolepis longicornis*). After fumigation we passed the shipment for delivery. Five packages of plants were found in the post office, which had arrived from foreign countries, and as these are prohibited from entry under the new ruling of the Federal Horticultural Law they were returned to the sender.

A small box of dead baked worms, similar to those found in the twigs, and which arrived during last month, was found in the mail. These were to be used as medicine.

*Hilo Inspection.*

Brother Newell at Hilo reports the arrival of nine steamers and three sailing vessels, of which six steamers brought vegetable matter consisting of 107 lots and 1924 packages, all of which was free from pests. There also arrived direct from Japan per T. K. K. steamer Kiyō Maru 6100 bags of rice and 420 bags of beans, all of which was found free from pests and all passed for delivery.

*Inter-Island Inspection.*

During the month of February 67 steamers plying between the Islands were attended to and the following shipments were inspected and passed:

Plants . . . . .	75 packages
Taro . . . . .	510 bags
Vegetables . . . . .	32 packages
Fruit . . . . .	25 “
	<hr/>
Total passed . . . . .	642 “

The following packages were refused shipment on account of being either infested with pests or having objectionable soil attached to the roots:

Plants . . . . .	14 packages
Fruit . . . . .	3 “
Vegetables . . . . .	1 “
	<hr/>
Total refused . . . . .	18 “

Respectfully submitted,

E. M. EHRHORN,  
Superintendent of Entomology.

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DIVISION OF FORESTRY.

Honolulu, March 31, 1914.

Board of Commissioners of Agriculture and Forestry.

Gentlemen:—I have to submit as follows the routine report of the Division of Forestry for March, 1914:

*Forest Fencing Projects.*

During the month progress has been made on several projects of forest reserve fencing.

Mr. A. M. Brown, for the Cornwell Ranch, Maui, reports the completion of the forest fence on the makai boundary of the Kula Forest Reserve; Mr. Chas. H. Will of Hilo, contractor for the fence at Ninole, Kau, Hawaii, states that that job is finished; and Mr. Alika Dowsett informs me that the repairs on the Lualualei Forest Reserve boundary fence, Waianae, Oahu, are progressing.

After much negotiating a contract has been drawn up and signed for the construction of a forest fence across a portion of the government land of Wailua, Lihue, Kauai, and only the final details wait to be arranged with regard to another forest fence, across the Lualualei Reserve, above Waianae, Oahu.

Work on other fencing projects is going forward on Maui, and

a considerable part of the preliminary detail has been attended to regarding other proposed fencing projects on Hawaii.

### *Forest Planting.*

On March 18th an agreement was signed with Messrs. Macfarlane & Robinson of Paumalu, Oahu, to plant with forest trees a portion of the Pupukea Forest Reserve, formerly known as "Water Reserve A," in return for the temporary use of the land for growing pineapples. The actual tree planting does not take place for some time, but when it is done the trees will get the benefit of the cultivation given the land while under pineapples.

The planting of the slopes of Mt. Sugar Loaf, above Makiki, Oahu, has continued steadily during March. The block of Koa at the head of the sub valley below Round Top has been practically completed. During April a stand of Kukui trees will be put in on the lower slopes, to round out the planted area.

### *Routine Administration Work.*

A considerable part of my time during March was given to attention to the details of various projects now under way in the Division of Forestry and to matters referred to me by the Commissioners. About the middle of the month I devoted parts of several days to assisting the Land Office and the Survey Department in a revision and retabulation of the List of Government Lands. Towards the end of the month I drew up for the use of the Board a revised estimate of expenditures for the remainder of the present fiscal period, to conform to the reduction made necessary by decreased income.

### *Distribution of Basket Willows.*

The U. S. Forest Service having become interested in the experimental planting by this Division of basket willows from the Azores, sent us during March for distribution and trial, cuttings of five species of American basket willows. Part of the consignment has been planted at our experiment garden in Makiki Valley. The remainder of the cuttings have been distributed to correspondents of the Division in different parts of the Territory. This experiment is one that is worth watching for there appears to be no good reason why a considerable industry should not in time be built up here through the manufacture of various articles from basket willows.

As usual I transmit herewith the report of the Forest Nurseryman, recounting in detail the work at the Government Nursery.

Very respectfully,

RALPH S. HOSMER,  
Superintendent of Forestry.

## REPORT OF FOREST NURSERYMAN.

Honolulu, March 31, 1914.

R. S. Hosmer, Esq.,  
Superintendent of Forestry.

Dear Sir:—I herewith submit a report on the principal work done during the month of March, 1914:

*Nursery.**Distribution of Plants.*

	In seed boxes	In boxes transplanted	Pot grown	Total
Sold . . . . .	4000	...	1592	5592
Gratis . . . . .	250	950	1309	2509
	<hr/> 4250	<hr/> 950	<hr/> 2901	<hr/> 8101

*Collections.*

Collections on account of plants sold amounted to . . . . .	\$ 15.55
Rent of building, Nursery Grounds, for 4 months ending with February, 1914 . . . . .	140.00
	<hr/>
Total . . . . .	\$155.55

*Plantation Companies and Other Corporations.*

The distribution of plants under this heading amounted to 1000 in seed boxes, 1250 in transplant boxes, and 455 pot grown, total 2705.

*Seed Collecting.*

The season is again coming in for the ripening of most of our forest tree seed and our two seed collectors will be busy for some time getting a fresh supply.

*Makiki Station.*

One hundred of each of the five varieties of the basket willow cuttings received from Washington have been planted and will be given our best attention.

The getting up of a stock, mixing and sterilizing soil and doing other routine work has constituted the principal labor done during the month. A number of the new species received are sprouting and will be ready for transplanting soon.

*Honolulu Watershed Planting.*

The work of planting Sugar Loaf and the surrounding district is getting along nicely. Trees to the number of 1199 were planted during the month and holes are dug for about 500 more. The total number of trees planted up to the end of March amount to 3740, all of which are Koa.

*Advice and Assistance.*

For the past six or seven months the writer has not had the time to attend to the giving of advice and assistance with the exception of a few visits per month to places in and around the city, the answering of questions by telephone or people calling at the nursery. I have not been keeping a record of this work for the reason that I considered the giving of advice and assistance in this way was ordinary routine and done as a kind of obligation and only when there was time to attend to such work without interfering with the more important work which we have on hand. Should you and the members of the Board deem it necessary that I shall keep a record of all visits which I make, also the names and addresses of the people who ask questions over the telephone and call at the nursery as well as the questions asked and the answers given to each I will do so and will record the same in my monthly reports.

During the month of March I visited the Capitol grounds at the request of Mrs. F. J. Lowrey; Fort Armstrong, at the request of Captain Hatch; College Hills and Manoa, for the purpose of inspecting the trees along the streets in regard to pruning. There are a few more requests still on the waiting list.

The more important work, and the work with which the writer's time is mostly taken up, is as follows: The tree planting on Sugar Loaf. The propagating and attending to new species which we are raising from seed sent to us from abroad. The propagating and keeping in stock a supply of trees wanted by homesteaders, military organizations, plantation companies and others. Attending to the distribution and shipping of plants, answering letters of inquiry from people on the different islands, attending to the seed exchange and correspondence connected with same, etc. About one-half day out of every two days is spent with the men on Sugar Loaf. It is necessary to keep close tab on the men to get the best results. They are all Portuguese, none of them can sign their own names, and their knowledge of English is very limited. This kind of work was new to them all when they started with us and of course they have to be watched closely. This work I think should claim our first attention and all our efforts should be directed toward making this undertaking a great success. The trees are making a splendid growth and there is every indication that this piece of work will prove to be

one of the best achievements in the line of tree planting attempted by the Board in the past ten or twelve years.

The experimental work in connection with the introduction of new species is, in the writer's opinion, very important and demands our closest attention. With the assistance of one man to help plant and attend to the trees we can do a good deal in the way of testing out the different species of seed which we are receiving from Mr. Rock and through the exchange of seed which we conduct with a number of Botanical Gardens and other institutions in different parts of the globe. The raising and distributing of about half a million trees a year requires a good deal of attention as any person who has any idea of the business knows. The trees are shipped to places all over the different islands and letters and bills of lading have to be attended to. Only trees of the very best of their kind are sent out and the people now know that they can depend on getting what they ask for and the best at that.

By attending to the most important work and attending to it well, will, in my opinion, be the means of giving us more credit and do us more good than dabbling in too many jobs and not being able to attend to any of them, as they should be attended to.

Respectfully,

DAVID HAUGHS,  
Forest Nurseryman.

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DIVISION OF HYDROGRAPHY.

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April 9, 1914.

Board of Commissioners of Agriculture and Forestry.

Gentlemen:—The following report of operations of the division of hydrography during the month of March, 1914, is submitted:

*Kauai.*

Construction work on the Kalihiwai stream gaging station was completed and the register installed. Work on the new trail up the Lumahai stream to the new station site was started.

Complete rainfall data received show that 475 inches of rain fell on Waialeale (elevation 5080 feet) in 1913, against a total of 405 inches in 1912. Owing to the high cost of reading this station it will be temporarily discontinued during the fiscal year 1915.

*Oahu.*

Clock register stream measurement stations were constructed on the Punaluu, Kahana, and Haiku streams, and a staff gage

station was established on the East Branch of the Kahana stream. All of these streams were equipped with bridges on cables for flood measurements.

At the request of the Governor a reconnaissance was made of the Pauoa waters. A copy of this memorandum is attached hereto.

At the request of the Deputy Attorney General an opinion relative to the purchase of Pauoa waters, and to the future of Honolulu's water supply was furnished that officer. A copy of this letter is attached hereto.

#### *Maui.*

Only routine stream gaging and rainfall measurement work was undertaken. A set of discharge measurements was made on one of the West Maui ditches which disclosed the fact that the actual discharge was one and one-fourth million gallons per day more than was shown by the weir formula. As this water is sold at \$7.00 per million gallons these measurements have aroused considerable interest both to the seller and buyer of the water.

#### *Personnel.*

W. V. Hardy, in charge of Kauai, has been transferred to the California District of the U. S. Geological Survey.

J. C. Dort, former office engineer, will take charge of Kauai work after April 1, 1914.

G. R. White, field assistant, has been released.

Application for transfer for Howard Kimble, assistant engineer, from the Hawaiian Islands to the mainland has been requested of the Washington office of the U. S. Geological Survey to take effect June 30, 1914.

D. E. Horner, field assistant on Kauai, will be released on the completion of construction in hand, probably about June 30, 1914.

Very respectfully,

G. K. LARRISON,  
Superintendent of Hydrography.

#### MEMORANDUM FOR THE GOVERNOR.

Honolulu, T. H., March 14, 1914.

On March 12, 1914, the undersigned made a set of measurements of all springs of the Pauoa valley, and the following results were obtained:

1. Pauoa Stream above Pacific Heights intake and above all diversions, elevation 680 feet: dry.
2. Pauoa Stream, immediately below Pacific Heights intake (seepage and leakage from same), elevation 660 feet, 110,000 gallons 24 hours.

3. Pump House Spring, elevation 630 feet, 105,000 gallons 24 hours.

4. Kahuawai Spring, elevation 590 feet, 320,000 gallons 24 hours.

5. Kaikahi Spring, elevation 275 feet, 98,000 gallons 24 hours.

There is no way of measuring the amount diverted by the Pacific Heights pipe line.

All of the above sources were being diverted by irrigation ditches. The stream below the road crossing at an elevation of about 250 feet being dry.

A comparison of these amounts of water with the amounts found previously show that the Pump House Spring (elevation 630 feet) and the Kahuawai Spring (elevation 590 feet) have decreased about ten per cent., while the Kaikahi Spring (elevation 275 feet) has decreased more than 60 per cent.

Extremely dry weather has prevailed, the February rainfall being extremely light. Indications point to even a smaller discharge from these springs during the coming summer and fall months.

As the season progresses, additional measurements will be made and the results furnished to you.

Attached hereto is a copy of a memorandum showing previous measurements.

G. K. LARRISON,  
District Engineer.

#### MEMORANDUM RE BOOTH WATERS.

Spring No. 1.—Pacific Heights. Elevation, 670 feet; 46,000 gallons per day. Water from mauka, measured below Spring No. 1 so as to include leakage from No. 1, about 317,200 gallons per day. On April 6, 1911, W. F. Martin measured by current meter and found 519,000 gallons.

Spring No. 2.—Pump House Spring. Elevation, 630 feet. Spring considered by C. W. Booth better than Pacific Heights Spring No. 1, which has been confirmed by Baldwin & Alexander, 121,800 gallons. Measured by W. F. Martin April 6, 216,000 gallons.

Spring No. 3.—Kahuawai Spring. Elevation, 590 feet; 366,000 to 408,200 gallons per day. (Land does not belong to Booth.) Measured by W. F. Martin April 7, 1910, 349,000 gallons; measured by W. F. Martin April 6, 1910, 369,400 gallons. Reported on from data, Max Lorenz, March 4, 1905, 400,000 gallons.

Spring No. 4.—Elevation 320 feet, on Booth land; 19,000 gallons per day.

Spring No. 5.—Kaikahi Spring. Elevation, 275 feet; about 255,000 gallons per day. Second largest spring. Nov. 15, 1902,

Grimwood, Richardson & Holloway reported flow 253,700 gallons.  
 April 15, 1910, W. F. Martin measured 375,000 gallons per day.

*Summary.*

Mauka sources .....	317,000	gallons
Spring No. 1.....	46,000	"
Spring No. 2.....	122,000	"
Spring No. 3.....	380,000	"
Spring No. 4.....	19,000	"
Spring No. 5.....	255,000	"
	<hr/>	
	1,139,000	"
With other waters about.....	1,200,000	"

The tenth successive year without a forest fire has just been passed by the Powell national forest in south central Utah.

Yellow poplar, or tulip tree, the largest broadleaf tree in America, has been known to reach nearly 200 feet in height and 10 feet in diameter.

Pennsylvania has about  $7\frac{1}{2}$  million acres of timberland, one-eighth of which is owned by the state. The total value of the state's timber is 139 million dollars.

Mistletoe thrives on the western coasts to an extent not approached in the east. In many places this parasitic growth is responsible, directly or indirectly, for a considerable loss of timber.

Forest officers in Washington and Oregon plan to discontinue the use of barbed wire on their forests. This will affect their own pastures and public drift fences. They say barbed wire has no advantage over smooth wire, that it injures stock, and that it is more likely to be borne down by soft snow. Stockmen on the Ochoco forest, in Oregon, recently constructed drift fences of smooth wire, though with some misgivings; now they say they will never use barbed wire again.

.. ALFALFA—A PROMISING FORAGE CROP FOR  
HAWAII.

By WILLIAM H. MEINECKE, Class of 1913.

(Continued.)

The quantity of seed to be sown depends directly upon one of three conditions:

(1) If the purpose is the production of seed, the planting should be very light, from 5 to 10 pounds per acre being the general practice.

(2) The amount of available moisture, whether in the form of natural rainfall or irrigation water, is a very important factor as alfalfa requires a large amount of water. The dryer the region, the thinner the planting should be. The Indiana Station recommends the sowing of 10 to 15 pounds in dry regions.

(3) Where the conditions are optimum, the *method of planting* is the deciding factor, especially when the purpose is the production of hay or green fodder. Two methods are generally used, as follows:

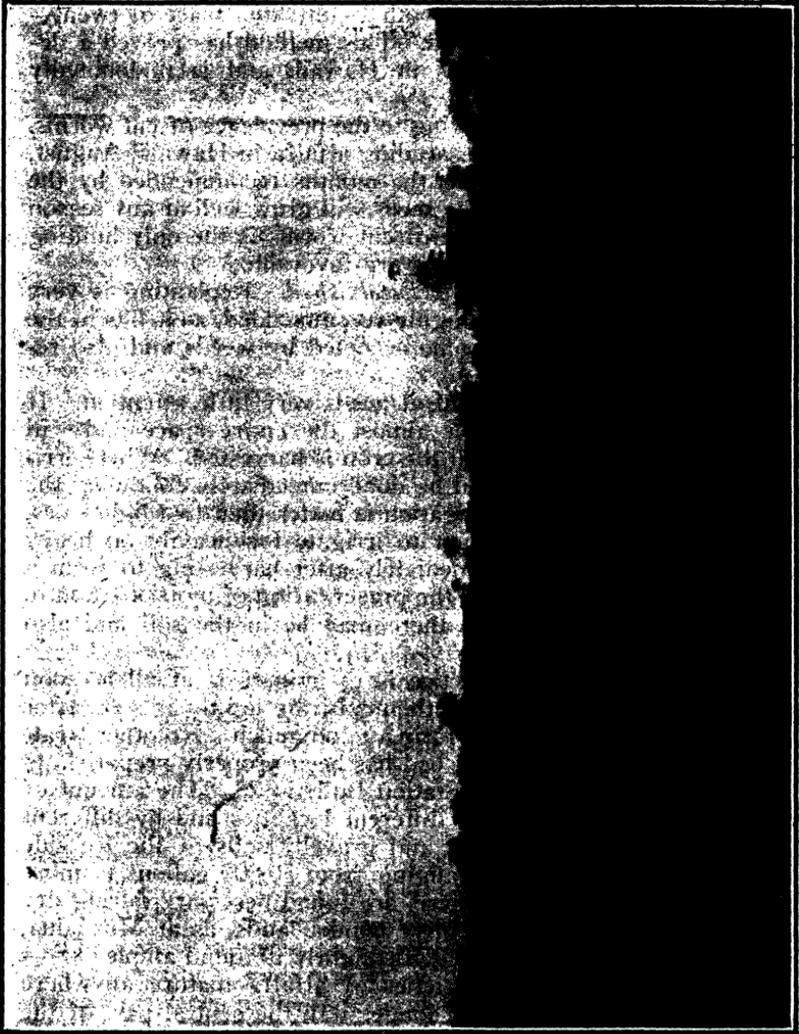
(a) *Broad Casting* requires from 18 to 30 pounds of seed per acre, Thos. Hunt<sup>9</sup> recommending never less than 20. This is the easier method and is commonly practiced in many parts of the United States and also in Hawaii. However, it is an uneconomic method where there is apt to be an attack of weeds and insects, as it is very difficult to combat these enemies without destroying a large number of the young plants and after cultivation is impossible.

(b) *The Drill Method* is recommended in almost every State of the Union. This method is not only more economical of seed and secures a more uniform stand, but facilitates the combating of noxious weeds and insects and also cultivation without damaging a single plant. From 10 to 20 and even 25 and 30 pounds of seed per acre is generally recommended by the various experiment stations of the mainland, while the College of Hawaii experimental plots yielded very well at the rate of 15 pounds of seed per acre. The Molokai Ranch found 14 quarts or about 25 pounds per acre very successful.

An ordinary seed planter with an adjustment for onion seed will answer every purpose if handled judiciously. An excellent planter worthy of high recommendation is the "Planet Jr." for small fields. This tool has adjustable parts and may be used as a planter for any kind of seed up to corn and is also a very satisfactory cultivator for alfalfa. It is light, strong and easily handled, and is especially suited to rows one foot apart.

The distance apart of the rows seems to be generally one foot,

<sup>9</sup> Forage and Fiber Crops in Hawaii.



Preparing the Ground for Alfalfa at College Farm, College of Hawaii, August 20, 1912.

though many planters have been successful with two foot rows, which facilitate the use of horse cultivators. For our Hawaiian conditions, one foot rows seem to be the best.

Wide spacing of rows means a greater chance for the encroachment of weeds, but where they are scant this may be worth consideration. Unfortunately the writer has found but one reference<sup>10</sup> to the double row system of planting alfalfa. It was tried out at San Antonio, Texas, and found to be the best method,

<sup>10</sup> U. S. D. A., B. P. I. Cir. 106.

double rows eight inches apart with a cultivated space of twenty-four inches between being used. This method has proved a decided success with pineapples in Hawaii, and is undoubtedly worthy of a few trials.

*The Time of Seeding.* Owing to the prevalence of cut worms, the fall months are safest for seeding alfalfa in Hawaii; August, September and October being the months recommended by the most successful growers. The seeds will grow well at any season of the year but the prevalence of cut worms is the only limiting factor where moisture conditions are favorable.

*Treatment after the Crop is Established.* Replanting is very often practiced and is to be highly recommended, as it fills in the gaps which would otherwise be occupied by weeds and also results in a more uniform stand.

Once the crop is established, it needs very little attention. If properly spaced it will cover almost the entire space and will thus keep down the weeds till the crop is harvested. Where irrigation is necessary, it should be done immediately following the harvest. A single heavy irrigation is better than two light ones, but one should be careful not to irrigate too heavily on heavy soils. Light cultivation immediately after harvesting to form a good mulch helps greatly in the preservation of moisture and in destroying what few weeds there may be in the soil and also helps the crop generally.

The most economical practice is to irrigate if at all as soon as the crop is off the field and then cultivate lightly as soon after as the land is in condition to form a good mulch. No other treatment is necessary if the seed bed has been properly prepared.

According to the Hawaii Station Bulletin 23, "The amount of water used varies greatly in different localities and by different growers. On the low sandy and gravelly soils of the lee side of Oahu, weekly floodings ranging from 50,000 gallons to more than twice that amount per acre, are found necessary during dry weather. On the more retentive mauka lands, as at Moanalua, 50,000 gallons and less applied fortnightly is found ample."

*Harvesting.* Different varieties of alfalfa mature anywhere from 18 to 30 days and even longer. In the central part of the United States, 3 to 4 crops are harvested annually while California generally harvests from 4 to 8 crops annually. Here in Hawaii, the common variety will produce 8 to 12 crops per annum, while the Arabian will produce about 18, since it is an earlier maturing variety. Covering a period of 18 months, there has been produced on the College farm an average of about 13 crops per annum.

Ordinarily the field is ready for harvesting when about one-tenth to one-fourth of it is in bloom, or when the lower leaves begin to wilt and turn yellow. Many varieties do not bloom well and may even start the new growth before the appearance of blossoms; such varieties are ready for the sickle as soon as the

new shoots begin to appear. As the leaves contain the greatest amount of food value, the crop should be harvested before they have begun to fall.

Fresh green alfalfa should not be piled up or stacked for any length of time, as it almost immediately begins to heat, and will spoil in a very short time. It should be spread out in the shade until a short time before feeding if it is to be fed green.

If the crop is to be ensilaged, it should be allowed to dry out a little before being placed in the silo, for it has been found that fresh, green, unwilted alfalfa will not make as good silage as that which has been allowed to become partially dry. Since it will not pack well unless it is chopped, one should not take the risk of packing it as it comes from the field. The crop must not be allowed to dry out enough to become brittle before being placed in the silo as it will fail to make good silage when in that condition.

While the silo has not yet come into general use in Hawaii, it has in most cases already proved a successful method of preserving green succulent fodder under Hawaiian conditions. And it is probable that its use will be greatly extended.

Although Mr. Pond was quite successful in making alfalfa hay and sold considerable baled, hay making has not been practiced in Hawaii except in an experimental way, because green feed is generally available throughout the year and it is therefore unnecessary to preserve our fodder.

However, alfalfa must be cut very soon after maturity as it cannot profitably be left in the field for more than a week. If the crop cannot be utilized or sold, the only profitable resort will be to turn it into silage or hay.

The making of alfalfa hay, as practiced on the mainland, is somewhat different from that of wheat hay, owing to the nature of the crop. On large farms kiln dried hay has proved economical, but it is not practical on smaller fields.

The crop is allowed to lie where it falls as it is cut and is turned over lightly once or twice during the day. It should be stacked or placed in the sack as soon as the stalks begin to become brittle and care must be taken in handling that too many leaves are not knocked off as they are the best part of the hay crop.

*The Seed Crop* is ready to be harvested when the majority of the seeds are mature. The crop is then cut close to the ground as usual, but it is stacked loosely and allowed to dry out, the unripe seeds meanwhile ripening in the stack. When the crop has become thoroughly dry and brittle, the seeds are removed. It is also a general practice to have a piece of cloth under the stack to catch any seeds that may have shattered, since these are invariably the plumpest and best seeds of all.

One crop will produce from eight-tenths to two and one-half bushels of seed. Calculating this at the legal rate of 60 pounds

per bushel, one may expect to get from 48 to 150 pounds of seed per acre.

#### ROTATIONS.

Alfalfa, being a perennial, will continue to produce good crops for several years. In some regions it has continued to produce good crops for from six to 10 years, and in California there are fields 40 years old still producing good yields. However, this is generally the exception, for in most cases the field will begin to decline in yield after the fourth year, and it has been found more profitable to replant soon after the yields begin to decline.

All up-to-date farmers practice rotation of crops, for by this method the fertility of the land is maintained and insect pests, diseases and weeds are more successfully combated.

Corn and other crops are especially benefited by a rotation with alfalfa. On new weedy land it is best to plant first a crop of corn or potatoes, which will leave the land almost free of weeds and also in good physical condition. Alfalfa will do very well after a corn crop and, by means of the nitrifying bacteria by which it is accompanied, the alfalfa crop following will, at the end of its period of growth, leave the soil more fertile and in better condition for the next crop.

Various methods and crops are used in rotations according to the natural adaptability of the soil and climate, but the following systems may be worthy of consideration by the dairyman:

- (1) Corn one year; potatoes two years; alfalfa three to four or more years.
- (2) Corn two years; alfalfa four or more years; corn two years.
- (3) Corn one year; potatoes one year; soy beans or cow peas one year; corn one year; alfalfa four or more years.
- (4) Sorghum two years; alfalfa four or more years; corn one year; cow peas one year.

It may be well to mention here that in general a legume is made to follow or alternate in the rotation with a non-leguminous plant, the choice of the varieties or species depending upon the natural environment, requirements of the market or farm, and also the prevalence of certain weeds, insects and fungous diseases.

#### WEEDS.

As mentioned above, weeds are the worst enemies of the young alfalfa plants, the dodder, yellow trefoil, bur clover, green foxtail and others being the most serious ones in the States. We do not have these weeds to combat in Hawaii, but we have worthy substitutes in the so-called "knot or onion grass," "Honohono," and the purcelain or "akulekule" (sometimes also called pig-weed).

“Rhodes grass” has also been found a serious pest where alfalfa is planted in fields formerly devoted to it, owing to the prevalence and persistence of its numerous underground stems.

(To be Continued.)

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THE KALO IN HAWAII (IX).

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By VAUGHAN MACCAUGHEY AND JOSEPH S. EMERSON.

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(Continued)

CULTIVATION OF KALO IN OTHER PARTS OF THE WORLD.

MADEIRA.

The cultivation of kalo in the Madeira Islands is described by Mr. David Fairchild of the U. S. Dept. Agriculture. He visited Funchal in March, 1907, and writes as follows regarding the “*Igname*” (Madeiran name for kalo): “According to one of the green growers here . . . these *Ignames* sell for 3 cents to 4 cents a pound, while sweet potatoes sell for only 2 cents. Crop comes in February and ends in April. Keep well; yield about one-third that of sweet potatoes; plantations continually watered; planting at all times of the year; side root stocks or tubers removed and the central stock left to form a perpetual plantation. The growers in the country boil the tubers before bringing them to market. Then they are brought down from the hills in baskets and sold in this boiled condition for 5 pence (10 cents) a pound. They are very palatable and nourishing, I believe, and rank here as more of a delicacy than the sweet potato. Only two kinds are known here so far as I have ascertained.” (U. S. D. A. Bur. Plant Industry Bul. 132, p. 59.) The two kinds are the “*Branca*” or white, and the “*Vermeilho*” or red variety. Mr. Fairchild reports that “there seems to be little preference given to either of these sorts . . . They are peeled or scraped, and then boiled three to four hours in salt water.”

CHINA.

“ . . . Seven species of the *Colocasia* are found native in Cochin China, two of which are edible ’ ’ . the *Colocasia indica* and the *Colocasia esculenta*, known to the natives as *Khoia mon sen* and *Khoia mon sap* respectively. The latter, which is by far the best species for food as well as in yield, includes two additional varieties, known as *Mon ding* and *Mon mink tia*. . . The cultivation of the edible species should begin in March or April. They require a marshy soil and are planted in ridges like sweet potatoes, about 30 inches apart, with about twice that space between the ridges. Young offshoots from the bottom

of the plants are also used for plant propagation, and the time necessary to mature is six months. The tubers are eaten boiled, the same as the sweet potato, and a kind of flour is also made from them. The price is . . . less than seven cents a pound." Mr. J. E. Conner, American Consul, Saigon, Cochinchina, May, 1908. (U. S. D. A. Bur. Plant Industry, Bul. 142, p. 35.)

#### SURINAM.

Mr. P. J. Cramer, Director of Agriculture, Paramaribo, Surinam, describes as follows the growing of various aroids (*Colocasia*, *Xanthosoma*, *Alocasia*), as follows:

"The aroids grown here for table use are wet-land crops insofar as they need more moisture in the soil than sweet potatoes and yams. They prefer a sandy loam with a thick layer of humus on the top, while a light shade is beneficial to their growth. On pure sand they do not thrive as well as the sweet potatoes and yams unless the ground is thickly mulched and lightly shaded.

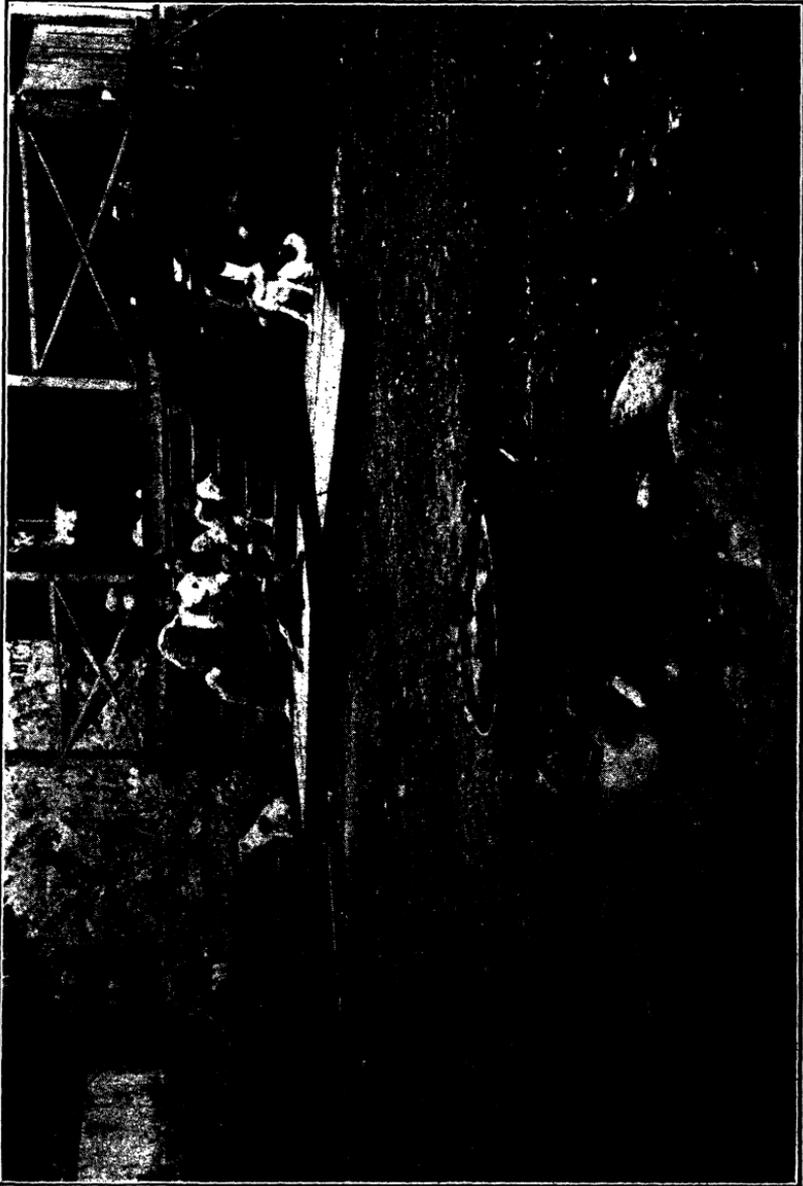
"The aroids are planted in Surinam the whole year through. They are never flooded, for during the greater part of the year sufficient moisture is kept in the soil by the rains, and in the three very dry months (September, October and November) fresh water for irrigation purposes generally is not available in the cultivated part (the coast lands) of Surinam."

The *Colocasia* chiefly raised is a dasheen, known to the natives as "Sinensie-taya." The corms and tubers are non-acrid; upon cooking the flesh of the corms becomes very white, that of the tubers slightly violet colored. It is regarded as a rather poor table vegetable, becoming soft and slimy when cooked. (U. S. D. A. Bur. Plant Industry, Bul. 233, p. 29).

#### FUNGI AND INSECTS.

The disease known as "taro rot" or "root rot" becomes prevalent when improper cultural methods are followed. The specific cause of the disease is not known. *Huli* cut from immature corms are especially liable to become diseased. The disease attacks the inner part of the corm, causing it to rot. Plants thus affected mature in an abnormally short time. The leaves develop yellow spots and are wrinkled in a characteristic manner. Planting *huli* from diseased plants; planting in fields where diseased plants have been recently grown; fertilizing with leaves from affected plants, and flooding the newly planted *huli* too soon,—these are common sources of taro rot.

The *kalo* plant is remarkably free from insect pests. It is occasionally attacked by plant lice, but the damage done is so inconsiderable as to be practically negligible.



#### COOKING THE KALO CORMS.

A crude method employed by Hawaiians nowadays instead of the old-fashioned *imu*. Note the simple fire place; the kettle for steaming the corms composed of two old wash tubs; and the coarse burlap covering the corms. In the rear is a portion of a Hawaiian family.

## THE MAKING OF POI BY HAND.

This method, employed by Hawaiian and Chinese poi-makers, is a long and arduous one. The kalo corms are cleaned of roots, washed, and cooked for several hours. The cooking is done in large kettles, or in an *imu*. The *imu* is the characteristic Polynesian under-ground oven in which food is cooked by means of water-vapor heated by hot stones. Previous to the introduction of iron kettles into these islands from abroad the natives had no means of boiling their food. All the cooking of kalo for poi was done in the *imu*, wherein it was steamed underground.

In constructing an *imu* a hole a foot or so deep and three or four feet across is dug and lined with stones. A few stones are then placed on the bottom, and covered with fire-wood. The wood is ignited, and small stones are put onto the fire, and become very hot. After the fire has consumed all the wood the heated stones cover the bottom of the *imu*. Ki leaves are spread over these stones, the corms are piled onto the leaves, and are covered with more leaves. A large stick or post is sometimes temporarily set up in the center to preserve a hole and then the *imu* is covered, *kaewewe*, with leaves and earth. A quantity of water is poured into the hole, which is then closed. The heated stones convert the water into steam, which cooks the kalo. Kalo but partly cooked is *mo'a uno'a* or *unounoa*, and when pounded the parts are easily scattered, *puchuchu*. Kalo partially cooked, so that the uncooked portions appear as white spots, is called *puhaaa*. Half-cooked kalo in general is *mo'a kolekole*. Baked kalo is *ai kupuu*; a bundle of cooked kalo partially pounded is *holo ai*.

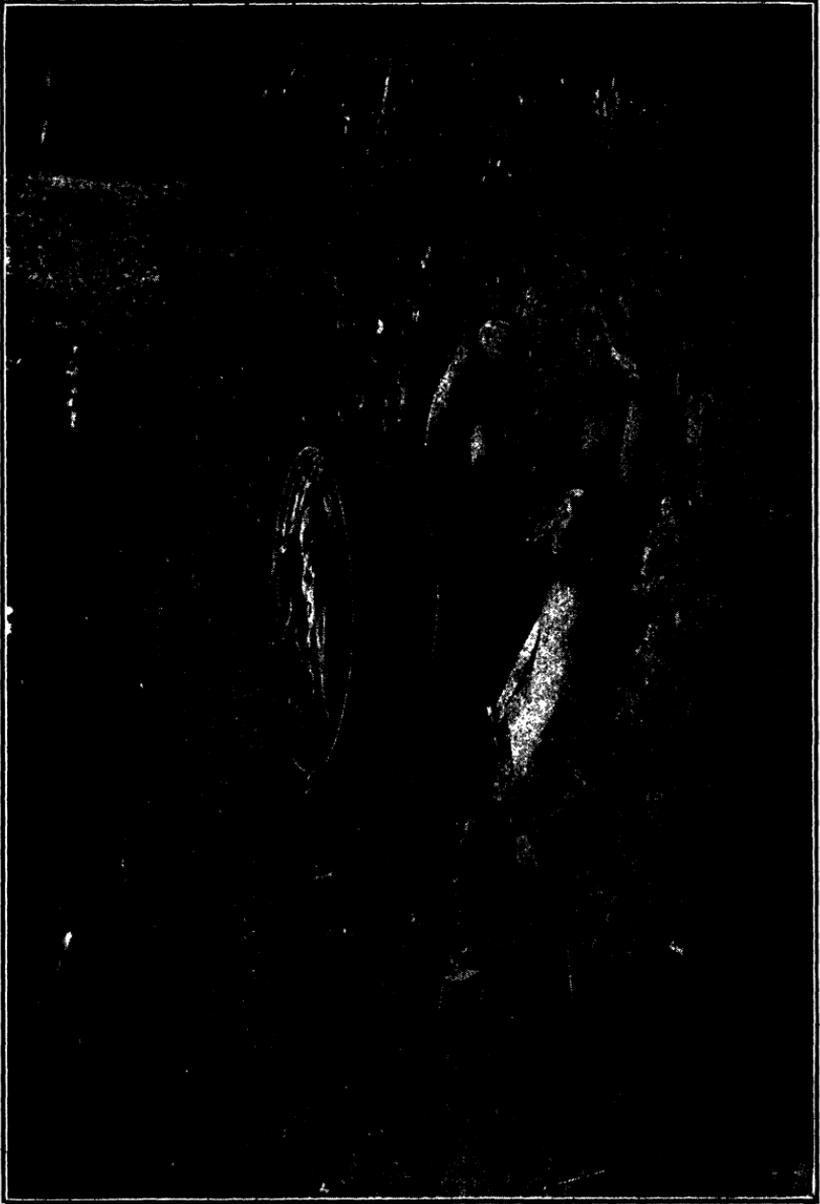
The time for cooking depends upon the amount of kalo put into the *imu*. It varies from one hour for a small amount to five or six, for an unusually large *imu*. The average time is two and a half hours. After the cooking is complete, the top or covering of the *imu* is removed, and the corms are taken out. The skin is scraped from the corms by means of shells, (*opihi* or patella shells being deemed especially suitable), sticks, or knives. In this state the corms, called *ai paa*, solid food, while fresh are much esteemed. The *ai paa* may be either dried or pounded.

Sometimes the *ai paa* were sliced up and dried in the sun, furnishing a convenient and portable food called *ao*, suitable for long voyages and comparable to hard-tack. According to Andrews' Dictionary, "Sea-bread or army hard-bread was called *ao* by Hawaiians when they first saw it."

## POUNDING THE POI.

If the corms are to be made into *ai pa'i* they are put onto a poi-tray or *poi-board*, *papa ku'i ai*, and pounded with stone pounders. This process is called *ku'i ai*, *kimo*, or *po'c*.

The *poi-board* is usually hewn from a single large plank, five



COOKING THE CORMS.  
A near view of the cooking-apparatus. The fire place is built of smooth porous lava boulders.

or six inches thick, 24 to 30 inches wide, and three to six feet long. Any hard, close-grained wood, that could be obtained in pieces sufficiently large, is suitable for a *poi*-board. *Koa* and *ohia* were among the woods anciently used; to these in recent times has been added monkey-pod, mango and other introduced trees.

The short boards are used by men working alone; when the long boards are employed two men work together, one at each end.

The *poi*-pounder or pestle is fashioned from a piece of hard lava or coral rock, selected because of its proper weight and grain. It must be neither too heavy nor too light; it may be porous, but the vesicles must be small. In shape the pounder is like a thick, stubby pestle, the neck of convenient size to be gripped firmly by one hand; the face is markedly curved and very smooth. On the island of Kauai, other forms of *poi*-pounders were made, namely the ring-form, and the stirrup-form.

A small type of pounder, called *pohaku ku'i poi malū* was used by the common people in times of great scarcity, to avoid by the loud noise of pounding the preparation of food, lest others hearing should expect to share the *poi*.

This pounding of the *kalo* by hand, like the primitive methods of its cultivation, requires a large stock of patience, persistence, and muscular power. This work is always performed by the men; although the women participate in the subsequent mixing of the *poi*. The workman seats himself on the ground, his legs extended along either side of the *poi*-board. He has divested himself of all unnecessary clothing, in fact is usually nude to the waist, for it is important that the arms be perfectly free. At one side, close to him, is a pile of the cooked and cleaned corms, on the other side a container of water. The board immediately in front of him is well moistened with water, several corms are placed thereupon, and are mashed by short, quick strokes.

At every blow the pounder is lifted high in the air, the intensity of the blows increasing as more corms are added and the mass of partially pounded *kalo* gains in size. The face of the pounder is kept moist by water applied with the other hand between strokes. This prevents the *kalo* from sticking to the pounder. Corms which are tough are called *uaua*. Those water-soaked are *loliloli*, or *popo*. Of these terms *loliloli* is most commonly used; *popo* is stronger and signifies entire rottenness. Corms decayed below but with an upper portion still fit to use as food are *palalalo*. The white spots that appear in *ai paa* while being pounded are called *a*.

#### AI PA'I.

A firm, dough-like mass is the result of this continuous beating. In this state it is called *ai pa'i*, and will keep unchanged for some time. When desired for storage or transportation the *ai pa'i* was made with a minimum amount of water, and was tied up in



CORMS OF UAU A READY FOR PEELING.

The burlap cover has been taken from the cooker, spread upon the ground, and the thoroughly steamed corms placed upon it, preparatory to peeling. Three different peeling tools are shown—an ordinary kitchen knife, largely used nowadays; a bit of coconut shell; and two limpet or patella shells, these latter being used in olden times.

ki leaves in bundles called *pa'i-ai* or *holo-ai*, according to the shape of the package. If of the ordinary shape, a flattened spheroid, they were called *pa'i-ai*, a bundle of food. These bundles are usually done up in *la'i*, ki leaves, but frequently an old flour bag was substituted when the *pa'i-ai* was to be sent to another island. When the bundles were somewhat larger and done up with greater care in the form of a cylinder, they are called *holo-ai*. Such bundles were usually covered with *la'i*, and often protected on the outside by a strong covering of *lauhala*, pandanus leaves. The valley of Waipio, Hawaii, formerly supplied the greater part of that island with *ai pa'i*. Much of this was transported by sea; often, however, the boats were unable to come to the shore on account of the high surf. At such times a score or more *holo-ai* were lashed together in the form of a raft and pulled through the waves to the boat waiting outside in the smoother water. So firmly were these bundles secured in their protecting envelopes that the food within was none the worse for the external wetting in salt water. When loaded on donkeys and mules the *holo-ai* was regarded as a more convenient form for packing than the ordinary *pa'i-ai*.

Loose bundles of *ai pa'i*, not properly secured, so that the poi escapes, are called *ponununu*. Sometimes the two bundles, *holo-ai*, put upon the pack-horse, do not properly balance each other and need to be readjusted. This lack of balance is called *oloolo*.

Before steamers had replaced the sailing craft of a former day the inter-island delivery of native food was often seriously delayed, and the *pa'i-ai* became *mahumahu*, that is parts of it were bad from exposure to the air, and it could not be made into good *poi*. The proper remedy in all such cases was to place the bundles of food in a native *imu*, and steam them over again. On taking them out they were in such condition that they were readily made into good *poi*. Often, however, the native food was so scarce and difficult to obtain that wheat flour was made into a thick paste, enclosed in a flour-bag and boiled. This was mixed in with native food and used as a substitute for pure *poi*. In extreme cases where *ai-pa'i* was not obtainable, wheat flour thus prepared without any admixture would be the only *poi* used for a long time. *Poi* is also made from breadfruit, sweet potatoes, and sometimes from pumpkins.

#### POI.

*Poi* is made by pounding *ai-pa'i* and adding water until it has acquired a smooth, fine-grained and somewhat fluid, *uouo*, consistency. Bundles of pounded *poi* made into soft poi were called *popo-ai* or *ai-lau*. *Poi*, which has been well pounded, so that it is fine without lumps, is *aeac*, *wali maika'i*, or *uouo*. If not well pounded it is *puuʻpuu*.

*Hu* means to rise or swell up, like new *poi*. *Wiliau* or *au*



#### CLEANING THE CORMS.

Four natives cleaning the corms; the women are dressed in *holoku*. Note the three metal vessels containing water, for washing the peeled corms, and the three wooden bowls, (*umete*), for receiving the cleaned corms. The cooking process thoroughly softens the bark, so that it is easily removed.

means the circular motion of the hand in stirring *poi*. *Uuluhaku* means to stir *poi* like a lazy man, hence the *poi* will be lumpy. *Poi* that is not well-pounded and therefore full of lumps, which cannot be removed by careful mixing, is said to be *puupuū*, a much stronger term than *hakuhaku*. When the lumps in *poi* are fine, like sand, it is *oncone*.

Mild acetic fermentation gradually takes place, so that the fresh, sweet *poi*, called *pololei* or *okaokai*, becomes slowly changed to the older sour *poi* or *poi aawaawa*.

Among the Polynesians *poi* is universally eaten with the fingers. According to the amount of water with which it is diluted it becomes "one-finger," "two-finger," or "three-finger" *poi*, this criterion being that of the number of fingers required in eating it. When *poi* has been successfully pounded and mixed it can be readily transferred from the container to the mouth by one or sometimes two fingers. The act of transferral is called *miki*; the dextrous swirl given to the finger in the *poi* to make it adhere properly before carrying it to the mouth is *koai*. *Miki pakahi* indicates the use of one finger; *miki palua* the use of two fingers, and *miki pakolu*, the use of three fingers. If the *poi* is so thin as to require three or more fingers it is better form to fill a small *umeke* and pour its contents down into the wide-open mouth. This act is called *kau*, and is performed with great dexterity. The skill with which a well-bred chief was able to dispose of a large quantity of *poi* in one *kau* was called *miki oi*. Only a *kanaka hauka'i*, "a careless fellow," would use his fingers in eating thin *poi*.

If a person in eating from a bowl of poorly mixed *poi*, shuns the lumpy part and seeks out the better part, this action may be called *aloalo*, "dodging the lumps." When a person is too lazy to have his food properly prepared, or to clean his fingers before eating, or eats in a dirty manner and then leaves the food without care he is called *he kanaka pono-ai*, "one who eats like a pig."

*Hoo-wali* is the process of mixing *poi* with the hand in the calabash; *wiliau* is the final process of the *hoo-wali*. If the *poi* adheres to the side of the calabash after this mixing, the sides of the calabash are cleaned by a circular motion of the hand. This motion is called *kahi*, and is a conventional signal on the part of the host or hostess, at a meal, that the eating is at an end. To *kahi* before the guests have all finished is *pi*, mean or very bad form.

Thin, watery *poi* is called *kale*, *kakale*, or *kalekale*. *Piholoholo* is a thin kind of *poi* made for the sick; it is like the ordinary *poi* "cocktail" of the foreigner, save that it contains neither milk nor sugar.

#### UMEKE.

The *poi* was kept either in wooden bowls or calabashes. The bowls, *umeke*, were hewn from solid blocks, usually of *kou*, *koa*,



A nearer view. Note the curved bit of coconut shell in the hand of the woman to the extreme left.

*milo*, or *kamani*. They were sometimes very large, three or four feet in diameter, but the common forms were of moderate size. The highly polished bowls common in the curio stores now-a-days are not genuine antiques, but are either turned on lathes, or are old Hawaiian bowls that have been recently polished and finished in a manner wholly unknown to the ancient Hawaiians.

The calabashes or gourds were the prepared fruits of certain tropical vines. There were two species of gourd commonly cultivated by the ancient Hawaiians. The *ipu*, *Lagenaria vulgaris*, is the familiar "bottle gourd." This plant, according to Hillebrand, "is cultivated or naturalized in most tropical countries. . . . The hard woody shell of the fruit served for containers in their households, while the largest gourds were converted into drums for use during their dances. The drastic pulp and seeds were a favorite medicine in the hands of the kahunas, although by no means free from danger."

The other gourd is *ipu nui*, *Cucurbita maxima*, and is the "calabash" or "large gourd." The Hawaiians were apparently the only people of Polynesia familiar with this gourd before the coming of foreigners. This fruit sometimes attains a diameter of several feet. These gourds were used as containers for *poi*, water, clothing, and other materials.

(To be concluded.)



IMPLEMENTS USED IN MAKING POI.

Observe the poi board; the stone pestle; the pail of water used in wetting the pestle and giving the poi the proper consistency; the *umeke* filled with fresh poi. The mat is woven of pandanus (*hala*) leaves.

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