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Volume VII		No.1	Tenth annual report of the Agricultural Department.
"	"	No.1 Suppl.	Summer session announcement, July 5 - August 10, 1928.
"	"	No.2	Catalogue & announcement of courses, 1928-1929.
"	"	No.3	Directory of Officers and students, 1928-1929.
"	"	No.4	Eleventh annual report of the Agricultural Department.

UNIVERSITY OF HAWAII
QUARTERLY BULLETIN

VOLUME VII NUMBER 1

Tenth Annual Report

OF THE

Agricultural Department

of the University of Hawaii for the Fiscal Year
July 1, 1926 to June 30, 1927

JANUARY, 1928

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PART I

Animal Husbandry Division

By L. A. HENKE, *Professor of Agriculture*

INTRODUCTION

This tenth report covers the experimental work carried on at the University of Hawaii Farm from July 1, 1926 to June 30, 1927 and such occasional data from other years as seemed necessary to make for continuity. The first report was published in 1917.

The University of Hawaii Farm is not an experiment station in the commonly accepted meaning of the term. It has no funds for research work or men detailed thereto. The farm is necessary primarily as an agricultural laboratory for students, since the University of Hawaii does not have the advantages resulting from the usual arrangement whereby the university and the experiment station are combined. A reasonable amount of experimental work is done on the University Farm each year, but only as a by-product of the men engaged in teaching in the agricultural department of the University.

The Waiakea Experiment Station and demonstration farm was established at Waiakea, Hilo, Hawaii and placed under the direction of the University, by the act of the Territorial Legislature. It began operations July 1, 1921. A report of the Waiakea Station will be issued soon.

UNIVERSITY OF HAWAII
DEPARTMENT OF AGRICULTURE
INVENTORY JUNE 30, 1927

LANDS:		
60 acres valued on residential basis		$441,813.00
BUILDINGS:		
Farm Superintendents' houses (2)	$ 4,734.00	
Laborers' cottages (4)	2,371.00	
Milk house, dairy laboratory and office (2)	3,420.00	
Dairy and calf and bull barn (2)	13,458.00	
Piggery	3,133.00	
Portable hog houses (2)	104.00	
Poultry house, commercial	1,500.00	
Poultry house, divided in pens	2,672.00	
Poultry houses, portable (23)	1,265.00	
Poultry houses, small (7)	288.00	
Poultry brooder houses (5)	770.00	
Old feeding shed	2,400.00	
Implement shed	500.00	
Horse stable	470.00	
Slat house	175.00	$ 37,260.00
FARM FENCING		1,097.15
FARM ROADS		1,500.00
IRRIGATION SYSTEM, NEW		5,264.04
SWINE:		
Berkshires (4)	425.00	
Tamworths (6)	550.00	
Market hogs (12)	216.00	
Pigs under three months (20)	200.00	
Equipment	21.00	$ 1,412.00
DAIRY:		
Holsteins (41)	8,050.00	
Guernseys (14)	3,200.00	
Equipment (excluding truck)	3,296.50	$ 14,546.50
POULTRY:		
Single Comb White Leghorns (1,672)	4,243.50	
Rhode Island Reds (41)	166.00	
Light Brahma (1)	3.00	
Silver Spangled Hamburg (1)	3.00	
Miscellaneous chicks under 2 months (892)	446.00	
Poultry equipment	800.57	$ 5,662.07
AGRONOMY AND HORTICULTURE		5,188.32
APPARATUS IN LABORATORIES:		
Soils	808.52	
Animal and Dairy Husbandry	271.20	
Miscellaneous	280.45	$ 1,360.17
Total		$515,103.25

DAIRY CATTLE

All of the University cattle are purebred and registered. At the close of the fiscal year the herd consisted of forty-one Holsteins and fourteen Guernseys, an increase of eleven animals over a year ago. This increase was brought about by raising desirable heifer calves. The herd at the close of the fiscal year had 21 females below the producing age; too large a proportion for economical operation at the present time, but a very favorable condition as regards the future herd.

All of the Holstein females and all but three of the Guernsey females were born and raised on the University Farm. The two herd sires are unusually well bred animals, both imported, the Guernsey from Wisconsin and the Holstein from California.

Eight of the cows are under test at the present time for advanced registry semi-official records. Nine advanced registry official seven day records have been made to date by cows in the University herd.

Thirty-one different cows were milked during the year producing 200,644.9 lbs. of milk. Seven of these cows were in the herd only part of the year leaving an average production of 7049 lbs. of milk for the 24 full year cows. Segregated as to breeds, the 16 full year Holsteins averaged 8011 lbs. and the eight full year Guernseys 5125 lbs. of milk respectively.

The herd is tested annually for tuberculosis and no reactors have been found since 1916.

The details of milk production, butter fat production, feed cost per cow and per quart of milk, total milk production costs, breeding and feeding investigations are given in the following pages:

BUTTERFAT PRODUCTION OF UNIVERSITY OF HAWAII HERD

(Based on composite samples tested once each month)

Stable No.	NAME	July 1, 1926 to June 30, 1927	
		Pounds Butterfat	Average % Fat
	Holsteins:		
9	Manca Creamcup	361.65	3.14
11	Manca Korndyke	258.34	3.35
15	Joletta Camino Korndyke	198.37	3.11
30	Natoma Hawaii Creamcup	260.37	3.26
31	Joletta University Girl	299.74	3.10
35	Baby Korndyke Joletta	263.55	3.21
38	Lady Mead Manca	267.79	3.17
39	Joletta Girl	205.98	2.99
41	Lady Natoma Mead	124.36	3.24
42	Korndyke Mead Manca	241.79	3.39
43	Madam Luku Mead	30.98*	3.13
45	Baby Tela Gem Mead	348.92	3.61
47	Princess Manca Creamcup	280.03	3.47
48	Lady Joletta El Prado	220.18	3.20
49	Korndyke El Prado Manca	296.91	3.29
50	Manca Hawaii Korndyke Mead	255.46	3.33
52	Natoma Hawaii Creamcup 2nd	233.35	3.31
58	Luku Gem (Twin)	151.76*	3.23
59	Luku Mead (Twin)	178.30*	3.16
60	Segis Joletta Girl	226.33*	3.14
61	Lady Manca Mead	184.71*	3.35
62	Korndyke Segis Prilly DeKol	83.12*	4.15
	Average†	257.30	3.26
	Guernseys:		
18	Alberta of Hidden Valley	132.68	3.97
20	Clementina of Hidden Valley	199.88	4.32
21	Alberta of Manoa	186.91	4.49
32	Mysie's Manoa Lady	232.56	4.01
44	Corona Boy's Alberta of Hawaii	256.69	4.24
46	Corona Queen of Hawaii	117.68	4.30
51	Lulu of Hawaii	309.06	4.12
57	Mysie Alberta	243.06*	4.29
63	King's Golden Bess	242.27	4.36
	Average†	209.72	4.23

*In herd during only part of year.
†For animals in herd during full year.

YEARLY PRODUCTION RECORDS OF COWS IN THE UNIVERSITY OF HAWAII HERD, JULY 1—JUNE 30

Barn No.	NAME	Born	Date First Calf	1917-1918	1918-1919	1919-1920	1920-1921	1921-1922	1922-1923	1923-1924	1924-1925	1925-1926	1926-1927
	Holsteins:												
9	Manca Creamcup	Oct. 3, 1915	July 4, 1917	3,108.7	6,493.7	7,645.9	10,714.5	11,169.3	10,867.5	9,043.3	10,768.2	9,095.0	11,581.5
11	Manca Korndyke	Oct. 10, 1916	Dec. 7, 1918	.....	6,165.4	12,233.8	13,177.5	13,951.6	12,987.4	10,763.5	11,101.9	9,830.5	7,690.0
15	Joletta Camino Korndyke	Oct. 3, 1918	Oct. 18, 1920	.....	.....	.....	7,876.2	6,385.6	6,406.6	9,466.1	7,502.2	8,276.1	6,411.0
30	Natoma Hawaii Creamcup	July 23, 1920	July 22, 1922	.....	.....	.....	.....	.....	4,766.6	7,862.0	7,829.4	8,560.9	8,218.2
31	Joletta University Girl	Dec. 1, 1920	Oct. 4, 1922	.....	.....	.....	.....	.....	3,691.8	7,215.4	8,873.2	3,262.1	9,836.8
35	Baby Korndyke Joletta	May 21, 1921	May 6, 1923	.....	.....	.....	.....	.....	989.4	5,240.6	3,165.3	7,887.6	8,316.9
38	Lady Mead Manca	Oct. 20, 1921	May 24, 1924	.....	.....	.....	.....	.....	.....	1,060.5	9,558.3	8,535.8	8,449.8
39	Joletta Girl	Dec. 16, 1921	April 12, 1924	.....	.....	.....	.....	.....	.....	2,147.7	7,848.5	4,300.5	6,960.6
41	Lady Natoma Mead	Mar. 13, 1922	Aug. 11, 1924	.....	.....	.....	.....	.....	.....	.....	7,443.8	8,377.1	3,817.8
42	Korndyke Mead Manca	Apr. 26, 1922	Nov. 29, 1924	.....	.....	.....	.....	.....	.....	.....	4,702.8	6,420.9	7,071.7
43	Madam Luku Mead	May 14, 1922	Oct. 15, 1924	.....	.....	.....	.....	.....	.....	.....	3,879.0	1,902.5	855.1[1]
45	Baby Tela Gem Mead	June 4, 1922	Oct. 27, 1924	.....	.....	.....	.....	.....	.....	.....	6,919.3	9,611.4	9,596.7
47	Princess Manca Creamcup	Sept. 30, 1922	Sept. 7, 1925	.....	.....	.....	.....	.....	.....	.....	.....	8,191.3	8,452.0
48	Lady Joletta El Prado	Oct. 4, 1922	Feb. 8, 1925	.....	.....	.....	.....	.....	.....	.....	3,838.8	5,502.8	7,089.0
49	Korndyke El Prado Manca	Dec. 6, 1922	Feb. 1, 1925	.....	.....	.....	.....	.....	.....	.....	4,673.5	7,700.1	9,576.9
50	Manca Hawaii Korndyke Mead	Jan. 30, 1923	Sept. 5, 1925	.....	.....	.....	.....	.....	.....	.....	.....	6,794.4	8,106.3
52	Natoma Hawaii Creamcup 2nd	July 3, 1923	Feb. 23, 1926	.....	.....	.....	.....	.....	.....	.....	.....	3,275.1	7,001.6
53	Manca Creamcup El Prado	July 20, 1923	Sept. 25, 1925	.....	.....	.....	.....	.....	.....	.....	.....	5,557.5	.....[2]
58	Luku Gem (Twin)	June 20, 1924	July 6, 1926	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,501.9
59	Luku Mead (Twin)	June 20, 1924	July 28, 1926	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,684.1
60	Segis Joletta Girl	Aug. 30, 1924	Sept. 21, 1926	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,206.4
61	Lady Manca Mead	Sept. 19, 1924	Nov. 14, 1926	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,527.1
62	Korndyke Segis Prilly DeKol	Nov. 29, 1924	April 24, 1927	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,031.4
	Guernseys:												
18	Alberta of Hidden Valley	Feb. 1, 1917	July 28, 1919	.....	.....	4,625.3	4,305.4	5,359.6	2,680.4	6,097.5	5,495.4	4,102.2	3,267.4
20	Clementina of Hidden Valley	Nov. 16, 1918	June 16, 1920	.....	.....	224.5	4,765.9	3,915.8	3,267.8	4,339.7	5,545.8	2,927.2	4,393.1
21	Alberta of Manoa	July 28, 1919	Oct. 18, 1921	.....	.....	.....	.....	4,817.9	5,774.0	6,955.1	7,567.6	3,641.4	4,178.8
32	Mysie's Manoa Lady	Feb. 16, 1921	Oct. 1, 1923	.....	.....	.....	.....	.....	.....	4,118.7	5,822.8	3,501.7	5,941.4
44	Corona Boy's Alberta of Hawaii	June 2, 1922	Aug. 21, 1924	.....	.....	.....	.....	.....	.....	.....	6,010.1	6,192.8	6,698.1
46	Corona Queen of Hawaii	June 11, 1922	May 8, 1924	.....	.....	.....	.....	.....	.....	881.6	4,752.2	3,020.5	2,724.0
51	Lulu of Hawaii	June 16, 1923	Sept. 30, 1925	.....	.....	.....	.....	.....	.....	.....	.....	6,293.2	7,825.8
63	King's Golden Bess	Jan. 15, 1924	Dec. 24, 1925	.....	.....	.....	.....	.....	.....	.....	.....	3,644.3	5,968.0
57	Mysie Alberta	May 5, 1	Aug. 18, 1926	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,665.5

[1]Sold March 10, 1927
[2]Died July 12, 1926

Stable No.	NAME	Breed	Date of Birth	Value of Feed for Year	Value of Feed per Day	Feed Cost per Quart of Milk
9	Manca Creamcup	*H.	Oct. 3, 1915	216.79	0.59	0.040
11	Manca Korndyke	H.	Oct. 10, 1916	183.15	0.50	0.051
15	Joletta Camino Korndyke	H.	Oct. 3, 1918	171.51	0.47	0.057
18	Alberta of Hidden Valley	*G.	Feb. 1, 1917	158.72	0.43	0.104
20	Clementina of Hidden Valley	G.	Nov. 16, 1918	160.89	0.44	0.079
21	Alberta of Manoa	G.	July 28, 1919	160.08	0.44	0.082
30	Natoma Hawaii Creamcup	H.	July 23, 1920	182.23	0.50	0.048
31	Joletta University Girl	H.	Dec. 1, 1920	187.05	0.51	0.041
32	Mysie's Manoa Lady	G.	Feb. 16, 1921	177.10	0.49	0.064
35	Baby Korndyke Joletta	H.	May 21, 1921	185.02	0.51	0.048
38	Lady Mead Manca	H.	Oct. 20, 1921	179.82	0.49	0.046
39	Joletta Girl	H.	Dec. 16, 1921	176.14	0.48	0.054
41	Lady Natoma Mead	H.	Mar. 13, 1922	150.93	0.41	0.085
42	Korndyke Mead Manca	H.	April 26, 1922	173.28	0.47	0.053
43	Madam Luku Mead	H.	May 14, 1922	103.21	0.42	0.026
44	Corona Boy's Alberta of Hawaii	G.	June 2, 1922	174.55	0.48	0.056
45	Baby Tela Gem Mead	G.	June 4, 1922	180.12	0.49	0.040
46	Corona Queen of Hawaii	G.	June 11, 1922	149.73	0.41	0.118
47	Princess Manca Creamcup	H.	Sept. 30, 1922	174.44	0.48	0.044
48	Lady Joletta El Prado	H.	Oct. 4, 1922	173.63	0.48	0.053
49	Korndyke El Prado Manca	H.	Dec. 6, 1922	180.69	0.49	0.040
50	Manca Hawaii Korndyke Mead	H.	Jan. 30, 1923	183.96	0.50	0.049
51	Lulu of Hawaii	G.	June 16, 1923	171.93	0.47	0.047
52	Natoma Hawaii Creamcup 2nd	H.	July 3, 1923	172.40	0.47	0.053
53	Manca Creamcup El Prado	H.	July 20, 1923	1.93	0.24	
56	Hawaii Ladock Cassandra	H.	Nov. 29, 1923	96.92	0.38	
57	Mysie Alberta	G.	May 5, 1924	168.19	0.46	0.064
58	Luku Gem	H.	June 20, 1924	163.17	0.45	0.078
59	Luku Mead	H.	June 20, 1924	168.15	0.46	0.064
60	Segis Joletta Girl	H.	Aug. 30, 1924	178.44	0.49	0.053
61	Lady Manca Mead	H.	Sept. 19, 1924	153.51	0.42	0.060
62	Korndyke Segis Prilly DeKol	H.	Nov. 29, 1924	134.34	0.37	
63	King's Golden Bess	H.	Jan. 15, 1924	168.47	0.46	0.061
64	Prilly Manca	H.	Sept. 7, 1925	117.71	0.32	
65	DeKol Prilly Segis Pontiac	H.	Sept. 25, 1925	113.10	0.31	
66	Segis DeKol Gem	H.	Oct. 25, 1925	110.49	0.30	
67	Sterling's Golden Bess	G.	Dec. 24, 1925	127.20	0.35	
68	Uniwai Prilly Manca	H.	Jan. 14, 1926	110.26	0.30	
69	Uniwai Manca El Prado Prilly	H.	Feb. 3, 1926	127.08	0.35	
70	Uniwai El Prado Joletta Prilly	H.	Feb. 19, 1926	111.71	0.31	
71	Uniwai Natoma Mead Prilly	H.	Feb. 23, 1926	96.17	0.26	
72	Uniwai DeKol Segis	H.	May 8, 1926	83.58	0.23	
73	Uniwai Joletta Girl Prilly	H.	July 3, 1926	156.52	0.43	
74	Uniwai Luku Prilly	H.	July 28, 1926	122.92	0.36	
75	Uniwai Korndyke Prilly	H.	Sept. 14, 1926	116.04	0 40	
76	Uniwai Segis DeKol	H.	Sept. 21, 1926	110.83	0.39	
77	Islander's Golden Bess	G.	Jan. 21, 1927	66.65	0.41	
78	Uniwai Gem Segis	H.	Jan. 24, 1927	59.76	0.38	
79	Uniwai Princess Segis	H.	Feb. 6, 1927	67.19		
80	Corona of Hawaii	G.	Mar. 3, 1927	49.23	0.41	
81	Uniwai Prilly Segis	H.	Mar. 3, 1927	48.37	0.40	
82	Uniwai Segis	H.	Mar. 19, 1927	40.13	0.38	
83	Uniwai DeKol Sarcastic	H.	April 24, 1927	31.00	0.46	
84	Uniwai Pontiac Girl	H.	May 10, 1927	21.43	0.43	
	King Pontiac Segis Prilly DeKol	*H.B.	June 26, 1922	207.20	0.57	
	Islander's Floss Boy	G.	July 15, 1924	207.33	0.57	
	16 Calves	*H.&G.		583.49	0.41	
	Total			8245.88	22.62	

*H.—Holstein
G.—Guernsey
H. B.—Holstein Bull
H. & G.—Holsteins and Guernseys

PINEAPPLE BRAN FOR DAIRY COWS

Pineapple bran is fed extensively to dairy cows around Honolulu. Experiments to determine its value for this purpose have been under way at the University Farm since August, 1922, and results of these earlier tests have been published in previous reports.* The present long time experiment was started in July, 1924, and will be completed in about another year. In brief, the experiment consists in selecting cows that already have production records made on the regular University concentrate mixture and putting them on pineapple bran mixtures for a continuous two year period. It is thought that this plan will give more reliable results than the common system of alternating feeds during the same lactation, the drawback of which is that a feed, even if good, cannot fully bring back production during a given lactation if it has been brought to a low point by a preceding inferior feed.

The full detailed report on the present experiment should show length of lactations, pounds concentrates per pound of milk required, and cost per quart of milk for the different feeds used. These will be compiled when the experiment is completed, but in this progress report a general idea of the results to date will be suggested by giving productions of the test cows on the fiscal year basis which in most cases corresponds reasonably closely with the times when the feeds were changed.

Two pineapple bran mixtures were used, one containing 33⅓ per cent and the other 66⅔ per cent pineapple bran, supplemented in each case with protein feeds to satisfy the requirements of the Henry-Morrison feeding standard. These mixtures as well as the regular herd mixtures previously fed were as follows:

Previous Herd Mixture Feed X	One-third Pineapple Bran Mixture Feed A	Two-thirds Pineapple Bran Mixture Feed B
75 lbs. cracked corn	60 lbs. pineapple bran	133 lbs. pineapple bran
100 lbs. wheat bran	60 lbs. rolled barley	27 lbs. rolled barley
50 lbs. coconut oil cake meal	20 lbs. rolled oats	20 lbs. linseed oil cake meal
10 lbs. linseed oil cake meal	20 lbs. wheat bran	2 lbs. raw rock phosphate
5 lbs. raw rock phosphate	20 lbs. soybean oil cake meal	2 lbs. salt
5 lbs. salt	2 lbs. raw rock phosphate	
	2 lbs. salt	

*1922-1923 (6th Annual Report) Dept. of Agriculture, University of Hawaii p20-24
1924-1925 (8th Annual Report) Dept. of Agriculture, University of Hawaii p24-27
1925-1926 (9th Annual Report) Dept. of Agriculture, University of Hawaii p14-16

FISCAL YEAR	PRODUCTION OF MILK IN LBS. AND FEEDS GIVEN									
	Cow 18	Feed	Cow 9	Feed	Cow 32	Feed	Cow 20	Feed	Cow 30	Feed
1923-24	6097	X	9043	X	4118	X	4339	X	7862	X
1924-25	5495	X	10768	X	5822	X	5545	X	7829	X
1925-26	4102	A	9095	A	3501	A	2927	B	8560	B
1926-27	3267	A	11581	A	5941	A	4393	B	8218	B

Conclusions: Unfortunately, for the purpose of drawing conclusions, the cows do not all react the same to pineapple bran, which, however, must be expected since dairy cows are highly individualistic creatures and other factors besides feed affect milk flow. Three of the cows, Nos. 9, 32, and 30 produced their maximum production in a year when on pineapple bran mixture; conversely, Nos. 18 and 20 made their maximum production on a non-pineapple bran mixture. While this does not prove either the superiority or inferiority of pineapple bran, it does suggest that pineapple bran, when properly supplemented with high protein feeds as was done in these mixtures, is a satisfactory feed for dairy cows.

CANE MOLASSES FOR DAIRY COWS

Since August 18, 1924, a mixture containing 25% cane molasses has been fed to all dairy cattle on University Farm except cows Nos. 18, 9, 32, 20 and 30 which have been on pineapple bran mixtures. This is in excess of the amount of molasses usually recommended for dairy cows, but since molasses is such a plentiful and cheap material in Hawaii, it seemed desirable to see how much could be safely fed.

Twenty-five percent molasses is more than can be properly incorporated with the dry feeds; so instead of mixing same, the proper amount of molasses is poured over the other feeds in the manger. Possibly a somewhat higher milk production could have been secured on a concentrate mixture containing less molasses but the object of this experiment is economical rather than maximum milk production. The production records of the entire herd are shown on page 6-a of this report. The cows were fed non-molasses feeds for the fiscal year 1923-1924 and preceding years and, except for special cows mentioned above, the cows were fed the 25% molasses mixture since then.

The following table shows the feeds and proportions of each in the 25% molasses mixture:

30 lbs. cane molasses
30 lbs. wheat bran
7½ lbs. coconut oil cake meal
10 lbs. soy bean oil cake meal
2½ lbs. linseed oil cake meal
40 lbs. cracked corn
1½ lbs. salt
1½ lbs. raw rock phosphate

This is fed in the proportions of approximately one pound of the mixture for each three pounds of milk produced, along with roughages, half of which should be legumes.

We have observed no physiological disturbances or unusual breeding troubles due to feeding the above mixtures. We do think that the cows would eat rather more concentrates with probable higher production if the amount of molasses were reduced somewhat.

CALVING RECORD OF HOLSTEINS AND GUERNSEYS ON UNIVERSITY OF HAWAII FARM JULY 1, 1914 TO JUNE 30, 1926

In a dairy it is important that each cow produce one calf each year. If calving is delayed beyond this period, due perhaps to delayed breeding, failure to conceive when bred, presence of contagious abortion or other breeding trouble, a considerable loss results in milk production, when such production is calculated on the calendar year rather than on the lactation period, as is sometimes improperly done. A cow may produce well during any given lactation period, but if such a lactation is followed by half a year of no production due to delayed calving, the production based on one calendar year after the other will be unsatisfactory.

An analysis was made of the individual calving records of all University cows during the twelve years ending June 30, 1926. The table is based on the assumption that a heifer should have her first calf when 30 months old or before, and on this assumption a heifer is counted as a cow eligible to have a calf from the time she is 21 months old. If sold when 5 years (60 months) old she would be credited with having been in the herd 3.25 years. This accounts for the decimal parts of a year noted in the table below.

HOLSTEIN COWS[1]

No. of Cow	Years in Herd	Living Calves No.	Living Calves %*	Percent Male	Percent Female	Abortions No.	Abortions %*	Calves born dead but carried Normal Period No.	Calves born dead but carried Normal Period %*	Calves died within one week No.	Calves died within one week %*	Total calves born dead or died within one week No.	Total calves born dead or died within one week %*	Percent* calves born living and dead
1	10.09	9	89.2	44	56	1	9.9					1	9.9	99.1
2	9.79	7	71.5	57	43					2	20.4	2	20.4	91.9
3	9.90	7	70.7	57	43					1	10.1	1	10.1	80.8
4	10.24	10	97.6	60	40	1	9.7					1	9.7	107.3
5	7.61	4	52.6	25	75	1	13.1	1	13.1			2	26.2	78.8
8	7.81	3	38.4	67	33	1	12.8	2	25.6	1	12.8	4	51.2	89.6
9	8.96	9	100.4	55	45									100.4
10	6.84	4	58.5	75	25	1	14.6	1	14.6			2	29.2	87.7
11	7.99	8	99.9	50	50									99.9
12A	1.04	1	96.1	0	100									96.1
12B	2.12	1	47.1	100	0									47.1
13	3.66	2	54.7	0	100	1	27.3					1	27.3	82.0
14	4.20	4	95.2	25	75									95.2
15	6.98	6	85.9	100	0			2	28.6			2	28.6	114.5
16	3.41	3	87.9	33	67			1	29.3	1	29.3	2	58.6	146.5
22	2.00	2	100.0	100	0									100.0
23	3.65	4	109.6	25	75									109.6
25	2.05	2	97.5	100	0									97.5
26	2.07	2	96.5	50	50									96.5
27	1.89	2	105.8	50	50									105.8
30	4.27	4	93.6	25	75									93.6
31	3.83	3	78.3	33	67	1	25.8					1	25.8	104.1
33	1.68	2	119.0	100	0									119.0
35	3.35	2	59.7	100	0	1	29.8					1	29.8	89.5
36	.40	1	250.0	100	0									250.0
38	2.93	2	68.3	100	0	1	34.1					1	34.1	102.4
39	2.78	3	107.9	67	33									107.9
40	1.55	1	63.8	0	100									63.8
41	3.55	2	56.3	100	0									56.3
42	2.42	2	82.6	50	50									82.6
43	2.37	2	84.4	100	0									84.4
45	2.31	1	43.3	0	100			1	43.3			1	43.3	86.6
47	2.00	1	50.0	0	100									50.0
48	1.98	1	50.5	0	100			1	50.5			1	50.5	101.0
49	1.82	2	109.9	50	50									109.9
50	1.67	1	59.8	100	0									59.8
52	1.24	1	80.7	0	100									80.7
53	1.19	1	84.0	0	100									84.0
58	.27													
59	.27													
60	.08													
61	.03													
Total and Summary	154.29	122	79.1	55	45	9	5.8	9	5.8	5	3.3	23	14.9	94.0

[1]Data summarized by H. Ochiae
*Based on years in herd

GUERNSEY COWS[1]

No. of Cow	Years in Herd	Living Calves No.	Living Calves %*	Percent Male	Percent Female	Abortions No.	Abortions %*	Calves born dead but carried Normal Period No.	Calves born dead but carried Normal Period %*	Calves died within one week No.	Calves died within one week %*	Total calves born dead or died within one week No.	Total calves born dead or died within one week %*	Percent* calves born living and dead
6	8.51	7	82.2	42	58									82.2
7	9.85	5	50.8	60	40	4	40.6					4	40.6	91.4
18	7.66	8	104.4	25	75									104.4
19	1.34	0												0
20	5.86	6	102.3	50	50									102.3
21	5.17	5	96.7	100	0									96.7
28	1.50	2	133.3	100	0									133.3
29	.72	0												0
32	3.62	3	82.8	67	33									82.8
34	2.46	1	40.6	100	0	1	40.6					1	40.6	81.2
37	3.16	3	94.9	33	67									94.9
44	2.32	2	86.2	50	50									86.2
46	2.30	2	86.9	50	50									86.9
51	1.29	1	77.5	100	0									77.5
54	2.26	2	88.0	50	50									88.5
55	.93	0												0
56	.82	0												0
57	.40	0												0
63	.70	1	142.8	0	100									142.8
Total and Average	60.87	48	78.9	54	46	5	8.1					5	8.1	87.0
Holstein & Guernsey Total and Average	215.16	170	79.0	55	45	14	6.5	9	4.2	5	2.3	28	13.0	92.0

[1]Data summarized by Y. Hamamoto
*Based on years in herd

CONCLUSIONS

In the case of cows kept in the herd for only one lactation and sold soon after having the second calf or as occurred in the case of cow No. 36, which was sold a few months after first calving because of a defective udder, the calving percentage appears ridiculously high. These occasional cases, however, affect the average only very slightly. In the case of the older cows in the herd the calving percentage gives quite a valuable index of her value to the herd.

University of Hawaii Holsteins were more easily bred than Guernseys, as indicated by a calving percentage of 94 and 87 respectively. It should be noted that a smaller percentage of the Holstein cows aborted, if the term abortion is interpreted to mean early expulsion of fetus. However, 14 other Holstein calves were born dead or were so weak that they died within the week.

Fifty-five percent of the total 174 living calves were of the male sex. Two of the 23 cows in the herd producing three or more calves produced only males, No. 15 producing six and No. 21 producing five consecutive males. In the case of no cow having three or more calves were all of them of the female sex, although several cows averaged three or four females for every male calf born.

SWINE

On June 30, 1927, ten breeding hogs (four Berkshires and six Tamworths), twelve market hogs on feeding tests, and twenty young pigs under three months of age were found on University Farm. All the breeding hogs are pure-bred and registered.

Four fine breeding sows were lost in November, 1926, due to an outbreak of hog cholera. Except for the immediate vaccination with serum, the loss would probably have been greater. Since that time all the hogs have been rendered immune to hog cholera by giving them both serum and virus as a preventative.

The pens around the permanent hog house have long been used for hogs and some high losses occurred among the litters due to worm infestation from the contaminated ground. The nature of the soil in the pens is such that it cannot well be thoroughly disinfected, but the difficulty has been largely remedied by constructing small portable farrowing houses on clean ground and removing sows from the permanent hog house several weeks before farrowing time to these portable houses, thoroughly disinfecting the sow before placing her in the clean house. Under these conditions little difficulty has been experienced in raising the litters. This system has been widely used in the corn and hog belt of the United States where it is known as the McLean county system of raising hogs.

Feeding tests completed during the year are detailed in the following pages:

FIFTY PERCENT PINEAPPLE BRAN MIXTURE FOR FATTENING HOGS

Experiment Planned by L. A. Henke
Carried out by N. K. Pekelo
Data summarized by James S. Low

Four pigs out of a litter of eight cross-bred pigs, farrowed December 13, 1925 by Sow No. 70 (Berkshire) and sired by Manoa Boy (Tamworth) were used in this experiment. These pigs were fed the regular University weaning mixture from weaning time to the beginning of this experiment. They were weighed and ear-tagged on March 29, 1926, and from this date were fed on the following pineapple bran mixture in self-feeders:

50 lbs. pineapple bran
30 lbs. wheat middlings
10 lbs. cocoanut meal
10 lbs. tankage
1 lb. salt
1 lb. raw rock phosphate

In addition to this mixture one pound of green alfalfa was given each pig daily.

The individual weights and gains were as follows:

Pig No.	1	2	3	4
Sex	M	M	F	F
Weight March 29	64	80	85	64
" April 19	83	105	104	84
" May 10	108	132	132	109
" May 31	128	148	163	139
" June 21	151	167	180	150
" July 6	159	176	190	170
Total gain per pig	95	96	105	106
Average gain daily per pig	0.96	0.97	1.06	1.07

An analysis of the cost of the increased weight resulting from feeding the pineapple bran mixture shows the following:

Total gain by 4 pigs in 99 days	402.0	lbs.
Average gain per pig in 99 days	100.4	lbs.
Average gain per pig per day	1.02	lbs.
Pineapple bran mixture consumed	2190.0	lbs.
Green alfalfa consumed	400.0	lbs.
Pounds concentrates per lb. gain	5.45	lbs.

Value of concentrates consumed	$45.35
Value of green alfalfa consumed	2.00
Total value of feed consumed	47.35
Feed cost per lb. of gain	0.118

SUMMARY AND CONCLUSIONS

The results of this feeding test with 50% pineapple Bran Mixture on cross-bred pigs, when supplemented with green alfalfa, produced one pound of gain for every 5.45 pounds of concentrate mixture at a total feed cost of 11.8 cents per pound of gain. Feed costs in previous experiments with the same pineapple bran feed mixture ranged between seven and eleven cents per pound of gain.

COMPARATIVE VALUE OF PINEAPPLE BRAN, CANE MOLASSES AND BARLEY AS FEEDS FOR FATTENING HOGS

Eighteen hogs ranging in weight from 26 to 79 pounds each, were divided into lots A, B and C on January 6, 1927 and continued on separate feed mixtures provided in self feeders until May 12, 1927—a period of 126 days. The feed mixtures were as follows:

	Average Price Per Ton
Mixture A—for Lot A	$40.00
50 lbs. pineapple bran	22.00
30 lbs. wheat middlings	55.00
10 lbs. cocoanut meal	43.00
7 lbs. tankage	95.00
3 lbs. linseed oil cake meal	65.00
1 lb. salt	16.00
1 lb. raw rock phosphate	30.00
Mixture B—for Lot B	$34.12
40 lbs. pineapple bran	22.00
25 lbs. cane molasses	6.00
20 lbs. wheat middlings	55.00
12 lbs. tankage	95.00
3 lbs. linseed oil cake meal	65.00
1 lb. salt	16.00
1 lb. raw rock phosphate	30.00
Mixture C—for Lot C	$46.80
90 lbs. barley	43.00
7 lbs. tankage	95.00
3 lbs. linseed oil cake meal	65.00
1 lb. salt	16.00
1 lb. raw rock phosphate	30.00

In addition to the above mixtures in self feeders so adjusted that the pigs could eat as much and when they chose, one pound of green alfalfa was supplied per pig daily.

A number of the pigs were rather unthrifty at the beginning of the test, and hence were not in the best condition for a feeding test. They were, however, divided as equally as possible, considering age, breed, sex, and weight, into three lots of six each. They were weighed at three week intervals during the test. The table below shows the initial and final weight, gain, and other descriptive matter of the individual hogs in each lot. The hogs were purebred Berkshires (B) or crosses of purebred Berkshires with purebred Tamworths (TxB).

	No.	Born	Breed	Sex	Wt. Jan. 6	Wt. May 12	Gain
LOT A							
	A-1	8/17/26	B	F	76 lbs.	176 lbs.	100 lbs.
	A-8	9/10/26	TxB	F	58 lbs.	155 lbs.	97 lbs.
	A-12	9/10/26	TxB	M	51 lbs.	142 lbs.	91 lbs.
	A-18	9/ 3 /26	B	M	55 lbs.	159 lbs.	104 lbs.
	A-6	9/10/26	TxB	F	46 lbs.	152 lbs.	106 lbs.
	A-22	9/10/26	TxB	F	48 lbs.	172 lbs.	124 lbs.
LOT B							
	B-9	9/10/26	TxB	F	59 lbs.	157 lbs.	98 lbs.
	B-11	9/10/26	TxB	F	49 lbs.	129 lbs.	80 lbs.
	B-21	9/ 3 /26	B	M	26 lbs.	55 lbs.	29 lbs.
	B-24	9/10/26	TxB	F	79 lbs.	203 lbs.	124 lbs.
	B-19	9/ 3 /26	B	M	26 lbs.	76 lbs.	50 lbs.
	B-5	9/10/26	TxB	F	60 lbs.	149 lbs.	89 lbs.
LOT C							
	C-2	8/18/26	B	F	111 lbs.	250 lbs.	139 lbs.
	C-7	9/10/26	TxB	F	47 lbs.	166 lbs.	119 lbs.
	C-10	9/10/26	TxB	F	66 lbs.	226 lbs.	160 lbs.
	C-13	9/10/26	TxB	F	40 lbs.	184 lbs.	144 lbs.
	C-27	9/10/26	TxB	M	52 lbs.	187 lbs.	135 lbs.
	C-17	9/ 3 /26	B	M	47 lbs.	193 lbs.	146 lbs.

FEEDS CONSUMED

	GREEN ALFALFA	CONCENTRATES
Lot A	792 lbs.	3396 lbs. Mixture A
Lot B	792 lbs.	3314 lbs. Mixture B
Lot C	792 lbs.	3571 lbs. Mixture C

SUMMARY OF RESULTS

	Lot A Lbs.	Lot B Lbs.	Lot C Lbs.
Final average weight	159.3	128.1	201.0
Initial average weight	55.6	49.8	60.5
Average gain per pig	103.7	78.3	140.5
Average daily gain per pig	.82	.62	1.11
Total concentrate feed consumed	3396.	3314.	3571.
Average concentrate per pig per day	4.49	4.38	4.72
Pounds concentrate per lb. gain	5.47	7.06	4.25
Total green alfalfa consumed	792.	792.	792.
Total feed cost	$ 71.88	$ 60.49	$ 87.56
Total feed cost per lb. of gain	.115	.129	.104

SUMMARY

1. The feed cost of a pound of gain on Feed A containing 50% pineapple bran and 30% wheat middlings, on Feed B containing 40% pineapple bran and 25% cane molasses, and on Feed C consisting of 90% barley all properly supplemented, was 11.5, 12.9, and 10.4 cents respectively.

2. In this test barley proved the best feed not only from the standpoint of rapid gains but economical gains as well.

3. Cane molasses, although a low priced feed, did not prove an economical feed for hogs when constituting 25% of the mixture.

4. In seven previous feeding tests at University Farm with a mixture essentially the same as Feed A (50% pineapple bran) the feed cost of a pound of gain was 11.8, 9.7, 7.9, 10.4, 8.6, 9.3, and 7.0 cents respectively. This strongly suggests that the pigs in this test were not in the best of condition for rapid economical gains.

POULTRY

The poultry division closed the fiscal year ending June 30, 1927 with 2607 birds, an increase of 1063 over a year ago. This increase was largely due to pullets hatched during the year.

Mr. J. Otis Dale, Instructor in Poultry Husbandry, was forced to resign in January, 1927, on account of poor health. The work was ably carried on during the balance of the fiscal year by the poultry foreman, Frank Botelho, working under the supervision of the writer.

Several new high records were made in the Fourth Annual Egg Laying Contest completed during the year. The previous high hen record in the Hawaii contest was 274 eggs and in this contest three hens exceeded this mark by laying 276, 284, and 286 eggs each. The contest is described in detail by Mr. Dale later in this report.

The Fifth Egg Laying Contest is now in progress and consists of two units, one on Oahu and one on Maui. All eggs are weighed and graded in the present contest and standing of pens and hens is based on value rather than merely number of eggs as in previous contests.

A careful record was kept of the hatching done in the incubator room this year and the data are included in this report.

Similarly each chick is numbered as soon as it leaves the incubator, and should it die before it reaches maturity or at any later time, the records show just when it died and the probable cause. High mortality among baby chicks is one of the problems of poultry keepers in Hawaii which the University hopes to help solve and an accurate record of when chicks die is one of the first essentials in solving the problem.

Egg production and disposition during the year was as follows:

Total eggs laid	90591
Set in University incubators	13125
Sold as hatching eggs	2625
Sold as market eggs	73566
Number of pullet size eggs	27444
Percent of pullet size eggs	30.3
Percent of eggs laid accounted for	98.6%*

Six thousand six hundred and nine strong chicks were hatched during the year of which 2283 were sold as day old chicks. Besides these, 63 birds were sold as breeding fowls and 360 were sold as culls to the meat market.

All birds are being trap-nested at the present time and practically all of them were trap-nested during the year.

High records made in different classes during the year (excluding the egg laying contest separately reported in these pages) are as follows:

Year hatched	Breed	High Record
1924	S. C. W. L.	193 eggs
1925	S. C. W. L.	180 eggs
1926	R. I. Red	216 eggs
1926	S. C. W. L.	224 eggs

These records were made under general flock conditions where no effort was made to force production so as to make high records. The egg laying contest report gives the records made under more ideal conditions where high production was the goal.

*Small losses due to breakage are occurring continuously. Other than these, differences between the number of eggs laid and eggs recovered are due to losses of eggs or errors in records.

INCUBATOR ROOM RECORD POULTRY DIVISION, UNIVERSITY OF HAWAII 1926-1927 HATCHING SEASON

Data secured by J. Otis Dale and Frank Botelho
Compiled by L. A. Henke

A careful record was made of all operations in the University of Hawaii Incubator Room during the hatching season of 1926-1927. Up to about the middle of January, 1927 these observations were made and recorded by J. Otis Dale and Frank Botelho. After that time they were all made by Frank Botelho because of Mr. Dale's illness and later resignation from the University.

The first incubator was started October 19, 1926. Heavy mortality in some of the early hatches was found by Dr. B. A. Gallagher, Bacteriologist of the Board of Agriculture and Forestry, to be due to the pullorum bacillus. Dr. Gallagher performed the agglutination test on the breeding hens and found that 45% of them were carriers of the pullorum bacillus. These were removed and only eggs from hens reacting negatively to the test were used after that time. Later in the season six hatches, using eggs from the positive reactors to the agglutination test, were made to note percent hatchability and to get other data. Thus the hatching records group themselves under three divisions:

A—Eggs from untested hens, 45% of which later showed a positive reaction to the agglutination test.

B—Eggs from hens free from the pullorum bacillus as determined by the agglutination test.

C—Eggs from hens reacting positively to the agglutination test.

CAUSES OF LOW PERCENTAGE OF STRONG CHICKS

A study of the above data shows 6614 strong chicks hatched out of 13,114 eggs, nearly two eggs required for every strong chick. This hatching percentage of 50.4% seems very much too low and improvement should be possible along this line. The range fluctuates between 72.2% from hatch B-17 to 19.0% from hatch A-10, the latter being one in which the failure of the thermostat to function properly caused many of the chicks to die in the shell. Summarizing, we find that the failure to produce strong chicks was due to 17.6% of the chicks dying in shell, 15.4% of the eggs being infertile, 12.7% having dead germs and 3.9% of the chicks being cripples.

EGGS FROM POSITIVE VS. NEGATIVE REACTORS TO THE AGGLUTINATION TEST

In comparing eggs from positive and negative reactors to the agglutination test we find that eggs from the positive reactors contained 5.1% more dead germs, 8.2% more of the chicks died in the shell and 1.0% more of those that hatched were cripples. The inferiority of eggs from positive reactors to the test is clearly demonstrated here considering only their hatchability. In addition a much bigger loss results from the high mortality among the chicks that do hatch out.

The percentage of strong chicks hatched was no higher after the positive reactors had been removed from the breeding pens when the averages of all hatches before and after are taken, but in this connection it must be considered that the percentage of infertile eggs was much higher during the later hatches and this corresponded with the period when the positive reactors had been removed from the breeding pens. This will be discussed later in comparing early and late hatches.

INFERTILE EGGS

15.4% of all the eggs set proved infertile with a range of from 4.7% in hatch A-11 to 33.7% in hatch B-29. The number of infertile eggs was much higher during the later part of the hatching season.

DEAD GERMS

Dead germs caused a loss of 12.7% in hatchability, the range being from 1.9% in hatch A-2 to 27.5% in hatch B-30.

Hatch No.	Incubator	Date Set	Eggs Set	No. Infertile	Percent Infertile	No. Dead Germs	Percent Dead Germs	No. Died in shell	Percent died in shell	No. weak or cripples	Percent weak or cripples	Number Strong Chicks	Percent Strong Chicks	Percent Strong Chicks based on fertile eggs
A-1	Ele. 3	10/19/26	216	56	25.9	9	4.2	30	13.9	3	1.4	118	54.6	73.7
A-2	Ele. 1	10/24/26	270	32	11.9	5	1.9	39	14.4	12	4.4	182	67.4	76.5
A-3	Ele. 2	10/28/26	252	29	11.5	10	4.0	49	19.5	14	5.5	150	59.5	67.3
A-4	C-1-2	11/ 7 /26	672	97	14.5	158	23.5	114	16.9	21	3.1	282	42.0	49.0
A-5	C-3-4	11/16/26	672	73	10.9	96	8.3	152	22.6	20	2.9	331	49.2	55.3
A-6	Ele. 3	11/19/26	252	31	12.3	18	7.1	23	9.1	13	5.1	167	62.3	75.6
A-7	Ele. 2	11/23/26	252	27	10.7	22	8.7	48	15.0	5	1.9	150	59.5	66.7
A-8	C-1	11/29/26	336	43	12.8	27	8.0	87	25.9	11	3.2	168	50.0	57.3
A-9	C-2	12/ 2 /26	336	21	6.2	26	7.6	46	13.7	8	2.3	235	66.6	74.6
A-10	C-3	12/ 8 /26	336	21	6.2	28	8 2	149*	44.3	74	2.2	64	19.0	20.3
A-11	C-4	12/10/26	336	16	4.7	20	5.9	49	14.6	17	5.0	234	66.6	70.9
Totals and averages from untested hens			3930	446	11.3	419	10.7	786	20.0	198	5.0	2081	53.0	62.6
B-12	Ele. 3	12/20/26	291	23	7.8	27	9.3	45	15.4	10	3.4	186	63.9	69.4
B-13	Ele. 1	1/ 4 /27	280	39	13.9	26	9.2	19	6.7	7	2.5	189	67.5	78.4
B-14	Ele. 3	1/11/27	252	38	15.0	31	12.2	4	1.5	8	3.1	171	67.8	79.9
B-15	C-1	1/14/27	332	38	11.4	19	5 7	33	9.9	12	3.6	230	69.3	78.2
B-16	C-2	1/22/27	335	28	8.3	12	3 6	84	25.0	16	4.7	195	58.2	63.5
B-17	Ele. 2	1/25/27	252	21	8.3	23	9.1	21	8.3	5	2.0	182	72.2	78.8
B-18	Ele. 1	1/31/27	269	27	10.0	18	6.7	32	11.9	11	4.0	181	67.3	74.8
B-19	C-1-2	2/13/27	672	78	11.6	50	7.8	108	16.0	28	4.1	408	60.7	68.7
B-20	Ele. 1	2/24/27	270	28	10.4	39	14.4	21	7.7	11	4.1	171	63.3	70.7
B-21	C-1-2	3/ 7 /27	504	97	19.2	79	15 5	71	14.0	13	2.6	244	48.4	59.9
B-22	Ele. 1 C-2	3/17/27	551	95	17.0	72	13.0	112	20.3	8	1.4	264	47.9	57.9
B-23	Ele. 2	3/24/27	252	49	19.5	33	13.1	37	14.2	7	2.7	126	50.0	62.1
B-24	C-1-3	3/31/27	588	134	22.8	71	12.0	120	20.4	13	2.2	250	42.5	55.1
B-25	C-4	4/10/27	286	50	17.1	33	11.5	43	15.0	5	1.8	155	54.2	65.7
B-26	Ele. 3	4/15/27	252	37	14.5	29	11.5	50	19.8	8	3.1	128	51.5	59.5
B-27	Ele. 2	4/20/27	252	41	16.5	27	10.7	94	37.3	14	5.5	76	30.1	36.0
B-28	C-1-2	4/25/27	588	89	15.1	62	10.5	92	15.6	25	4.2	320	54.4	64.1
B-29	C-3-4	5/ 4 /27	504	170	33.7	69	13.6	61	12.1	9	1.7	195	38.6	58.4
B-30	C-2-1	5/19/27	672	197	29.3	186	27.5	77	11.4	7	1.0	205	30.5	43.2
Totals and averages from negative reactors			7402	1279	17.3	906	12.2	1124	15.2	217	2.9	3876	52.4	63.3
C-31	C-4	2/ 8 /27	336	50	14.8	47	14.0	101	30.0	38	11.3	100	29.7	35.0
C-32	Ele. 2	2/17/27	252	23	9.1	61	24.2	35	13.9	19	7.5	114	45.2	49.8
C-33	C-4	2/24/27	252	48	19.0	39	15.5	47	18.2	13	5.1	105	41.7	51.5
C-34	C-3	3/ 3 /27	336	87	25.9	27	8.0	67	19.9	4	1.1	151	44.9	60.6
C-35	Ele. 3	3/ 6 /27	270	31	11.5	73	27.0	79	29.2	13	4.8	74	27.4	31.0
C-36	Ele. 2 C-4	3/12/27	336	59	17.5	69	20.5	84	24.6	11	3.2	113	33.7	40 8
Totals and average from positive reactors			1782	298	16.7	316	17.7	413	23.2	98	5.5	657	36.9	44.3
SUMMARY:														
All A—Hatches			3930	446	11.3	419	10.7	786	20.0	198	5.0	2081	53.0	62.6
All B—Hatches			7402	1279	17.3	906	12.2	1124	15.2	217	2.9	3876	52.4	63.3
All C—Hatches			1782	298	16.7	316	17.7	413	23.2	98	5.5	657	36.9	44.3
Grand Totals and Averages			13114	2023	15.4	1665	12.7	2323	17.6	513	3.9	6614	50.4	59.6

*Incubator thermostat did not work.

DIED IN SHELL

An average of 17.6% died in the shell, the range being from 1.5% in hatch B-14 to 44.3% in hatch A-10. This high loss in the A-10 hatch was due to the failure of the thermostat to function properly.

CRIPPLES

3.9% of the chicks hatched were cripples, the range being from 1.0% in hatch B-30 to 11.3% in hatch C-31. The percentage of cripples was materially lower in the eggs from the negative reactors as compared with eggs from positive reactors to the agglutination test, the percentages being 2.9 and 5.5 respectively.

TIME OF HATCHING

The hatching season in Hawaii is usually started in October or November. All hatches with the exception of the eggs from the hens reacting positively to the agglutination test are classified below on the basis of the month in which eggs were set. These figures suggest that the earlier hatches give a higher percentage of strong chicks. The poor results from May hatches are due chiefly to the high percentage of infertile eggs, and dead germs.

HATCHES ARRANGED ACCORDING TO MONTHS

Month of	Total Eggs Set	Infertile No.	Infertile %	Dead Germs No.	Dead Germs %	Died in Shell No.	Died in Shell %	Cripples No.	Cripples %	Strong Chicks No.	Strong Chicks %	Percent Strong Chicks based on fertile eggs
October	738	117	15.9	24	3.2	118	16.1	29	4.0	450	60.9	72.5
November	2184	271	12.4	321	14.7	424	19.4	70	3.2	1098	50.3	57.4
December	1299	81	6.2	101	7.8	289	22.2	109	8.4	719	55.4	59.0
January	1720	191	11.1	129	7.5	193	11.2	59	3.4	1148	66.8	75.1
February	942	106	11.3	89	9.4	129	13.7	39	4.1	579	61.5	69.2
March	1895	375	19.8	255	13.4	340	17.9	41	2.2	884	46.7	58.1
April	1378	217	15.8	151	10.9	279	20.2	52	3.8	679	49.3	58.5
May	1176	367	31.2	255	21.7	138	11.7	16	1.4	400	34.0	49.4

TYPE OF INCUBATOR

The hatches detailed in this report were made in separated sections of a 1200 egg Candee coal burning incubator or in one of three small electric incubators. Two of the hatches were made partly in the Candee and partly in the electric machine; so these two are excluded from these figures. The C hatches, made from eggs from hens reacting positively to the agglutination test, are also not included since these inferior eggs would obviously have placed the machine in which they were hatched at a disadvantage.

Type of Incubator	Eggs Set	Infertile No.	Infertile %	Dead Germs No.	Dead Germs %	Died in Shell No.	Died in Shell %	Cripples No.	Cripples %	Strong Chicks No.	Strong Chicks %	Percent Strong Chicks based on fertile Eggs
Electric	3612	478	13.2	317	8.8	512	14.2	128	3.5	2177	60.3	69.4
Candee Coal Burning	7169	1152	16.1	936	13.1	1286	17.9	279	3.9	3516	49.0	58.4

The small electric machines made better records during the 1926-27 hatching season at the University Farm than did the large coal burning incubator. The same men operated all of them. Hatch A-10 was a big factor in causing the low record of the large machine. Also, it should be noted that 16.1% of the eggs put in the Candee machine proved infertile and only 13.2% of the eggs set in the electric machines were infertile. Based on fertile eggs the electric machines hatched 69.4% and the Candee hatched 58.4% strong chicks.

PERCENT STRONG CHICKS BASED ON FERTILE EGGS

The discussions of hatching percentage, etc., in the preceding pages are based on total number of eggs set in the incubators. 15.4% of them were infertile with a range from 4.7% to 33.7% infertile eggs in the various hatches. Obviously the responsibility for infertile eggs goes back to the breeding pens. The right hand column in all tables in this report shows the percentage of strong chicks hatched based on the number of *fertile* eggs set. On this basis we find that an average of 59.6% of the *fertile* eggs set produced strong chicks, the range being from 79.9% in hatch B-14 to 20.3% in hatch A-10.

FOURTH ANNUAL HAWAII EGG LAYING CONTEST

By J. O. DALE

November 1, 1925 to October 26, 1926

There were fifteen pens of five pullets and one alternate entered in this contest. All entries were Single Comb White Leghorns and represented several of the leading Single Comb White Leghorn strains.

Each entry was kept in a 6x10′ house and given the same ration as in previous contests.

Feed was given as follows:

7:00 A. M. Wet mash
9:00 A. M. Cut alfalfa
12:30 P. M. Scratch Grain
4:00 P. M. Scratch Grain

Dry mash, grit, charcoal, crushed bone, and crushed oyster-shell were kept before the fowls at all times.

Although the high record pen of 1206 eggs was somewhat lower than the high record pen in the Third Contest, higher averages were made than ever before and a new individual hen record was made. The previous high hen record was 274 eggs, while in this contest the three high hens exceeded this mark by laying 276, 284, and 286 eggs each.

A total of 16,904 eggs were laid during the contest period, or 56.37 percent lay, with an average of 204.1 eggs per hen. These figures were determined on a hen-day basis. Mortality was 13.55 percent.

The egg value and feed cost were determined from the values given below.

AVERAGE MONTHLY WHOLESALE PRICE OF EGGS IN HONOLULU

November	1925	90¢ per dozen
December	1925	90¢ per dozen
January	1926	80¢ per dozen
February	1926	50¢ per dozen
March	1926	46¢ per dozen
April	1926	45¢ per dozen
May	1926	43¢ per dozen
June	1926	56¢ per dozen
July	1926	70¢ per dozen
August	1926	80¢ per dozen
September	1926	90¢ per dozen
October	1926	1.00 per dozen
Average		70¢ per dozen

FEED VALUES

Scratch grain	$58.00	per ton
Mash	60.00	per ton
Grit	2.00	per cwt.
Crushed Bone	3.00	per cwt.
Charcoal	3.20	per cwt.
Oystershell	2.00	per cwt.
Milk	.05	per pound
Alfalfa (green)	10.00	per ton

The following table shows the production, egg values which were determined on a monthly basis at current prices, feed costs and profits per pen:

PRODUCTION, EGG VALUES, FEED COSTS, AND PROFITS PER PEN

Pen No.	Eggs Laid 5 Hens	Eggs Laid 6 Hens	Average per Hen 5 Hen Totals	Value of eggs per pen 6 hen total	Average Price per dozen	Feed Cost per Pen	Feed Cost per Hen	Feed Cost per dozen Eggs	Value of eggs per Hen	Profit per Hen above Feed Cost	Labor Cost per Pen	Profit per Pen above Feed & Labor	Profit per Hen above Feed & Labor
1	994	1021	230.0	$56.42	$.6631	$13.36	$3.09	$ .180	$13.06	$ 9.97	$23.50	$19.56	$4.52
2	1206	1381	241.2	76.29	.6629	19.73	3.28	.171	12.71	9.43	23.50	33.06	5.51
3	1200	1227	240.0	69.12	.6760	15.64	3.04	.153	13.44	10.40	23.50	29.98	5.83
4	964	1076	192.8	64.17	.7056	18.07	3.19	.201	11.33	8.14	23.50	22.60	3.99
5	947	1055	189.4	54.88	.6241	18.69	3.11	.212	9.14	6.03	23.50	12.71	2.11
6	1014	1150	202.8	62.47	.6520	17.25	3.08	.178	11.15	8.07	23.50	21.72	3.91
7	1157	1330	231.4	76.19	.6874	18.87	3.14	.170	12.69	9.55	23.50	33.82	5.63
8	1070	1195	214.0	63.50	.6376	20.24	3.42	.205	10.58	7.16	23.50	19.46	3.24
9	999	1151	209.8	63.65	.6636	16.89	3.54	.176	13.37	9.83	23.50	21.26	4.47
10	954	961	190.8	51.69	.6454	17.34	3.42	.216	10.21	6.79	23.50	10.85	2.14
11	1077	1206	215.4	66.22	.6589	24.15	4.02	.269	11.03	7.01	23.50	18.67	3.11
12	1006	1142	201.2	61.80	.6809	18.25	3.36	.191	11.40	8.04	23.50	20.05	3.68
13	891	899	178.2	51.86	.6923	18.07	3.01	.241	8.64	5.63	23.50	10.29	1.71
14	1079	1093	218.4	59.84	.6570	15.07	3.05	.165	12.11	9.06	23.50	21.27	4.30
15	993	1017	198.6	55.79	.6584	15.99	3.13	.188	10.90	7.77	23.50	16.30	3.19
Total	15,551	16,904		933.89		267.91					352.50		
Average	1036.7	204.15	202.95	62.26	.6237	17.86	3.26	.194	11.45	8.19	23.50	20.77	3.82

The labor required in caring for the fowls was:

Total man hours 944 @ 37.5¢ per hour.....$352.50
Labor cost per hen.....$ 3.88

The following is a comparison of the highest, lowest and average pen in the contest, which emphasizes the value of well bred stock.

	High Pen	Low Pen	Average of Pens
Egg value	$76.29	$51.69	$62.26
Feed cost	24.15	13.36	17.86
No. of eggs	1206.00	891.00	1036.70
Profit per pen above feed & labor	33.82	10.29	20.77
Profit per hen above feed & labor	5.83	1.71	3.82

	High Month	Low Month	Average Month
Monthly receipts from eggs	$115.39	$46.82	$68.57

Receipts from eggs were highest in January when eggs were worth 80¢ per dozen wholesale and lowest in October when eggs sold at $1.00 per dozen.

PART II

Agronomy Division

By J. S. Low, *Assistant Agriculturist*

Dr. F. G. Krauss, Professor of Agronomy at the University of Hawaii, left Honolulu on May 30th, 1927, for a year's study in Europe, and it is the duty of the writer, as his assistant, to prepare this Tenth Annual Report of the Agronomy Division.

The University Farm has gone through one of its most successful years. This was due partly to the greater amount of rainfall which fell during the year as compared to previous years, and partly to the newly installed pumping system which utilizes the water from the Manoa stream for irrigating part of the fields. This irrigation system which replaces an old gravity system, now useless, will be materially extended during the coming year.

THE UNIVERSITY FARM

The University Farm at present comprises a total of sixty acres, which extend from the rear of the school campus to the Manoa stream. Of this total, 28 acres are arable, but only 23½ acres are improved and under cultivation. It is our hope that enough funds may be obtained to bring the other 5½ acres into cultivation within the next few years.

The entire farm is divided into two main sections, designated as North and South fields, with a main road between them. North Field comprises approximately 11½ acres and is devoted more or less to experimental crop breeding for student work. South Field, on the other hand, is wholly devoted to general planting of forage crops and alfalfa for stock feed. This comprises the remaining 16½ acres of arable lands.

A permanent system of division has been installed in the fields to facilitate the cropping system and the keeping of records. Each acre is lettered from left to right and numbered consecutively. Each is 148.6 feet by 293.1 feet, consisting of 58 rows spaced 5 feet apart.

The table below shows the areas planted to the different crops on University Farm for 1926-27.

CROPS	ACRES
Alfalfa	5.00
Sudan	3.00
Perennial grasses	3.00
Pigeon Peas (Intercropped with Corn)	5.80
Breeding Plots (Pigeon Peas)	2.22
Grass Garden, Papaya, Miscellaneous crop trials	1.84
Land in fallow	2.64
Unimproved lands not in crop	4.50
Total	28.00

CLIMATE AND RAINFALL

The climate at the University Farm has been quite equable during the last year. Situated between two hills and a steep mountain range in the rear, the farm is fairly protected from violent storms. The prevailing winds are from the east and northeast.

Though the rainfall was quite low, the total precipitation for the year was 25.03 inches. This was an increase of 7.91 inches when compared to the three previous years from 1924-26, the average of which was 17.12 inches. This total of 25.03 inches

of rain, however, was less than half the amount which fell at Miss Charlotte Hall's residence, at the junction of Oahu Avenue and Vancouver Highway, just about a mile away from the University Farm. The rain gauge at Miss Hall's is situated at an elevation of 210 feet, while that of the University Farm is at 97.5 feet (Lat. 21° 17′, Long. 157° 49′).

Below is a table showing the total monthly precipitations of the two stations, together with the mean total precipitation on the Island of Oahu from 39 stations, as compiled by the United States Weather Bureau:

TOTAL MONTHLY PRECIPITATIONS (1926-27)

Month	Oahu	Miss Hall's	U. H. Farm
July	2.08	1.83	0.22
August	4.35	4.65	0.38
September	2.74	3.25	0.46
October	4.23	4.68	3.80
November	1.81	2.22	0.91
December	3.70	2.02	1.19
January	7.11	8.37	4.83
February	4.04	3.32	1.37
March	11.42	8.44	5.39
April	7.99	3.45	1.49
May	9.88	13.43	4.68
June	2.43	2.46	0.31
Total	61.78	58.12	25.03 inches

This wide range of differences in precipitation goes to show the very uneven distribution of rainfall throughout the island, which is typical of the Territory as a whole. As water is one of the important, if not the greatest factor in successful crop production, the above table readily indicates why the University Farm needs an efficient irrigation system.

IRRIGATION SYSTEM

The first unit in the new irrigation system, a pump for lifting the water over a ridge intervening between the Manoa Stream and the University Farm, was installed in November, 1926. Owing to the lack of sufficient funds for necessary pipe lines, only two acres were under irrigation for the year, one of these being in Napier grass and the other in alfalfa. The installation of the new pump house and tank with permanent pipes over the ridge and temporary pipe lines leading to the fields cost $5,264.04. The efficiency of the pump and the cost of operating it will be given in the next annual report.

HORTICULTURE

Owing to the lack of a good orchard and a nursery, and the proper equipment for field and laboratory experiments, the horticultural work has not been very satisfactory. Until such can be obtained to facilitate carrying on the work, very little progress may be expected along this line. Fortunately, the Federal Agricultural Experiment Station is open for student work in orcharding and fruit culture. All instruction in scientific pruning and propagating of horticultural plants is carried on at this station. However, much time is wasted on the way to and from the station, which might be utilized to better advantage, provided we had the proper field equipment here on our own campus.

There is a vast promise in the horticultural possibilities in Hawaii, including the avocado, citrus, papaya, and numerous vegetable crops. The problems in connection with the production of these horticultural crops in commercial quantities are many and require definite knowledge as to the best varieties suited to Hawaiian conditions, and best methods in producing quantity and quality.

The horticultural work during the last year emphasized the art of raising fresh home-grown vegetables for table use. Students were assigned to a quarter of an acre in the northwest corner of Field A-1, for cultivation of various Hawaiian grown vegetables. The preparation of the seed beds, the systematic planting and operation of the garden were undertaken wholly by the students themselves. This in itself offered them training in the way of building up a successful vegetable garden of their own, should they care to indulge in the art later on.

FIELD CROPS

ALFALFA *(Medicago sativa)*

Alfalfa is still the outstanding forage crop on the University Farm. A total of five acres are now under cultivation, and it is our plan, if possible, to double the acreage and yield during the coming year. Among the varieties of alfalfa tested here, the Hairy Peruvian, to which the five acres are now planted, has shown its merits over all others. In spite of the stoniness and the poor soil conditions on University Farm, alfalfa has been growing well, and yielded a total of 138.8 tons of green forage for the year. Valued at $10 a ton, this gave a total of $1388.00 for the whole, or an average of 27.76 tons and $277.60 per acre per annum. This was entirely utilized as cattle and poultry feed by the livestock department. Besides being a most valuable feed for animals, alfalfa was invaluable for renovating worn out areas, and improving the fertility of the soil.

PIGEON PEA *(Cajanus indicus)*

Nearly six acres are now planted to Pigeon Pea, of which 2½ acres are used for breeding purposes. Over fifty different varieties are on trial, and it is hoped that some of these, crossed with the established New Era Strain D variety will give us a type that will thrive at an elevation of 5000 feet or more. This phase of the work is carried on by the students in genetics and plant breeding.

A recent development of a new strain of pigeon pea is Doctor Krauss' New Era Strain X. He hopes to purify and establish this strain in the Territory as he did the Strain D variety. This new variety is characterized by its strong, upright growth, compactness, and early-maturing and heavy seeding habits. The seeds are light, speckled, and larger than those of the New Era Strain D, or any other varieties. It is a very promising variety and Doctor Krauss thinks highly of it. So far the plant has done very well; a full acre intercropped with Strain D, is now planted to it, but further studies and careful observations are necessary to definitely prove its worth and merits over the other varieties. It is hoped that within the next year enough seeds can be produced to enable us to distribute seed for experimental purposes at various elevations in the Territory.

MISCELLANEOUS FIELD CROPS

Various other field crops of lesser importance were tried on a separate acre set aside for the Crop Production Class. These crops were planted by the students on March 2, 1927 and harvested by them at the close of the school year in May. The following were the crops planted and the results as observed by the students.

SOYBEAN *(Glycine hispida or Soja max)*

Among the soybeans planted, the O-Too-Tan, Biloxi, and Laredo were the outstanding varieties. The O-Too-Tan gave a yield of 3.2 tons of green forage per acre; Biloxi 2.1 tons; Laredo 1.23 tons; A. K. 1.26 tons; Mammoth Yellow 1.74 tons and the Manchu 1.21 tons per acre.

The soybean, although not a first class pasture crop, is nevertheless very valuable for seed, hay, and soiling purposes. For hay, the O-Too-Tan is highly recommended for Hawaiian conditions; for seed, the Biloxi. The Laredo is an intermediate type and is a fairly good hay and seeding variety.

COWPEA *(Vigna sinensis)*

Cowpeas have always been grown with a considerable degree of success on University Farm, and the last year's crop did exceptionally well. More than half a dozen varieties were planted, and among these the Brabham and Iron showed the best yields in green forage, giving 10.39 tons, and 8.3 tons respectively per acre. The other varieties, namely, Large Black-eye, Lady Pea, Whippoorwill and Clay also succeeded very well. These were planted mainly for forage and green manuring. Although all varieties seeded rather freely, no seeds were harvested.

SORGHUM *(Andropogon sorghum or Sorghum vulgare)*

The thirteen odd varieties of sorghums planted all gave fairly good yields in green forage. These included the sweet or saccharine sorghums, the grain or non-saccharine sorghums, and the broom corn.

Among the saccharine sorghums were the Early Amber, Early Orange, Red Top, Hasting's Syrup and Texas Seeded Cane, which grew to a height of from 8 to 12 feet. They matured within three months from date of planting and yielded from 21½ to 22½ tons of green forage per acre for the first crop.

The non-saccharine sorghums or grain variety were also utilized for cattle feed. Although the varieties seeded freely, no seeds were harvested. This group of sorghums, which included the milos and kafirs, grew to a height of from 8 to 12 feet, and matured a month later than the saccharine varieties. They included the following: Wonder Forage, Fancy Dwarf Milo, Yellow Milo, Feterita, White Kafir, Red Kafir and White Seeded Corn, which gave from 19½ to 21 tons of green forage per acre for the first cutting.

The one variety of broom corn planted did not give a satisfactory yield of either brushes or green forage.

BUCKWHEAT *(Fagopyrum esculentum)*

Two months after planting, the buckwheat was in full bloom, and the plants reached a height of from 2 to 2½ feet. The rows of white flowers were very pretty, and they served as a pasture for bees and other nectar-loving insects, the buckwheat being a honey plant. There was only one variety planted, namely, the Japanese, which matured its seeds from 9 to 12 weeks after planting. This crop was utilized for cattle feed.

MILLETS *(Choetochloa italica)*

The millets succeeded well, being somewhat drought-resistant. They grew to a height of about 5 to 8 feet, and matured in a shorter time than the sorghums. The yields, however, were much lower. Among the varieties tried were the Pearl, Bene, and the German. The German variety was the best of the three, and gave a yield of 6.2 tons of green forage per acre for the first crop. This was entirely used as stock feed for our dairy animals.

SUNFLOWER *(Helianthus annus)*

The Mammoth Russian variety of sunflower thrived very well on University Farm. Seed was planted thickly and later thinned. The woody nature of the stems made them undesirable for stock feed, so they were left to mature into seeds, which were harvested for future plantings. The stems were later turned under for green manure.

VETCHES *(Vicia sativa)*

Vetches have never done well on University Farm. They are grown with some degree of success at Makawao, Maui, where the climate is much cooler and more suited for growing this crop, which is very valuable for hay, green manure, pasture, and silage.

ECONOMIC GRASSES

A garden of one-fourth acre consisting of 31 rows 75 feet long, each planted to a variety, was set aside for economic perennial grasses. This plot was originally planted in December, 1924. Some of the original plantings failed to show any satisfactory results, and so were replanted to other varieties, all of which are now showing good growth. During the last year, four cuttings were taken from these varieties at approximately three months' intervals.

Below are the grasses on trial with their approximated yields, calculated on acre basis from the four cuttings during the year 1926-27:

VARIETY	YIELD (Tons per acre 4 cuttings)
Pennisetum merkeri (Merker Grass)	45.84
Pennisetum purpureum (Elephant or Napier grass)	32.24
Pennisetum clandestinum (Kikuyu grass)	18.20
Panicum maxum (Guinea grass)	17.80
Pennisetum setsum	17.44
Pennisetum barbinode (Para or Panicum grass)	16.40
Saccharum officinarum (Var. H109)	15.68
Trichlolaena rosea (Natal Red Top)	11.04
Panicum antidotale	10.72
Exophorus unisetus	9.60
Andropogon sericeus (Australian Blue Grass)	8.92
Andropogon spp. (Wilder grass)	8.56

The remaining 19 varieties which did not do so well included the following: Paspalum compressum (Carpet grass); P. Notatum; P. larranagai; Bromus inermis No. 1614; Saccharum officinarum (Uba or Japanese Cane grass); Melinis minutiflora (Molasses grass); Cynodon dactylon (Bermuda or manienie); C. dactylon (Giant Bermuda); Polytrias diversiflora (Java grass); Stenotaphrum americanum (Buffalo grass); Phalaris arundinacea No. 1630 (Canary grass); Coix lacryma (Job's Tears); Andropogon halegensis (Sudan and Johnson grasses). All of these yielded 4 tons and less per acre for the year.

The outstanding new variety which has done exceptionally well, not only on University Farm but elsewhere on the other islands, is the Kikuyu (Pennisetum clandestinum) grass. This variety seems to thrive very well under Hawaiian conditions, and its feeding value is said to equal that of alfalfa. Cattlemen of the Territory have found it a good pasture crop and highly recommend it for trial planting on other farms.

ELEPHANT OR NAPIER GRASS *(Pennisetum purpureum)*

An acre previously cropped to alfalfa was taken over in November, 1926 and planted to Elephant grass (Pennisetum purpureum). This area was divided into two sections of six plots each. These plots in turn were divided into 10 rows each, planted and treated with complete fertilizer as follows:

YIELDS OF ECONOMIC GRASSES ON TRIAL CALCULATED ON ACRE BASIS

Plot No.	Rows	How Planted	Soil Treatment	YIELDS (POUNDS) 1st Cutting	2nd Cutting	3rd Cutting	Tons per Acre
I	1-10	Root Division	500 lb. Complete Fertilizer	10836	13320	16200	20.18
II	10-20	Root Division	Check (No Fertilizer)	14100	18300	16260	24.33
III	20-30	Root Division	1000 lb. Complete Fertilizer	20480	28680	25320	37.24
IV	30-40	Stalk Cuttings	500 lb. Complete Fertilizer	12300	21600	24060	28.98
V	40-50	Stalk Cuttings	Check (no Fertilizer)	15960	19800	35460	35.61
VI	50-60	Stalk Cuttings	1000 lb. Complete Fertilizer	15000	19920	11940	23.43

From the above results, the plots planted from stalk cuttings showed higher yields in all cases except one. This was due to the poor condition of the soil in the last plot, and being at the farther end of the field received the minimum irrigation, hence the lower yield. The average yield per acre from stalk cuttings was 29.34 tons while that from root divisions was 27.28 tons.

The fertilizer treatments have shown very little, if any effect, upon the yields during this first year of planting. The check plots being in the middle of the field and between the two fertilized areas gave an average yield of 29.97 tons as compared to the 500 lb. and 1000 lb. fertilized plots, which gave 24.58 tons and 30.34 tons respectively per acre per annum.

GENETICS AND CROP BREEDING

Much of the work in genetics and crop breeding was devoted to the new strain of Cajanus, New Era Strain X, which has already been mentioned in connection with the pigeon pea. Much time has been spent and careful observations have been made in selecting seeds from the fifty best plants, which are now planted in a separate acre for further genetical study on this particular strain.

The papaya breeding work was carried on by the students, but the results have not been very satisfactory. The whole orchard, which comprises three strains of papaya, has been turned over to the Botany Division for further research work on the fruit.

CROP SURVEY

An intensive crop survey was inaugurated by the Crops Production Class to secure data pertaining to the yields and acreages of the ten leading crops of the Territory. Letters were sent to the various people and plantations regarding the status of the 1926 crops. The results obtained so far suggest that the project was a worthwhile one, and may serve as a beginning for more extensive work along that line by the Extension Division. The data when compiled and published will be a benefit to all concerned. Some of these publications are now ready for distribution by the University of Hawaii.