Preliminary Studies with Poultry Rations for the Territory of Papua and New Guinea. I.—Grower Rations with Copra, Sago and Leucaena leucocephala.

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This study is part of a continuing project to develop poultry rations for the Territory of Papua and New Guinea utilizing the maximum amount of feedstuffs indigenous to the Territory. In this connection a number of feedstuffs of potential value were collected in the Territory and tested with young chickens. Springhall (1964), *has demonstrated that a number of those materials had a high nutritional value and appeared suitable for use in poultry rations. The study reported below is an extension of this work to pullet grower rations.*

MATERIALS AND METHODS.

THREE hundred one-day old White Leghorn x Australorp pullets, obtained from a commercial hatchery, were brooded on a deep litter of wood shavings under an infra-red hover brooder for nine weeks. During this time they received the standard 21 per cent. protein ration shown in *Table* 1. At nine weeks of age the pullet chicks were distributed into four groups of 64 chicks each, and started on the experimental rations shown in *Table* 2. It will be noted from this table that approximately 80 to 85 per cent. of these experimental rations consisted of materials available in the Territory.

Ferrous sulphate was added to the *Leucaena leucocephala* (*Leucaena glauca*) in rations 3 and 4 because it had been shown to reduce the growth depressing effect of *L. leucocephala* in chick rations (Ross and Springhall, 1963).

Because of the uncertainty of shipments from the Territory, equivalent feedstuffs available in the Brisbane area were used. *L. leucocephala* was obtained from the experimental plots at Samford (C.S.I.R.O.) and on analysis was found to contain 2.3 per cent. of mimosine and 25.4 per cent. of crude protein. Cuttings of the shrub were sun dried, the leaves shaken off, then hammer milled before use. The ferrous sulphate was added as a solution to the *L. leucocephala* one week prior to the mixing of the rations.

The sago used was commercial domestic quality from Malaysia, of equivalent nutritive value to sago obtained in the Territory (Springhall, 1964). Copra meal was obtained from a local extractor, who also supplied the raw copra used during the first week of the study. Owing to milling difficulties with the copra, copra meal and coconut oil were substituted in proportions approximating the composition of copra. This was found to be, by analysis, 64 per cent. coconut oil and 36 per cent. copra meal.

The experimental groups remained on deep litter throughout the treatment period, from 9 to 22 weeks of age. All groups were vaccinated at 12 weeks of age, and individual body weights obtained periodically. Feed consumption data were also obtained.

At 22 weeks of age, 14 pullets were selected at random from each grower treatment group and placed in 15 in. layer cages, one or two birds per cage. All pullets then received the standard University of Queensland layer ration shown in *Table* 3. Daily egg production, mean egg weights, and feed consumption data were recorded over the eight-month experimental period.

Statistical treatment of the data consisted of the variance analysis (Snedecor, 1956), and the multiple range test (Duncan, 1955 ; Kramer, 1956).

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RESULTS AND DISCUSSION.

Growing Period.

The mean body weights and mortality during the growing period are shown in *Table* 4. It is apparent from these data that *L. leucocephala* retarded growth at both levels fed, the depression becoming more acute at the higher concentration. This effect on growth may be attributed to both the lower energy content of the *L. leucocephala* diets and the presence of mimosine. The relative contribution of each of these factors to the growth depression cannot be definitely evaluated, although the addition of ferrous sulphate to the *L. leucocephala* should have reduced the toxicity due to the mimosine. It would appear, therefore, that the relative growth rates of the pullets were related mostly to the energy content of their experimental diets. Palatability may also have been a factor since it was observed that considerable feed wastage occurred with some of the experimental diets. This is quite noticeable in the 9 to 22 week feed conversion values shown in *Table* 4 especially in the 15 per cent. *L. leucocephala* group.

In considering the growth rates achieved by the different experimental diets, consideration must also be given to current concepts of feeding pullet replacement stock. One of the prevailing views is that delaying sexual maturity, by limiting nutrient intake during the growing period, results in fewer small eggs at the outset of lay, and more persistent production during the laying year. In some studies, lower laying house mortality has also been observed. The sexual maturity of the groups receiving the experimental grower rations was delayed, as measured by days to first egg ; by eight days in the case of the copra-sago and 10 per cent. *L. leucocephala* rations, and by 17 days with the 15 per cent. *L. leucocephala* rations. These differences were statistically significant.

The mortality data also shown in *Table* 4 indicate a random effect since no mortality occurred among the groups making the greatest and poorest gains.

Laying Period.

A summary of the data collected during the laying period is shown in *Table* 5. In spite of the growth depression and subsequent delay in sexual maturity of the groups receiving the experimental diets, no significant differences were found in total egg production for the 8 month experimental period. It is of interest to note that the group that was most retarded (15 per cent. *L. leucocephala*) during the growing period, performed as well as the control group. Thus, even though sexual maturity was delayed by 17 days at the outset, after approximately two months of lay the experimental group had caught up with the production rate of the control group, and then surpassed it over the next four-month period. *Figure* 1 illustrates the effect of the various grower rations on overall egg production. The poorer production of the copra-sago and 10 per cent. *L. leucocephala* groups is difficult to explain inasmuch as their growth rate was satisfactory and the rations would appear to have been as fully adequate as the 15 per cent. *L. leucocephala* ration.

The average weight of eggs from all experimental groups exceeded the weight of the control eggs although none of the differences were statistically significant. This effect on egg size is probably related to age at first egg, since this phenomenon has been frequently reported in the literature.

No significant differences were found between treatments in feed efficiency although the apparent differences are related to the egg production of the treatment groups. Here again the birds receiving the 15 per cent. *L. leucocephala* ration compared favourably in efficiency of feed utilization with the control birds.

The hens which had received the 10 and 15 per cent. *L. leucocephala* rations were approximately 100 and 200 grams respectively lighter in weight at the end of the trial, than the hens which had received the control grower ration. Although these two groups which gained at a slower rate and attained a lower final weight also had a lower mortality rate, the data are too limited to warrant any conclusions. Although the weight gain differences were statistically significant, the differences in mortality were not.

SUMMARY.

Pullets fed grower rations containing up to 85 per cent. of a combination of sago, copra meal, copra and *Leucaena leucocephala* did not differ significantly in egg production, egg weights or feed conversion, although the groups receiving

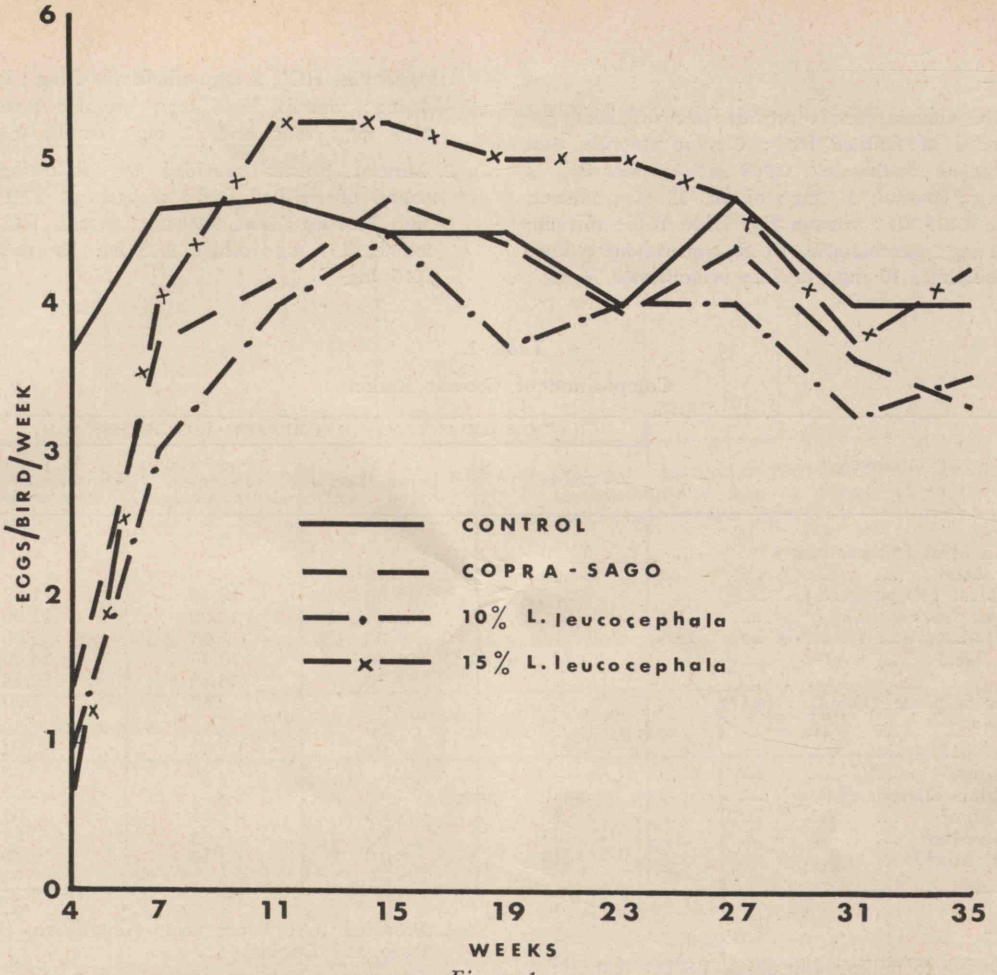

Figure 1.

the experimental grower rations took significantly longer to reach sexual maturity (days to first egg) and were significantly lighter after eight months production.

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APPENDIX.

Table 1.

Composition of Starter Ration.	lb.
Maize	64.3
Soybean Meal (50 per cent.)	30.4
Dicalcium phosphate	4
Salt	0.5
Vitamin mix[1]	314g.
Mineral mix[2]	50g.
	100 lb.

Note.—

1. The vitamin premix provided the following per pound of finished feed: Choline chloride, 500 mg; dl methionine, 0.908 g; vitamin B_{12}, 8 mcg; inositol, 50 mg; niacin, 32 mg; vitamin A, 8,125 IU; vitamin D_3, 1,200 ICU; thiamin, 12 mg; ascorbic acid, 10 mg; menadione sodium bisulphite, 10 mg; calcium pantothenate, 8 mg; pyridoxine HCL, 8 mg; riboflavin, 4 mg; PABA, 4 mg; vitamin E, 6 mg; procaine penicillin, 2.25 mg; folic acid, 2 mg; biotin, 0.3 mg.
2. Mineral premix provided the following per pound of finished feed: manganese, 27.2 mg; zinc, 20.4 mg; iron, 9.09 mg; copper, 1.12 mg; iodine, 0.59 mg; cobalt, 0.23 mg; molybdenum, 0.16 mg.

Table 2.

Composition of Grower Rations.

Ingredient.	RATION (QUANTITIES EXPRESSED AS PERCENTAGE).			
	Control.	Copra-Sago.	10 per cent. Leucaena leucocephala.	15 per cent. Leucaena leucocephala.
Soybean Meal (50 per cent.)	10.90	....	....	....
Maize Meal	83.80	....	....	....
Meat Meal (50 per cent.)	....	15.00	16.40	11.60
Leucaena leucocephala	....	....	10.00	15.00
Copra[1]	....	5.00	5.00	5.00
Copra Meal	....	25.00	10.00	15.00
Sago	....	53.70	56.40	50.58
Ferrous Sulphate ($FeSO_4$. $7H_2O$)	....	....	.60	1.00
Salt	.50	.50	.50	.50
B.H.T.	....	.02	.02	.02
Methionine	....	....	.20	.30
Tricalcium Phosphate[2]	4.00	....	....	....
Amprolium[3]	.05	.05	.05	.05
Vitamin Mix[4]	.65	.65	.65	.65
Mineral Mix[4]	.10	.10	.10	.10

Note.—

1. Owing to milling difficulties, 1.8 per cent. copra meal and 3.2 per cent. coconut oil were substituted after the first week on experiment.
2. Contained 32 per cent. Ca and 16 per cent. P.
3. Provided 0.0125 per cent. Amprolium (Merck Sharp and Dohme).
4. For composition of vitamin and mineral mixes see *Table* 1.
5. All rations were calculated to contain 15 per cent. crude protein.

Table 3.

Composition of Control Layer Ration.

Ingredient.	(Quantities Expressed as Percentage).
Meat Meal (50 per cent.)	12
Liver Meal (65 per cent.)	3
Lucerne Meal	4
Buttermilk Powder	5
Ground Limestone	5
Sorghum Meal	45.50
Wheat Meal	25
Salt	0.5
Premix[1]	0.02

Note.—

1. Premix contained the following per lb. of mixed feed, Vitamin A, 3,040 IU; Vitamin D_3, 567 IU; riboflavin, 1.31 mg; menadione sodium bisulphite, 0.51 mg; calcium pantothenate, 1.5 mg; manganous oxide, 57.5 mg.
2. Ration was calculated to contain 15 per cent. crude protein.

Table 4.

Mean Body Weight, Feed Conversion and Mortality During Growing Phase.

Treatment.	Average Weight in Grams.				Feed Conversion.	Days to First Egg.	Mortality (Per cent).
	9 WKS.	13 WKS.	17 WKS.	22 WKS.			
Control	728	1,120	1,450	1,800	6.82	169	0
Copra-Sago	602 *	1,043	1,276	1,666	6.77	177	8
10 per cent. *Leucaena leucocephala*	700	1,035	1,124	1,402	7.44	177	5
15 per cent. *Leucaena leucocephala*	735	882	908	1,175	13.67	186	0

* All groups were of uniform weight at eight weeks of age when distribution was made. In the intervening week this group failed to gain, possibly due to inaccessibility of feed or water. However, the group gained rapidly on the grower ration and appeared unaffected by the setback.

Table 5.

Hen Day Production, Mean Egg Weight, Feed Conversion, Body Weight and Mortality During Laying Phase.

Grower Treatments.	Hen Day Production.	Mean Egg Weight.	Feed * Conversion.	Final Body Weight.	Mortality.
	Per cent.	Grams		Grams	Per cent.
Control	59.2	55.7	5.63	2,621	14.3
Copra-Sago	52.4	56.6	7.05	2,612	14.3
10 per cent. *Leucaena leucocephala*	48.2	56.4	7.42	2,509	7.1
15 per cent. *Leucaena leucocephala*	59.2	57.1	5.73	2,401	7.1

* Pounds of feed required to produce a dozen eggs.