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### The place of clover meal in poultry feeding

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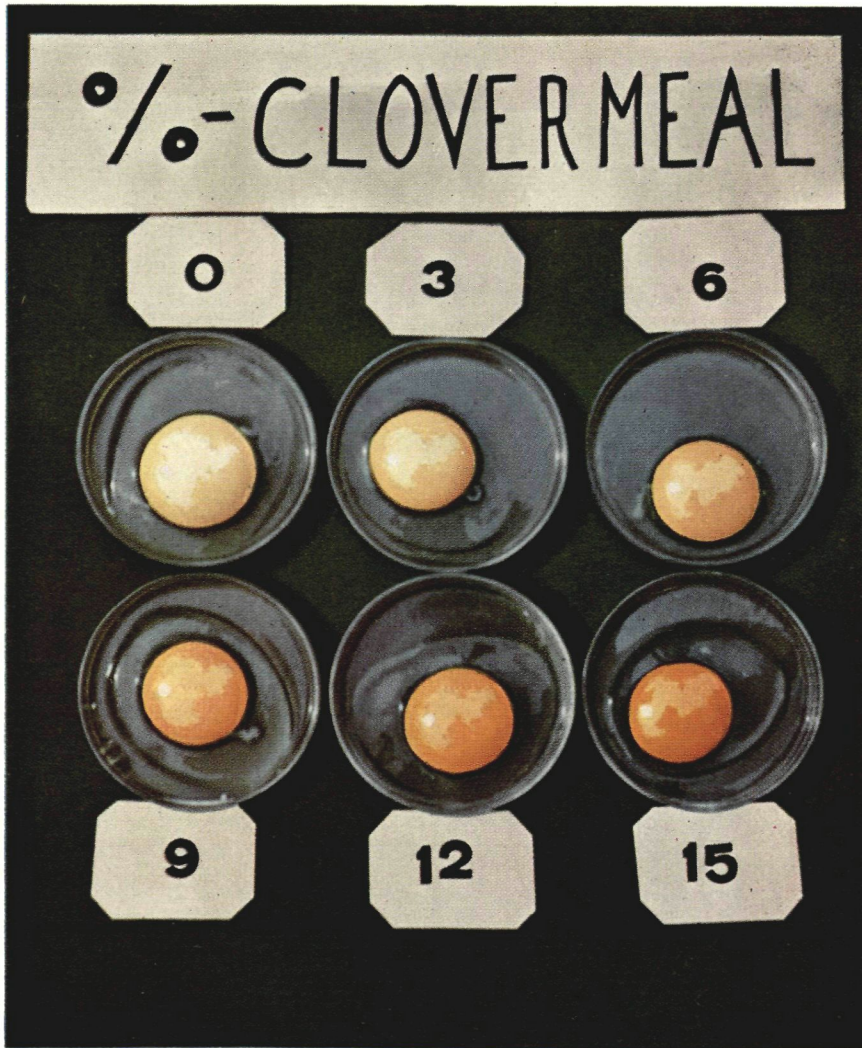
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The improvement in yolk colour resulting from the feeding of increasing amounts of clover meal in the laying ration is illustrated above. The colour associated with the feeding of an 8 to 9 per cent. level in the ration would satisfy the requirements of most people although some may prefer a richer colour.

It should be appreciated that the yolk colour resulting from the feeding of any particular level of clover meal will vary according to the xanthophyll content of the meal used. In England, grass meal is often used in laying rations, and in this State, meal made from high quality meadow hay such as is sometimes produced from our irrigated areas could have a place in poultry feeding.





Fig. 1.—This 54-acre paddock of Woogenellup clover pasture grown by Mr. F. Ford at Woogenellup cut nearly three tons of hay an acre. There are about 60,000 long tons of clover hay produced in the State each year. It is possible that up to 2,000 tons of either clover meal or lucerne meal could be required annually by the poultry industry in the next few years providing good quality meals can be purchased at reasonable prices.

(Photo. by Courtesy of West Australian Newspapers Ltd.)

## THE PLACE OF CLOVER MEAL IN POULTRY FEEDING

*A progressive report covering the first of a series of clover meal experiments conducted at the Poultry Research Station, Herdsman Lake.*

By R. H. MORRIS, Officer-in-Charge, Poultry Branch

**T**HE majority of people both at home and abroad prefer eggs which have golden-coloured yolks. Because of their bright yolks, eggs produced on farms where green feed is fed are strongly favoured by Australians and it is felt that local egg sales would increase if only eggs with golden-coloured yolks were offered to the public.

A check in February, 1959, by three Departmental officers on a cross-section of eggs supplied to the two largest egg receiving floors at Perth and Fremantle respectively showed 36.8 per cent. of the eggs to have very pale yolks, 18.0 per cent. to have yolks of reasonable colour and 45.2 per cent. to have very bright-coloured yolks.

All the eggs received at the two floors during four consecutive days were included in the survey. Five hundred and eighty-four farms forwarded 66,639 dozen eggs during the four days. Three eggs taken

at random from each consignment were broken out and the yolk colour classified into the three abovementioned categories.

The figures show that many farmers do not supply their birds with greenfeed, and as the majority of the eggs in the "pale" category were very pale indeed it is obvious that considerable scope exists for improving yolk colour.

Lucerne meal is an alternative source of the yolk colouring pigment exanthophyll, but unfortunately it is both expensive and in very short supply in



Western Australia. Very little lucerne meal is produced in this State and we have to rely to a large extent on lucerne meal imported from Eastern Australia. Even then the high cost of this imported foodstuff weighs heavily against its widespread use.

The retail price to the farmer of imported lucerne meal was about £45 a short ton in 1958 and in the previous year sold for more than £50 per ton. The local product sells for about £40 a short ton.

A possible alternative yolk colouring foodstuff which is grown in large quantities in this State is clover hay which can readily be made into clover meal.

Very little experimental evidence is available on the feeding of clover meal to poultry but preliminary trials carried out at the Poultry Research Station, Leederville, have shown it to be capable of imparting that desirable golden colour to egg yolks.

Using substandard diets in laying cages it has also been shown to increase egg production by virtue of its nutritive value.

However, no benefit was gained by including 10 per cent. of clover meal in chicken diets fed to both replacement pullets and cockerels for meat.

In view of the good responses with laying birds and because clover meal is retailing for about £27 per short ton at the present time, with a possibility of a price reduction, should a clover meal industry become established, further trials are justified and are being undertaken during 1959 at the Poultry Research Station in order to determine the extent to which clover meal can fulfil the advantages which greenfeed and lucerne meal are known to provide.

A summary of the work already carried out is contained in this paper.

The sample of clover meal used in experimental work during 1958, was derived from the Yarloop variety of subterranean clover grown at Capel, 132 miles south of Perth.

The clover is mown just prior to flowering, and wind-rowed. It is then left to be suncured for a day before being turned. The next day it is baled and subsequently it is hammer-milled. In 1958 a pure stand of the Yarloop variety yielded three tons of hay per acre and it is this material with which we are currently experimenting.

It will be appreciated that the analyses of clover meal will show some variation depending upon the variety, stage of maturity at time of mowing, conditions during the suncuring period and the method of handling. Samples of clover hay which vary in quality will be harvested during 1959 with the object of determining the extent to which the quality of the meal affects yolk colour and egg production.

An analysis of the material used in the experimental work is given in Table I.

Table I  
CLOVER MEAL ANALYSIS

	Per cent.
Moisture (as analysed) ....	10.6
Ash ....	7.2
Crude protein (Nx 6.25) ....	10.5
Crude fat (petroleum ether extract) ....	1.7
Crude Fibre ....	21.3
Nitrogen-free extractives ....	48.7
Calcium, Ca ....	0.95
Phosphorus, P ....	0.09
	Parts per million
Carotenoids ....	100
B-Carotene ....	10

## YOLK COLOURING EXPERIMENTS

Clover meal was fed at varying levels to groups of laying pullets in cages with the aim of improving egg yolk colour.

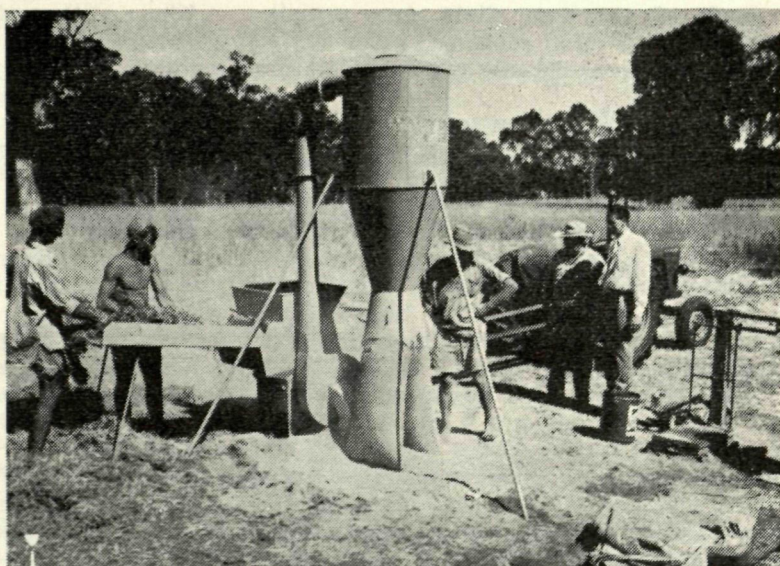
Levels of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 per cent. of clover meal were included in a basal ration, with six birds on each level. Similarly clover chaff was used at the same levels in another ten rations.

It was found that a period of three weeks was necessary for the colour of the yolk to become stabilised. The group on the 1 per cent. level of clover meal showed a slightly improved yolk colour, but there was no marked colour change below 4 per cent. A level of 5 per cent. clover meal as part of the diet gave a definite response and it was felt that the colour obtained when a level of 8 per cent. was fed would satisfy practically everyone. The 8 per cent. was sufficient to enable the yolks to qualify for the "bright yolk" category referred to in the second paragraph of this article.

The birds on the clover chaff ate it readily and the meal and chaff were equally effective in influencing yolk colour at any of the 10 levels.



Fig. 2.—Clover hay being put through a hammer-mill for the production of clover meal, on the property of Mr. A. E. Dunkley, Capel.



In another trial, levels of clover meal at 3, 6, 9, 12 and 15 per cent. of the ration were fed. The change in yolk colour with each increase in the level of clover meal was quite pronounced and at the 15 per cent. level the colour was extremely bright.

As with lucerne meal the yolk colour obtained from feeding clover meal at any particular level is reasonably uniform in all eggs laid.

In a laying trial a good sample of lucerne meal at a 5 per cent. level in the diet is currently being compared with the same level of clover meal. The colour provided by the clover meal is slightly less pronounced than that obtained from the lucerne meal.

Under industry conditions the actual xanthophyll content of the samples of clover meal or lucerne meal used, together with the intensity of the yolk colour required would determine the level at which the meal should be fed.

However, as mentioned previously the clover meal we have used has given quite a good colour to the yolks, when fed at an 8 per cent. level although some people would no doubt prefer the colour resulting from a higher level in the ration.

### LAYING EXPERIMENTS

Once it had been established that clover meal was able to impart the desired yolk colour to eggs, further trials were carried out to determine whether clover meal,

when fed to laying birds, had any other beneficial effects such as increasing egg production by virtue of its nutritive content.

First Cross (W.L. x Aust.) point-of-lay pullets housed in laying cages were used in this experiment which covered a period of 11 months production.

Four treatments were included in the experiment with six replications of 12 birds on each treatment.

Birds on the first treatment were fed the control ration given in Table II. Three different levels of clover meal namely 5 lb., 10 lb., and 15 lb., were added to every 100 lb. of the control diet and these diets which automatically had slightly lower levels of protein than the control diet comprised the remaining three treatments.

Table II

Ingredients						Control Ration
						lb.
Bran	...	...	...	...	...	15
Wheatmeal	...	...	...	...	...	35
Meatmeal	...	...	...	...	...	3½
Whalemeal	...	...	...	...	...	3½
Bone flour	...	...	...	...	...	1½
Oyster flour	...	...	...	...	...	1
Total	...	...	...	...	...	59½

#### Analysis (Calculated)—

Protein %	...	...	15.9
Calcium (Ca) %	...	...	2.3
Phosphorus (P) %	...	...	0.8



Each of the four diets were supplemented with the required amounts of common salt, manganese sulphate, Vitamin A and D<sub>3</sub>.

Records were kept on feed consumption, egg production, body weight, egg size and mortality.

A glance at Table III will show that the addition of clover meal to the control ration had a marked effect on food consumption and resulted in a significant increase in egg production. Body weight was improved slightly but mortality was not affected.

Egg weight was also measured throughout the experiment and it was found that the average weight of the eggs from the birds on the three clover meal rations was slightly higher in each case than for the eggs laid by birds on the control ration. Therefore the increased egg production did not adversely affect egg weight.

The addition of 12 lb. of clover meal to every 100 lb. of this second control diet reduced mortality significantly and improved the average egg production by 15.8 per cent. The pounds of feed required per dozen eggs was reduced from 7.9 lb. for the control diet to 6.1 lb. for the clover meal ration.

However, in the same experiment another treatment was included to test the effect of adding greenfeed to the control diet at the rate of 1½ oz. of fresh kikuyu lawn clippings a bird a day. This stimulated food consumption even more, and lifted the average egg production 13.2 per cent. over the clover meal group.

Although the clover meal did not measure up to the greenfeed under the conditions of this experiment it has been shown in other experiments carried out at the Poultry Research Station that the ratio of mill offal to wheat in relatively

Table III

Ration	Feed consumption per bird per day	Average egg production	Hen Housed Egg Production per bird during 11 months or 334 days from 170 days of age	Pounds of feed consumed per dozen eggs	Mortality	Average egg weight	Body Weight	
							At beginning of experiment — 24½ weeks old	At end of experiment
	ozs.	%			%	gms.	lb.	lb.
Control .....	3.6	44.0	138	6.1	15.3	57.9	3.8	4.3
5 lb. clovermeal	4.0	51.5	168	5.8	4.2	58.1	3.8	4.6
10 lb. clovermeal	4.0	54.3	169	5.6	16.6	58.1	3.8	4.5
15 lb. clovermeal	4.2	55.8	178	5.6	7.0	58.4	3.8	4.6

The control ration in this experiment is a relatively simple diet known to be inadequate for maximum efficiency in laying cages. For each of the levels of clover meal added to the control ration there was a significant improvement in egg production, the rations with the higher levels of clover meal (10 lb. and 15 lb.) giving the best production.

A second laying trial also carried out in laying cages over an 11 month period, tested the effect of adding clover meal to an unsupplemented higher energy ration which was known to be even more inadequate for maximum production in cages, than the control diet used in the previous experiment.

simple diets and whether or not the layers are housed in cages have an influence on the results obtained when greenfeed is fed.

Trials now in progress are expected to yield further information on the benefits to be obtained by including greenfeed, lucerne meal, or clover meal in laying rations under both cage and floor conditions and also information on the effect of supplementing these rations with other nutrients. In the meantime it has been shown that clover meal does enhance the feeding value of an otherwise substandard diet and what is perhaps more important it brings about a marked improvement in yolk colour when fed at an 8 per cent. level in the ration.



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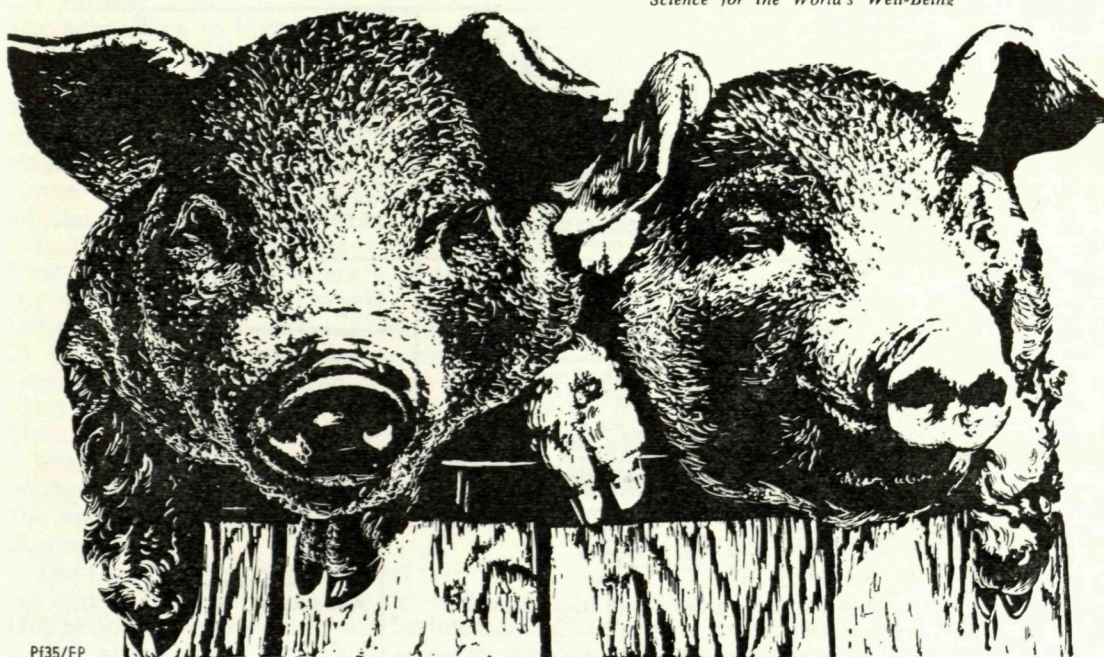
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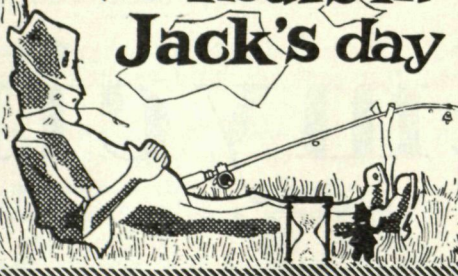


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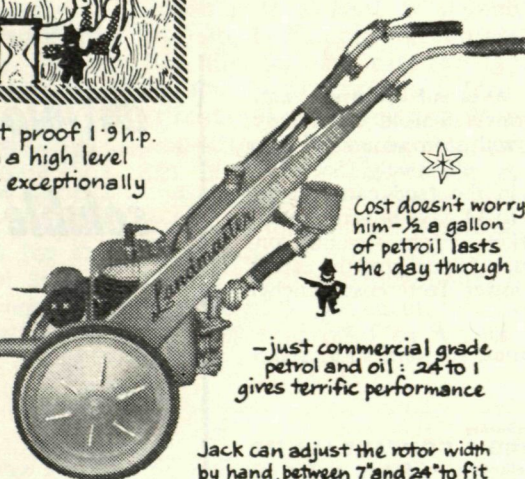
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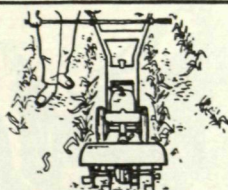


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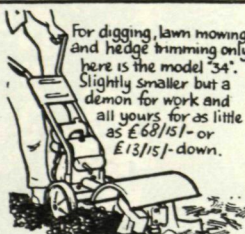
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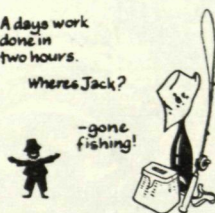
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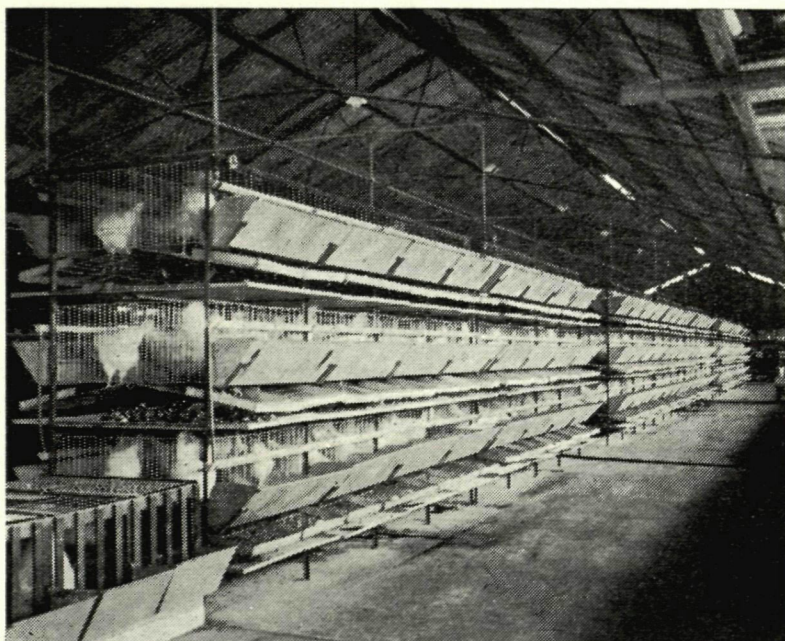
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Fig. 3.—Batteries of laying cages at the Poultry Research Station Herdsman Lake. These cages were used in the clover meal experiments.



### COCKEREL FEEDING EXPERIMENT

Although encouraging results have been obtained by including clover meal in laying rations, there does not appear to be any advantage in including clover meal at a 10 per cent. level in rearing diets. Trials have been carried out at the Research Station with both cockerel and pullet rearing diets which contained 10 per cent. clover meal but in neither case did the clover meal group show an improvement on the unsupplemented control group.

In the cockerel experiment, 300 day-old First Cross cockerels were divided into three treatments and brooded on litter under a hot water system in 12 groups of 25 birds. At the age of five weeks the cockerels were transferred to small deep litter units still in their 12 groups of 25 birds.

Records were kept on mortality, feed consumption and gain in body weight until the age of 12 weeks when the birds were marketed.

The three different rations fed from day-old consisted of a control ration, the control ration plus greenfeed and the control ration with 10 per cent. clover meal incorporated in it.

The composition of the three rations in which the calculated protein content was 18 per cent. was as follows:—

Table IV

Ingredients	Control	Green-feed	Clover Meal
	lb.	lb.	lb.
Wheatmeal ....	30	30	30
Bran ....	10	10	10
Dried buttermilk			
Powder ....	2	2	2
Whalemeal ....	3½	3½	3½
Meatmeal ....	3½	3½	3½
Boneflour ....	½	½	½
Clover meal ....	Nil	Nil	5½
Greenfeed ....	Nil	¾ oz. per bird per day	Nil
Total ....	49½	49½	55

Each ration was supplemented with the required amounts of common salt, manganese sulphate, synthetic riboflavin, Vitamin A and Vitamin D<sub>3</sub>.

During the 7 to 12 week period the buttermilk powder was deleted from the rations but the protein was kept constant at 18 per cent. by increasing slightly the quantities of whalemeal and meatmeal.

It can be seen from Table V that the birds on the clover meal ration ate slightly less than the birds in the other two groups. The lower feed consumption in the clover meal group was consistent in each replication within the treatment and



corresponded very closely to the average body weight of the birds on each treatment.

The mortality record showed a lower death rate in the clover meal group but this result was not significant and in no case could the mortality be associated with any of the rations. A large number of deaths, of unknown causes, occurred in the first few weeks and the remainder of the losses were due to coccidiosis and nephritis.

Table V

Treatment	Average body weight per bird at 12 weeks		Average feed consumption per bird	Conversion ratio	Mortality
	lb.	oz.	lb.		%
Control .....	2	9.7	9.27	3.75	20
Control + greenfeed .....	2	11.1	9.39	3.62	20
Control with 10 per cent. clover meal	2	7.7	9.00	3.80	12

### PULLET FEEDING EXPERIMENT

A similar result was obtained in a trial carried out in 1956 with pullets instead of cockerels. In this case rearing records were kept from day-old to 18 weeks and these show once again that the inclusion of clover meal in the diet of young stock at a 10 per cent. level was of no advantage.

The birds were reared on litter with three replications of 60 birds (180 birds) on each treatment. Although there was no appreciable difference at 18 weeks in mortality between the three treatments the conversion figures for both the control group and the group with greenfeed were significantly better than for the group on clover meal.

Table VI

Treatment	Mortality to 18 weeks	Conversion ratio	Average weight per bird	Feed consumption per bird
	%		lb.	lb.
Control Ration .....	8.6	5.32	3.05	16.23
Control Ration plus greenfeed .....	9.4	5.05	3.15	15.89
Control with 10 per cent. clover meal	8.6	5.68	2.98	16.93

### CONCLUSIONS

In summing up the work done with clover meal it is clear that there is a need for further investigation into several aspects of the feeding of this material to poultry. Further trials which should yield

useful information are at present in progress.

At the present stage it can be said that clover meal does have a place in the nutrition of laying stock not already receiving greenfeed or lucerne meal chiefly by virtue of the ability of clover meal to impart the all-important golden colour to the egg yolk and partly, also due to its nutritive value in the case of certain basal rations.

Trials carried out with clover meal in rearing diets for both meat chickens and pullets showed that there was no advantage in feeding this product at a 10 per cent. level to young stock.

The potential for a clover meal industry exists in Western Australia. Large areas of clover hay are grown and several tons of meal suitable for feeding to poultry were produced in 1958.

If subsequent trials at the Poultry Research Station show clover meal to compare favourably with lucerne meal on the basis of its ability to improve both yolk colour and egg production and if clover meal continues to be considerably cheaper than lucerne meal it is possible that relatively large quantities of clover meal will be used in laying rations in the future.

In the meantime, as about 90 per cent. of the public have a definite preference for eggs containing bright coloured yolks, more farmers should feed fresh greenfeed to their laying fowls with the object of supplying this class of egg.

### ACKNOWLEDGMENT

Grateful acknowledgment is made to the staff at the Poultry Research Station for their co-operation in this work.

### CORRECTION

*In the reprint of Mr. K. Needham's radio talk "Farm Water Supplies" (March-April 1959 issue, page 225) it was stated that "water containing up to 600 grains per gallon may be used in a septic tank system." The correct figure is 700 grains.*