

Chick Growth Factor in Cow Manure. VI. Effect on Hatchability and Storage in Hens.

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Whitson *et al.*¹ showed that as the level of soybean oil meal in the diet of hens increased from 0 to 40% in increments of 10%, the hatchability of fertile eggs decreased in spite of apparently adequate quantities of the dietary factors known to affect hatchability. There was no other adverse effect. Whitson *et al.*² also showed that there was considerable improvement in hatchability when 8% of dried cow manure was included in a diet containing 30% soybean oil meal. Shortly thereafter, Bird *et al.*³ reported that the inclusion of 6% cow (or steer) manure, 10% sardine meal, or 10% dried skimmilk in this diet corrected the detrimental effect on hatchability.

Rubin and Bird⁴ prepared concentrates of a factor found in cow manure, which greatly stimulated the growth of chickens fed a diet containing 35 percent of soybean oil meal but no animal protein. It seemed likely that both growth and hatchability were influenced by the same unknown dietary factor in cow manure. To obtain further evidence on this point one of the concentrates which stimulated growth was tested for its effect on hatchability, and the results are reported herewith.

The hens used in part A of this experiment were Rhode Island Reds that were 10 months old when the experiment commenced. As chicks, they were fed diets which contained 2.5 to 4% of fish meal and they had access to grass range until they were 5 months old. During the latter half of the pre-experimental

TABLE I.
Experimental Diets.

Ingredients	Diet 311 %	Diet 312 %
Yellow corn	57.0	78.3
Alfalfa leaf meal	5.0	5.0
Soybean oil meal	30.0	
Sardine fish-meal		10.0
Steamed bone meal	4.2	3.2
Limestone	2.3	2.0
Butyl fermentation solubles (250 μ g riboflavin per g)	0.5	0.5
Salt (94% NaCl; 6% MnSO ₄)	0.5	0.5
Iodized salt	0.2	0.2
Vit. A and D feeding oil	0.3	0.3

period they were fed diet 311 (Table I).

The 16 hens used in the experiment were selected because of their low hatchability records and were divided on the basis of these records into 2 comparable groups of 8 birds each. Their average hatchability from the start of egg production to 10 months of age was 54%. This ranged between 34 and 67% for individual hens. The object of the careful selection was to minimize the number of birds and hence the quantity of concentrate used. The hens were kept in a laying battery in an air-conditioned room for the duration of the experiment. Fertile eggs for hatchability studies were obtained by artificial insemination with semen from Barred Plymouth Rock males.

Both groups were fed diet 311 except that the diet of one of the groups was supplemented with 0.1% of the acid insoluble fraction of an extract of cow manure (Rubin and Bird⁴). This supplement was known to produce optimum growth in chicks when fed as 0.05% of an all-plant-protein diet containing 35% of soybean oil meal. The experiment was started March 6 and terminated November 12, 1946. After the groups had been on their respective diets for 6 weeks, the diets were reversed. This dietary regimen was

¹ Whitson, D., Titus, H. W., and Bird, H. R., *Poultry Sci.*, 1946, **25**, 52.

² Whitson, D., Titus, H. W., and Bird, H. R., *Poultry Sci.*, 1946, **25**, 143.

³ Bird, H. R., Rubin, M., Whitson, D., and Haynes, S. K., *Poultry Sci.*, 1946, **25**, 285.

⁴ Rubin, M., and Bird, H. R., *J. Biol. Chem.*, 1946, **163**, 393.

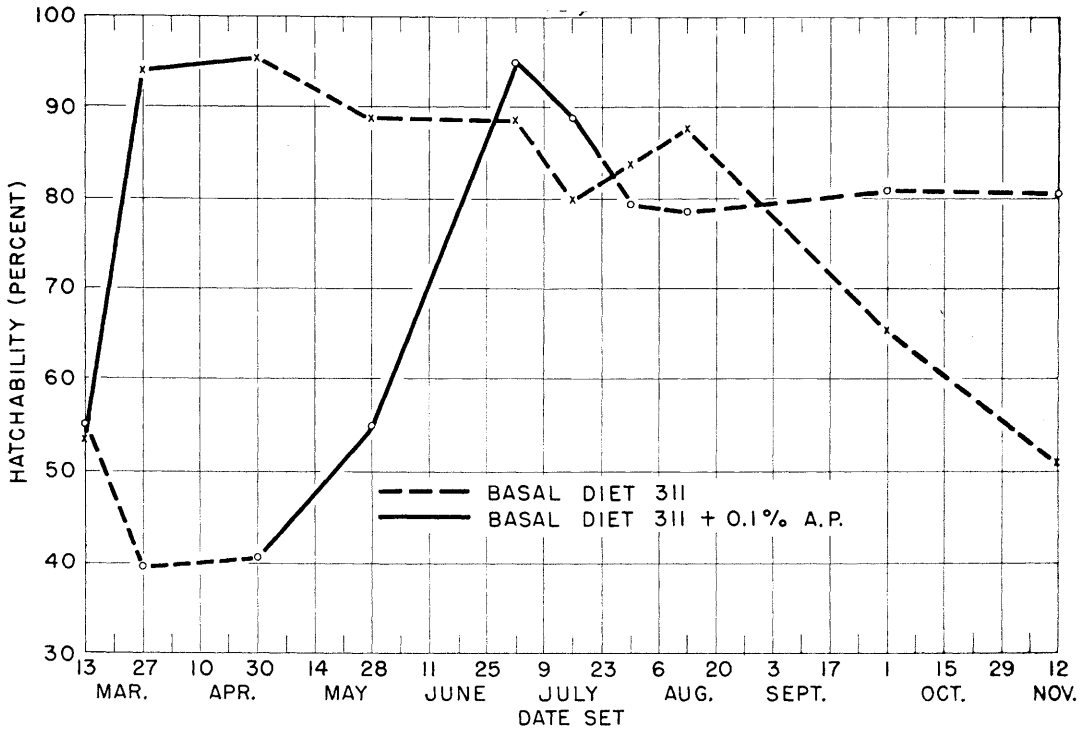


Fig. 1.

Effect upon hatchability of supplementing basal diet 311 with 0.1% of the acid precipitate of the water extract of cow manure.

continued until the seventeenth week of the experiment. At this time and until the termination of the experiment, all the hens were fed diet 311. The dietary changes and the hatchability data are illustrated in Fig. 1.

The concentrate prepared from cow manure brought about a rapid increase in the percentage of hatchable eggs, (Fig. 1), while the hens on the unsupplemented diet continued at a low level of hatchability. When these hens received the concentrate after the initial 6 weeks' period, their percentage of hatchable eggs also increased to a high level. The data in Fig. 1 show that when the supplement was removed from the diet, enough of the hatchability factor had been stored by the hens to enable them to maintain hatchability at a high level for 15 to 16 weeks. The experiment was terminated before the hens in the second group, which had received the concentrate for 11 weeks, had enough time to exhaust their store of the hatchability factor, even though they were fed the diet without the supplement for 16 weeks.

The hens used in part B were crossbreds (Rhode Island Red X Barred Plymouth Rock). During the growing period they had been fed a mash which contained 2 to 3% of fish meal and which supported rapid growth. They had access to grass range during the first 5 months of life. For the following 21 months, until June 4, 1946, they were fed diet 312 (Table I).

On June 4, 45 of these hens were changed to diet 311. They were housed in 2 colony laying houses with New Hampshire males and all eggs with good shells were incubated to determine hatchability. The experiment was terminated August 27, 1946.

During the 5 month period when the hens were fed diet 312 containing fish meal, the average hatchability was 82% of fertile eggs set. Hatchability during the 3 months period in which the hens were fed diet 311 was also 82% (Fig. 2).

Bird *et al.*⁵ found that pullets had no

⁵ Bird, H. R., Rubin, M., and Groschke, A. C., *J. Nutrition*, 1947, **33**, 319.

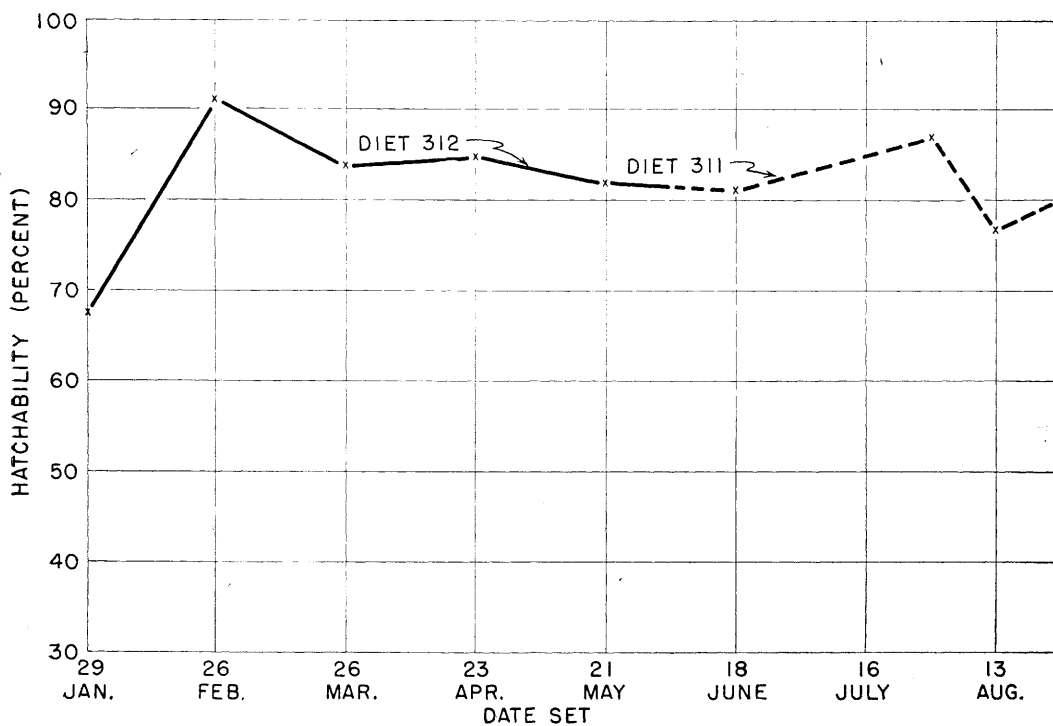


FIG. 2.

Effectiveness of bodily stores in maintaining hatchability in spite of dietary deficiency of the factor found in cow manure and in fish meal.

measurable stores of the hatchability stimulating factor at the time they began to lay. The pullets were of the same breeding as the hens in Part B of this experiment and like them had received a diet containing 2 to 3% of fish meal during the growing period. In this experiment hens fed 10% of fish meal or 0.1 percent of the concentrate from cow manure stored considerable quantities of the factor. Differences in the quantity of intake may account for the different results, or it may be that the mature bird has greater storage capabilities than the growing bird.

Summary. An acid precipitate of a water

extract of cow manure which was highly potent as a source of the chick growth factor was shown to possess a high potency of the hatchability factor required by hens fed an all-plant-protein diet. This result is in accord with the view that the same dietary factor influences both growth and hatchability.

Hens that obtained the hatchability factor from the above mentioned concentrate or from fish meal, stored sufficient quantities of the factor, so that high hatchability was maintained for at least 12 to 15 weeks even when a deficient diet was fed.