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Effect of Soybean Oil Meal on Avian Reproduction.*

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In studies of the iodine requirements of poultry a simple type of goitrogenic ration has been used at this Station. This has consisted essentially of ground yellow corn, dried brewers' yeast residuals, soybean oil meal, steamed bone meal, salt and vitamin D oil. This has supported fairly good growth and feathering and has allowed the production of severe goiter when feedstuffs selected for low iodine content were used. The goitrogenic effect has been readily overcome by the addition of iodine to the ration. However, it was found that both production and reproduction on this ration were poor, even when sufficient iodine was present to prevent goiter.

In order to study the iodine requirements of laying birds, it was necessary to correct this difficulty. Experience had shown that the replacement of part of the soybean oil meal with casein in the type of ration just mentioned would permit excellent growth. Accordingly, a number of single-comb White Leghorn pullets, reared on the goitrogenic type of ration, were divided into 3 pens at time of sexual maturity and were fed rations containing different proportions of casein and soybean oil meal. The protein, vitamin, calcium and phosphorus content of these rations were approximately the same. Oat groats were also added at the 15% level in pens 2 and 3. Pertinent data are given in Table I.

It is obvious from the data in Table I that reproductive performance in period A improved as the soybean oil meal was replaced with casein and oat groats. Nevertheless the results were not satisfactory. Hence in period B the amount of soybean oil meal was reduced to 6% in pens 1 and 2. Pen 3 was retained as control on the same level of soybean oil meal as in period A. Pen 2 received an addition of bran since Taylor and Lerner[1] had reported that it aided in hastening sexual maturity. Pen 1 received bran and meat scrap in place of casein.

While bran improved the ration, the beneficial response to bran and meat scrap was marked. No difference was noted in thyroid weight and histology. This indicated that the small amount of

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1 Taylor, Lewis W., and Lerner, I. Michael, *Poultry Sci.*, 1939, **18**, 323.

TABLE I.

Exp. No.	Pen	Protein supplements	Birds, No.	Egg wt., g	Egg prod., %	Eggs set No.	Fertility %	Hatchability %
1	Period A—24-31 weeks of age							
	1	16% soybean oil meal	21	43	40	280	68	8
	2	12% " " " , 1% casein	21	43	39	291	80	31
	3	6% " " " , 4% "	21	45	37	259	71	54
	Period B—32-41 weeks of age—6% soybean oil meal in each ration							
	1	20% bran, 6% meat scrap	18	52	59	498	90	67
	2	20% " 4% casein	18	50	49	403	88	51
	3	4% casein	16	52	37	204	84	35
	Period C—42-59 weeks of age—6% soybean oil meal and mixed cereals in each ration							
	1	5% meat scrap	15	57	29*	355	90	70
	2	2% casein	14	55	27*	326	92	63
	3	2% casein	13	56	24*	258	81	55
2	24-34 weeks of age—6% soybean oil meal in each ration							
	1	4% casein	18	44	31	441	65	20
	2	4% " + 2,000 p.p.b. iodine	7	46	31	140	60	0
	3	4% " + 50,000 p.p.b. "	18	45	33	365	78	17
	4	Practical ration	25	50	41	719	91	72

*Slump caused by moving birds.

iodine contained in the bran and meat scrap was not responsible for the beneficial effects.

In period C all pens received a mixed cereal base of ground yellow corn, wheat bran, wheat gray shorts and pulverized oats. Pen 1 continued to receive meat scrap as the chief protein supplement but with dried buttermilk replacing the yeast. Pens 2 and 3 received casein and yeast. While the data show that the mixed cereal base influenced reproduction favorably, meat scrap was still essential for better results. Subsequent studies have confirmed this observation. Furthermore, early work has indicated that dried buttermilk would have little beneficial effect.

Further evidence was obtained in Experiment 2. The birds in pens 1, 2, and 3 were reared on the goitrogenic ration with iodine supplementations as indicated in the table. The reproduction of these birds on this type of ration was very poor, even with the addition of iodine. In contrast to this was the satisfactory performance of control pen 4, which was fed the practical ration. This ration contained 6% of soybean oil meal with the mixed cereal base, meat scrap and dried buttermilk.

In both experiments chicks hatched from eggs of hens on the experimental ration which did not contain any meat scrap were very poor. Few survived the first week, even when fed a practical ration. Chick condition and viability were proportional to hatchability.

It is evident from these preliminary observations either that soybean oil meal exerts a depressing effect on reproduction or that meat scrap, bran, shorts and possibly casein tend to correct a deficiency in the ration. Particularly surprising is the fact that this goitrogenic type of ration with casein will support an excellent rate of growth while it fails to maintain satisfactory production, egg size, fertility and hatchability.

The detrimental effect from soybean oil meal is probably not the same as that noted from cottonseed oil by Morgan and Ringrose.[2]

A number of other workers have demonstrated that soybean oil meal as the sole protein supplement in poultry rations fails to support good hatchability. This was earlier ascribed to a deficiency of riboflavin. Christiansen, Halpin and Hart[3] recently demonstrated that such rations may be deficient in manganese as well as in riboflavin. Nestler, Byerly, Ellis and Titus[4] presented data indicating that poor hatchability with soybean oil meal was not corrected by supplementing the rations with dried whey, a good source of vitamin G. They postulated the existence of a newly discovered factor required for hatchability present in green grass, dried pork liver and to a lesser extent, in meat and fish by-products. The poor hatchability encountered in our work could not readily have been caused by a deficiency of riboflavin or of manganese, since sufficient yeast was used to provide a total of 240 to 260 units per 100 g of ration and since 50 parts per million of manganese was added. Byerly, Titus, Ellis and Nestler[5] have reported that hatchability of eggs from birds on the soybean oil meal ration is increased when these birds get direct sunlight. Christiansen, *et al.*,[3] have noted poorer hatchability on such a ration during the winter months. We have not ascertained as yet whether or not sunlight would have an effect similar to that of meat scrap.

It has been shown by Sharpless, Pearson and Prato,[6] and has been substantiated by this Station,[7] that soybeans have a marked goitrogenic effect. Soybean oil meal has also been shown to be goitrogenic.[7] It is suggested that there may be a relationship between

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2 Morgan C. L., and Ringrose, R. C., 51st Ann. Rpt., So. Car. Exp. Sta., 1939.

3 Christiansen, J. B., Halpin, J. G., and Hart, E. B., *Poultry Sci.*, 1940, **19**, 55.

4 Nestler, R. B., Byerly, T. C., Ellis, N. R., and Titus, Harry W., *Poultry Sci.*, 1936, **15**, 67.

5 Byerly, T. C., Titus, H. W., Ellis, N. R., and Nestler, R. B., *Poultry Sci.*, 1937, **16**, 322.

6 Sharpless, George R., Pearsons, Janice, and Prato, Geneva S., *J. Nutr.*, 1939, **17**, 545.

7 Wilgus, H. S., Jr., Gassner, F. X., Patton, A. R., and Gustavson, R. G., unpublished results.

the goitrogenicity of soybean oil meal and the poor reproduction noted in this report This goitrogenic factor could act primarily as a stimulant on the hypophysis. Excess of the thyrotropic hormone thus produced would account for the marked hyperplastic and hypertrophic changes in the thyroid glands of birds on a low iodine ration. It would also account for the depressed reproduction, either through excess thyroxine, or through an excess of gonadotropic hormone, or both. The fact that the thyroid gland is closely interrelated to the ovary in the reproducing female would lend additional support to this assumption.

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Experimental Infection of the Rabbit with Duval's Chromogenic *B. leprae* Culture.

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Many attempts have been made to infect the lower animal with fresh human leprosy tissue rich in the bacillus of Hansen and with acid-fast cultures isolated from the lesion of human leprosy. While Sugai,[1] Kedrowski,[2] Duval,[3] *et al.*, claim that leprosy may be induced experimentally, there is no mention of a progressive type of infection having occurred.

Since doubt exists as to the causal significance of Duval's chromogenic acid-fast culture of leprosy, the author has attempted to clear up the matter through a comparative study of the lesions produced in the rabbit with Duval's culture and certain well known saprophytic acid-fast bacilli and to determine whether the experimental infection is progressive and becomes generalized.

Saline suspensions of Duval's chromogenic bacillus of human leprosy and cultures of *B. phlei* and *B. smegmatis* were used for the injection of the animals. Fifty normal full grown rabbits were employed. The animals were inoculated either subcutaneously, intravenously or intraperitoneally with 2 cc of a heavy suspension of the various cultures. Each animal received 3 injections in all at weekly intervals over a period of 3 weeks. The animals were sacrificed at varying intervals and autopsies were performed for cul-

[1] Sugai, T., *Lepra*, 1909, **8**, 203.

[2] Kedrowski, W. J., *Ztschr. f. Hyg.*, 1901, **37**, 52.

[3] Duval, C. W., *J. Exp. Med.*, 1910, **13**, 374.