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The Utilization of Food Elements by Growing Chicks. XIII. The Effect of Additions of Dehydrated Alfalfa Meal to High Corn Chick Rations

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SUMMARY

Feeding trials were conducted on three groups of chicks in eight lots receiving a growing mash containing dehydrated alfalfa meal at levels of 2, 3, 4, 5, 6, 9, 10, 12, and 15 per cent. Comparisons were not made simultaneously but no general trend toward growth depression was evident in comparable lots.

In addition duplicate trials of four lots of newly hatched New Hampshire chicks were made on pelleted rations carrying 0, 2, 4, and 6 per cent of a good quality dehydrated alfalfa meal. The chicks were all fed accurately known amounts of the pelleted rations for six weeks. In each of the duplicate trials the lot fed 2 per cent alfalfa meal made slightly better gains than the other lots. The lots fed 4 and 6 per cent alfalfa made as good gains as the control lots fed no alfalfa. It is evident that with the sample of dehydrated alfalfa meal used in these experiments no adverse effect was produced by the alfalfa. Another trial of four lots was made on rations containing 0, 5, 10 and 15 per cent of alfalfa meal. In this case equal gains were made by each of the alfalfa-fed lots and all were better than the control without alfalfa.

It is also seen that the efficiency of gain was higher in the alfalfa-fed lots than in the control. Perhaps most interesting of all is the difference in time required to finish equal amounts of feed. Here the advantage is definitely in favor of the alfalfa-fed lots.

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CONTENTS

THE INCLUSION OF ALFALFA in chick growing rations has been the subject of study by poultrymen for many years. Alfalfa has been grazed in the field, fed fresh, dried, chopped or ground. More recently the expansion of the dehydrating industry has developed keen interest in dehydrated products by processors, feed manufacturers and poultry raisers generally. Attention has been focused on the carotene of alfalfa processed in various ways. Mangelson and others (1949) reported that birds fed dehydrated alfalfa meal stored more vitamin A in the liver than did those fed sun-cured meal, while the amount of carotene stored in the liver was essentially the same for the two kinds. Bolin and others (1943) attributed the increase in the liver storage of vitamin A in young chicks to carotene supplied by dehydrated alfalfa. Frey and Wilgus (1949) fed laying hens carotene in oil, fish liver oil, fresh alfalfa and dehydrated alfalfa meal as sources of vitamin A. The carotene in oil was utilized less efficiently than that in the alfalfa but only the fish oil enabled laying pullets to maintain their reserves of vitamin A in the liver. The vitamin A and carotene in the eggs were highest from pullets given alfalfa supplements. They felt that alfalfa apparently carries a factor which enhances the utilization of carotene.

Alfalfa meal has been used in poultry rations at the Nebraska Agricultural Experiment Station for 30 years. Originally the meal was made by grinding baled or stacked alfalfa. This resulted in a meal of comparatively low protein and high fiber. A meal containing more protein and carotene was made when methods of cutting and curing eliminated some of the fibrous stems and retained more of the leaf with a better color in the product. As the meal improved, so in general did rations made with it as a constituent.

A ration used at this Station in 1928, for instance, was made up as follows, by parts: yellow corn meal 50, shorts 23, alfalfa meal 10, meat meal 12, yeast 3, and salt mixture 2. This was varied through the years by decreasing the corn meal to 32, cutting the shorts to 20,

[1] With the technical assistance of John E. Temper.

adding 10 parts of bran and 10 of ground oats, substituting 5 parts each of meat scraps, fish meal and soybean meal for the meat meal, while leaving the alfalfa at 10 parts. During this period feeding trials were conducted to determine the kinds and amounts of protein concentrates required to promote good growth. These tests were not designed to study alfalfa as a constituent of the ration but the general observation was that it contributed to the well-being of the chicks. With 5 per cent of good quality animal protein in the diet, chick weights of 600 grams were obtained in six weeks.

Certain high energy rations recommended for chick feeding include only very low levels of alfalfa. The inclusion of alfalfa meal up to 10 per cent has been the standard procedure at this Station for years. When the practice drew criticism the question was studied in great detail by including varying amounts of alfalfa meal in a growing chick ration. It was planned to feed both in brooders and in individual cages where feed intake could be closely controlled.

EXPERIMENTAL

When dehydrated alfalfa meal came on the market a comparison of meals from different sources was made. One such test made in 1939 compared dehydrated leaf meal, dehydrated alfalfa meal and sun-cured meal at a level of 10 per cent in a ration for growing chicks. In this test a base ration was made up of the following, in pounds: yellow corn meal 31.5, shorts 20, bran 10, pulverized oats 10, meat scraps 5, fish meal 4, dried buttermilk 5, limestone 2, sodium chloride 1, and biotol 0.5. To this base was added alfalfa from three sources with the following carotene, protein, and fiber contents:

Description of alfalfa meal used	Carotene (δ/g.)	Crude protein (pct.)	Crude fiber (pct.)
S-6 dehydrated leaf meal	350	22	21
S-7 dehydrated meal	150	13	34
S-8 sun-cured meal	5	15	21

These three meals were used at a 10 per cent level in making up the experimental rations with 90 per cent of the above base. In addition, the dehydrated leaf meal was fed at a 5 per cent level to one lot, making four lots in all. The meals did not have a common origin but were random commercial products. Variation between alfalfa meals produced from different localities, or even the same field at different seasons, was recognized but facilities for studying this phase were lacking.

This trial was started in November 1939 with day-old Cornish-Leghorn crossbred chicks reared in a brooder house maintained under usual conditions. Sixty chicks were placed in each lot and fed

for eight weeks. There were no deaths in any of the lots. Four- and eight-week weights were recorded.

TABLE 1.—Final weights of chicks.

Lot No.	Meal used	Final weight in grams		Remarks
		Males	Females	
461	S-6	674 (29)[1]	597 (31)	10 pct. alfalfa
462	S-7	773 (30)	691 (30)	10 pct. alfalfa
463	S-8	742 (30)	663 (30)	10 pct. alfalfa
464	S-6	848 (35)	701 (25)	5 pct. alfalfa

[1] Numbers in parenthesis indicate number of chicks of each sex per lot.

The data in Table 1 show no significant difference between the sun-cured meal and the dehydrated meal but both produced significantly better growth than the dehydrated leaf meal when all were fed at a 10 per cent level. The leaf meal gave 20 per cent more growth when fed at the 5 per cent than at the 10 per cent level. Comparisons were not made of the other meals at the lower level. There were no readily discernible correlations between growth and carotene, protein or fiber contents of the three meals.

Feeding trials conducted in 1944 showed no appreciable differences when the meals were derived from the same field of alfalfa at the same time. One part was dehydrated in a commercial drum, a second portion was field-cured and the third was cured in diffused light.

In view of the tendency to omit alfalfa meal from chick starting rations it was decided to check on the growth of chicks started on alfalfa meal. Accordingly a high energy ration was mixed and additions of 2, 4, and 6 parts of a good quality dehydrated alfalfa meal were made at the expense of corn to form three experimental rations. It was felt that this should give some evidence of the utilization of alfalfa meal by growing chicks. The complete rations were mixed as follows:

	Control	2 pct. alfalfa	4 pct. alfalfa	6 pct. alfalfa
	(lbs.)	(lbs.)	(lbs.)	(lbs.)
Ground yellow corn	57	55	53	51
Soybean meal	22	22	22	22
Corn gluten meal	10	10	10	10
Meat scraps	5	5	5	5
Alfalfa meal, dehydrated	0	2	4	6
Fish solubles	2	2	2	2
Activated animal sterol blend (200 AOAC units/g.)	1	1	1	1
Calcium carbonate	2	2	2	2
Sodium chloride	1	1	1	1
Total	100	100	100	100

The crude protein varied from 23 per cent in the control to 23.7 per cent in the ration with 6 per cent alfalfa meal which reflects the increase due to the protein in the alfalfa meal substituted for the corn meal. The dehydrated alfalfa meal used in the ration contained 20 per cent protein and 18 per cent crude fiber with a carotene content equivalent to 100,000 I. U. per pound. Thus, at a level of 2 per cent of meal in the ration the amount of carotene recommended for growing chicks would be available from alfalfa alone. However, the base carried 60 per cent or more of corn and corn gluten meal which also provided vitamin A in excess of the recommended amount. It developed in the feeding trials that the carotene supplied by the base was sufficient to produce normal growth in newly hatched chicks.

The day-old New Hampshire chicks were divided into four lots of 190 each, and raised on the floor of a heated brooder house. They were fed for eight weeks from August 27, 1949. They were weighed individually at the end of that time and the sex was noted. Losses of about 10 per cent occurred in each lot. In brooder trials such as this a considerable range of live weights is found. The male and female averages were 713, 740, 728 and 743 grams for the control, 2, 4, and 6 per cent alfalfa lots respectively. Differences between lots were not statistically significant even when calculated for males and females separately. The data thus indicate that as good growth was obtained when 2, 4, or 6 per cent dehydrated alfalfa meal of this particular lot was included as on the control with no alfalfa. The data are given in more detail in Table 2. Calculated standard errors were about 18 grams so that significant differences were not found between lots.

TABLE 2.—Final weights of chicks.

Lot No.	Final weight in grams		Remarks
	Males	Females	
869	776 (81)[1]	650 (89)	No alfalfa
870	798 (86)	682 (78)	2 pct. alfalfa
871	815 (80)	641 (87)	4 pct. alfalfa
872	809 (85)	677 (89)	6 pct. alfalfa

[1] Numbers in parenthesis indicate number of chicks of each sex per lot.

At the conclusion of the above feeding trial a similar feeding trial was conducted using the same base but adding 3, 6, 9, and 12 per cent of the same dehydrated alfalfa meal. The lot with no added alfalfa was omitted since no difference was found between lots in the earlier trial. The alfalfa was added at the expense of the yellow corn. For this trial day-old New Hampshire chicks were divided into four lots of 175 each, and raised on the floor of a heated brooder house. They were fed for eight weeks from October 28, 1949, at which time the sex and weight of each bird were noted. Losses were lower

than in the previous trial, and were lowest in the lot carrying the most alfalfa meal.

The data of Table 3 show that lot 879 which received but 3 per cent alfalfa meal had a significantly lower growth rate than the lots fed 6, 9 and 12 per cent, whereas no differences existed between the last three lots. The weights by lots and sex, and the number of survivors from the original 175 chicks are given below.

TABLE 3.—Final weights of chicks.

Lot No.	Final weight in grams		Remarks
	Males	Females	
879	637 (72)[1]	519 (83)	3 pct. alfalfa
880	735 (76)	620 (91)	6 pct. alfalfa
881	745 (76)	597 (89)	9 pct. alfalfa
882	733 (69)	604 (105)	12 pct. alfalfa

[1] Numbers in parenthesis indicate number of chicks of each sex per lot.

In the conduct of experimental work either in batteries or in floor brooders results are frequently difficult to interpret because of the large variation in growth response of chicks which are lot-fed. Such variations are inevitably a part of the problem in assessing the value of rations in practical broiler production. In work at this Station attempts have been made to reduce the standard error by housing chicks in individual cells where they may be fed exactly known amounts of feed without loss (Ackerson and others, 1938, 1950). By this means variations in feed intake can be avoided and a more uniform growth response obtained. In feeding trials here where chicks have been housed and fed individually to avoid variation in feed intake better agreement in growth between individuals resulted. Thus more replicates can be obtained in a feeding trial but more work is involved. Such a trial was initiated after the work described in Table 2 was undertaken.

The four rations as listed in Table 3 were pelleted using a 1/8" die so that they could be fed to day-old chicks without loss. Individual compartmented feeding batteries were used in the feeding trials so that young chicks could be fed a predetermined amount of the ration. Each battery housed eight chicks. Sixteen New Hampshire chicks were assigned to each lot at hatching time and fed in a lot for four days so they would learn to eat readily. On the fifth day all were placed in their individual cells which were divided into feeding and housing units. All chicks were fed four times daily and were returned to the housing unit after each feeding. Each chick of the four lots was fed 920 grams of its proper ration. When each finished its 920 grams of feed it was held over until the following morning when its empty weight and sex were noted. The time required to

eat the feed varied from 42 to 50 days with an average of 49, 44, 46, and 43 days, respectively, for the chicks in lots carrying 0, 2, 4, and 6 parts of dehydrated alfalfa meal.

The average weights of the chicks based on the empty weight the morning after the day on which each had finished its allotment of 920 grams of feed were 439, 465, 443, and 445 grams respectively for the lots fed 0, 2, 4, and 6 parts of dehydrated alfalfa meal. Individual variation between chicks in each lot was low so the difference between the lots fed 0 and 2 per cent alfalfa meal was of borderline significance. The lots fed 4 and 6 per cent of the meal weighed essentially the same as the lot without the alfalfa addition. In this study it was evident that the lots receiving alfalfa ate more readily than the lot without the additions, finishing three to six days earlier. This would be a factor in broiler production.

In order to duplicate this work another batch of newly hatched New Hampshire chicks was divided into four lots and fed the same rations. Distribution in each lot was made at random so that the position of the chicks in the batteries would not affect the result. Feeding and handling of the chicks was the same as before. Nine hundred grams of the same rations were fed to the chicks in each lot. At the end of the trial the empty weight and sex were noted. In this trial it took an average of 46, 43, 46, and 45 days for the chicks of the 0, 2, 4 and 6 per cent alfalfa lots to eat their feed. They weighed an average of 411, 440, 407 and 417 grams for the groups in the order given above.

By way of a summary the final weights and efficiency of gain for the two trials are given in Table 4.

TABLE 4.—Data on pellet-fed chicks, Trials 1 and 2.

Lot	Control	Alfalfa		
		2 pct.	4 pct.	6 pct.
		Trial 1		
Weight (g.)	439	465	443	445
Gain per g. eaten (g.)	0.43	0.46	0.43	0.43
Av. no. days on feed	49	44	46	43
		Trial 2		
Weight (g.)	411	440	407	417
Gain per g. eaten (g.)	0.41	0.44	0.41	0.42
Av. no. days on feed	46	43	46	45

In view of the results obtained with these two trials a third test was set up using higher levels of dehydrated alfalfa meal, namely 5, 10, and 15 per cent. The base of the ration was essentially the same as that used earlier. It was mixed and pelleted as in the previous tests. It was made up as follows:

	Control	5 pct. alfalfa	10 pct. alfalfa	15 pct. alfalfa
	(lbs.)	(lbs.)	(lbs.)	(lbs.)
Ground yellow corn	49	45	41	37
Corn gluten meal	18	17	16	15
Soybean meal	22	22	22	22
Meat scraps	5	5	5	5
Fish solubles	2	2	2	2
Activated animal sterol	1	1	1	1
Calcium carbonate	2	2	2	2
Sodium chloride	1	1	1	1
Alfalfa meal, dehydrated	0	5	10	15
Total	100	100	100	100

The chicks were handled as in the earlier trials and fed 900 grams of the pellets. The data for the third trial are given in Table 5. White Rock chicks were used.

TABLE 5.—Data on pellet-fed chicks, Trial 3.

Lot	Control	Alfalfa		
		5 pct.	10 pct.	15 pct.
Weight (g.)	407	446	447	448
Gain per g. eaten (g.)	0.41	0.45	0.45	0.45
Av. no. days on feed	53	42	39	37

With the ration used there is no evidence of growth inhibition. In fact, an increase of 10 per cent in weight is to be noted in the alfalfa lots over the control fed a high corn ration.

In addition it is evident that the feed was readily accepted by the chicks up to 15 per cent of the ration for at that level the allotted feed was consumed in 37 days. The chicks fed the control ration required 53 days, on the average, to eat an equal amount of feed. The 5 and 10 per cent alfalfa lots required two and five more days respectively than the 15 per cent lot. Since the chicks were chosen at random for distribution among the lots it is not likely that inherent capacity for growth was confined to the chicks of the alfalfa-fed lots. The efficiency of gain varied from 0.40 to 0.45 which means that between 2.2 and 2.5 pounds of feed were required for a pound of gain over the period covered.

On the other hand, Cooney, Butts and Bacon (1948) report a depression of growth in chicks when fed alfalfa meal above the 5 per cent level. The ration used was not given in this preliminary report. Lepkovsky and others (1950) reported growth depression in chicks fed varying levels of alfalfa meal up to 20 per cent for three weeks. Peterson (1950) suggested that saponins present in alfalfa were the cause of this depression of growth.

CONCLUSIONS

When additions of 2, 3, 4, 5, 6, 9, 10, 12, and 15 per cent of dehydrated alfalfa meal bought on the open market were made to a high-energy ration no inhibition of growth resulted in the cases studied. This effect was obtained in trials where the entire ration was fed as a mash or in pelleted form. In two trials where it was fed as part of an all-mash ration growth was not inhibited up to a 15 per cent level.

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