UNIVERSITY OF IDAHO
College of Agriculture

AUSTRIAN PEAS

A Protein Supplement In Poultry Rations

C. F. PETERSEN
C. E. LAMPMAN

Department of Poultry Husbandry

Idaho Agricultural Experiment Station

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Summary

AUSTRIAN winter peas contain approximately 25 percent protein. This protein permitted excellent chick growth when supplemented with the one amino acid, methionine.

Austrian peas can be successfully used in starter, developer, and laying mashes when properly supplemented. The level of peas should not exceed 20 percent of the mash, but at this level peas will adequately replace an equal amount of wheat or corn along with the necessary reductions in the supplementary protein concentrates. These results were obtained with rations containing a minimum of 2.5 percent fish meal and 5.0 percent meat meal. It cannot be concluded that peas will result in satisfactory growth in the absence of these animal proteins.

The results of these experiments have demonstrated that methionine must be included in starter mashes containing peas. When 0.1 percent methionine was added to a ration containing 20 percent peas, the results were equal to a high-quality starter mash which contained fish meal, meat meal, and soybean oil meal as protein supplements. The addition of 1 pound methionine per ton of mash (0.05 percent) with an antibiotic supplement permitted excellent growth. Further improvement was obtained when the feed was crumbled. The texture and palatability of rations containing 20 percent or more of peas will be improved by pelleting.

Peas can be used successfully in developer and laying mashes. It has not been definitely determined if methionine can be eliminated from these rations, although the addition of 1 pound per ton of mash was adequate. This is equal to only ½-pound per ton of total feed intake. These results were also obtained with rations containing adequate levels of animal proteins. Animal proteins should be included in all rations in which peas are used.

AUSTRIAN PEAS

A Protein Supplement in Poultry Rations

C. F. PETERSEN and C. E. LAMPMAN

INADEQUATE supplies of supplementary protein concentrates are a constant problem of the feed and poultry industries in the formulation of various poultry rations. During past years, excess Alaska peas *(Pisum sativum)*, either as sound peas or as shriveled and weevil-infested peas, have been available for use as livestock and poultry feed. More recently, Austrian peas *(Pisum arvense)* have been produced in volume in excess of their demand for seed. Experimental work was undertaken by the Idaho Agricultural Experiment Station to determine their value as a poultry feed ingredient. The use of Austrian winter peas for poultry and livestock feeding could make a substantial contribution to these industries when there is a surplus of peas in the Pacific Northwest and the price of peas is comparable to common feeds used in poultry rations.

Although little or no previous work appears to have been conducted with Austrian peas, information was available concerning the value of Alaska peas in poultry feeding. It has been demonstrated by Lampman (1) (2) that Alaska peas could be used successfully in laying rations at 10 to 15 percent when both fish meal and dried milk were also included as sources of supplementary protein. Later, Petersen and Lampman (3) (4) found that Alaska peas could not be used as a single protein supplement. Rations were also inferior which contained soybean oil meal, meat meal, and peas in which no fish meal or dried milk was included

Woods, Beeson and Bolin (5) demonstrated that methionine was the limiting amino acid of Alaska peas for rat growth. These workers found that supplementation of a pea meal diet containing 10 percent protein with 0.3 percent methionine resulted in a more efficient use of protein, as determined by grams gain in body weight per gram protein consumed, than was obtained with casein. Petersen and associates (6) found that methionine was also the limiting amino acid for early chick growth when peas supplied all of the protein. Carver, Bohren and Cook (7) reported that Alaska peas were not satisfactory as a single protein supplement but that they could be used as a partial replacement for herring fish meal in either a chick starter or laying mash.

No comparable data are available for Austrian peas, although Keith, *et al.* (8) have studied the value of Austrian peas as a source of protein for sheep and Goodwin, Schneider and Ensminger (9)

*Associate Poultry Husbandman and Poultry Husbandman, University of Idaho, Moscow, respectively.

and Schneider and Christian (10) have compared these with other peas for swine feeding. The Austrian peas were equal to Alaska peas for feeding hogs to market weight.

Unless otherwise stated, from hereon all reference to peas specifically deals with Austrian peas.

The purpose of the experiments reported here was to determine whether Austrian peas could be used successfully in poultry rations; namely, starter, growing and laying mashes. The value of additional methionine in the various rations needed to be determined, as well as the most satisfactory level of peas to include, the value of antibiotic additions, and the influence of pelleting upon rations containing peas.

METHIONINE DEFICIENCY OF AUSTRIAN PEAS

A purified diet in which Austrian peas supplied all of the protein except for that present in 2.5 percent dehydrated alfalfa meal was fed to chicks to determine if methionine was a limiting amino acid. The basal diet is given in Table 1. The ration was fed to duplicate lots of 15 straight-run New Hampshire chicks each for a period of 4 weeks. The same diet supplemented with 0.25 percent methionine was fed to two additional lots. The feed and water were supplied *ad libitum*. Individual chick weights were recorded at weekly intervals.

Table 1.—Composition of basal and methionine supplemented Austrian pea diets and resulting chick growth response.

Ingredient	Supplement	Diet 1 None	Diet 2 Methionine
		Percent	Percent
Austrian pea meal		54.5	54.5
Dehydrated alfalfa meal		2.5	2.5
Soybean oil		3.0	3.0
Cerelose		33.75	33.5
Salt mixture*		6.0	6.0
Vitamin mixture**		+	+
Vitamin B_{12} supplement		0.25	0.25
dl-Methionine		—	0.25

* Salt mixture (mg. per 100 grams diet)		**Vitamin mixture (mg. per 100 grams diet)	
NaCl	940	Thiamine hydrochloride	1.0
K_2HPO_4	1675	Riboflavin	1.0
$CaHPO_4$	346	Calcium pantothenate	3.0
$MgCO_3$	196	Niacin	0.5
$CaCO_3$	1678	Pyridoxine hydrochloride	1.0
$CuSO_4$	1.68	Choline chloride	65.0
$MnSO_4$	7.83	A & D oil (800D-2000A)	250.0
KI	4.47		
$ZnCO_3$	0.28		
$CoCl_2$	0.60		
Iron citrate	155		

RESULTS:		
average 4-weeks wts. in grams	50.8	192.0
Average net gain in grams	12.8	153.9
Grams feed required per gram gain in weight	16.4	3.4

The results of this preliminary trial are included in Table 1. The basal diet failed to support growth during the 4-week ex-

perimental period. The total protein content of this diet was only 12 percent but previous work has demonstrated that this level will support fairly satisfactory growth if the source of protein is of good quality. This was also demonstrated in the diet which was supplemented with methionine at a level of 0.25 percent. Approximately a 12-fold increase in body weight over the basal resulted when methionine was included. The average gain in weight of the chicks at 4 weeks of age when fed the basal diet was only 12.8 grams as compared to 153.9 grams for the lots fed the supplemented diet.

These results confirmed previous studies with Alaska peas, indicating that peas are a fairly good source of essential amino acids needed for chick growth—with the exception of methionine. Since this amino acid was available at nominal cost for use in poultry feeds, further studies were planned and conducted to determine how effectively peas could be used in poultry feeds when methionine was included.

USE OF AUSTRIAN PEAS IN PRACTICAL CHICK STARTERS

Peas Replace Corn or Wheat

This study was to determine if Austrian peas could be successfully used as a partial protein supplement replacement and as a substitute for corn or wheat. The control ration contained 30 percent corn. Wheat and peas were each used at 30 percent in two rations as a replacement for corn. Peas were also included in other rations at either 10 or 20 percent, replacing an equiva-

Table 2.—Experiment 1. The use of Austrian peas in starter rations (White Leghorn chicks)

Ration No.	1	2	3	4	5	6	7
Ingredient				Percents			
Austrian peas	—	—	30.0	10.0	10.0	20.0	20.0
Yellow corn	30.0	—	—	20.0	—	10.0	—
Wheat	—	30.0	—	—	20.0	—	10.0
Herring fish meal	5.0	5.0	4.0	4.5	4.5	4.0	4.0
Meat meal	8.0	8.0	4.0	7.0	7.0	4.5	4.5
Soybean oil meal (44%)	9.0	9.0	4.0	7.5	7.5	5.5	5.5
Wheat bran	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Oats	10.0	10.0	12.5	10.0	10.0	12.0	12.0
Barley	10.0	10.0	13.5	12.0	12.0	14.5	14.5
Wheat shorts	6.0	6.0	8.0	6.0	6.0	6.0	6.0
Dehyd. alfalfa meal	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Riboflavin concentrate (500 ug. per gm.)	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Oyster shell flour	2.0	2.0	2.5	2.0	2.0	2.0	2.0
Steamed bone meal	—	—	1.0	.5	.5	1.0	1.0
Iodized salt	.5	.5	.5	.5	.5	.5	.5
A & D feeding oil	.4	.4	.4	.4	.4	.4	.4
Manganese sulfate	10 grams per cwt.						
RESULTS:							
Average 4-week weight in grams	303	280	242	290	264	263	260
Grams feed consumed per gram gain	2.52	2.82	3.14	2.76	3.02	3.25	3.12
Percent growth compared to control	100	92	80	96	87	87	86

lent amount of either wheat or corn. Since Austrian peas contain approximately 25 percent protein, an adjustment was also necessary in the various protein supplements to maintain 20 percent protein rations. This protein adjustment was accomplished by reducing in approximately equal proportions the three protein concentrates used. These were fish meal, meat meal, and soybean oil meal. The various test rations used in this experiment are given in Table 2. In further feeding trials reported here, the same ration numbers are used for all similar rations. The rations were fed to White Leghorn chicks for a period of 4 weeks.

The results of this experiment are summarized in Table 2. A level of 30 percent Austrian peas resulted in 4-week chick growth 20 percent below that of the control ration. Efficiency of feed utilization also decreased. It required 3.14 grams of feed to produce a gram of gain with ration 3 containing 30 percent peas as compared to 2.52 grams for the control ration.

Peas included at 20 percent (rations 6 and 7) also resulted in reduced growth and decreased feed efficiency when the peas replaced either an equal amount of corn or wheat.

The 10 percent pea meal ration containing 20 percent wheat did not prove any better than 20 percent peas. Ten percent peas as a replacement for 10 percent corn and the slight protein adjustments necessary resulted in fairly satisfactory growth. The growth was equal to 96 percent of the growth obtained with the control ration. Feed efficiency was reduced about 10 percent.

The use of 30 percent wheat (ration 2) in place of corn also resulted in reduced growth rate. The chicks fed this diet weighed 92 percent as much as the chicks fed the control diet.

Methionine Improves Rations with 20 or 30 Percent Peas

The same rations as used in Experiment 1 were repeated for this experiment. The rations were fed to New Hampshire chicks

Table 3.—Experiment 2. The use of Austrian peas in starter rations with methionine supplements (New Hampshire chicks).

Ration No.	Supplement to ration	Av. wt. in grams at 4 wks.	Av. wt. in grams at 8 wks.	Grams feed per gram gain 4 wks.	Grams feed per gram gain 8 wks.	Percent growth of control 4 wks.	Percent growth of control 8 wks.
1 - 30% Corn	Control	321	879	2.34	2.96	100	100
2 - 30% Wheat		307	809	2.65	3.25	96	92
3 - 30% Peas		265	—*	2.76	—	83	—
4 - 20% Corn 10% Peas		299	822	2.44	3.11	93	94
5 - 20% Wheat 10% Peas		314	834	2.47	3.24	98	95
6 - 10% Corn 20% Peas		277	798	2.74	3.28	86	91
7 - 10% Wheat 20% Peas		268	804	2.85	3.38	83	92
3 - 30% Peas	0.1% Methionine	283	798	2.64	3.26	88	91
6 - 10% Corn 20% Peas	0.1% Methionine	325	870	2.24	3.09	101	99

* Discontinued because of insufficient facilities.

of mixed sexes, duplicate lots being fed each ration. The experimental period was for 8 weeks instead of 4. Weekly body weights and feed consumption records were obtained.

In addition, the rations containing 30 percent peas, and 20 percent peas and 10 percent corn, were supplemented with 0.1 percent methionine.

The results are summarized in Table 3. The data for growth and feed efficiency to 4 weeks of age for rations 1 through 7 were quite similar to the previous trial (Table 2). A reduction in early chick growth occurred with peas included at either 10, 20, or 30 percent of the rations. The results with these rations at 8 weeks are more favorable, indicating that as the birds increase in age they are able to utilize the protein of peas more efficiently than at an earlier age. In contrast, the rations containing 20 and 30 percent wheat resulted in 8-week growth rates slightly less than those at 4 weeks.

Supplementing rations containing peas with 0.1 percent methionine improved chick growth, although the ration containing 30 percent peas and methionine did not result in growth equal to the control ration. This may be partially due to lack of palatability. Methionine supplementation to a ration containing 20 percent peas resulted in growth response equal to the control. Feed efficiency was also very similar to that obtained with the control ration. The addition of methionine improved growth approximately 10 percent and improved feed efficiency approximately 25 percent over the same ration (No. 6) which contained no supplementary methionine. The inclusion of methionine at this level resulted in a reduction in the cost per pound of gain of 2.2 cents at 4 weeks of age and 1.5 cents at 8 weeks of age.

Antibiotic Feeding Improves Pea Meal Rations

This experiment was conducted with mixed sexes of New Hampshire chicks from 1 day to 4 weeks of age to determine the level of methionine required both in the presence and absence of an antibiotic (oxytetracycline). The control ration (30 percent corn) was also fed with and without the antibiotic which was included in the various rations at 15 grams per ton of feed. All test rations contained 20 percent peas and either 10 percent corn or 10 percent wheat. These rations were supplemented with either 1 or 2 pounds of methionine per ton of feed. These levels were fed with and without an antibiotic.

The results of this trial are summarized in Table 4. The addition of 2 pounds (0.1%) of methionine per ton of a mash containing 20 percent peas and either 10 percent wheat or corn resulted in 4-week growth approximately equal to that of the control ration. The inclusion of only 1 pound methionine per ton resulted in a growth response equal to 90 percent of that of the control. The addition of 1 pound methionine plus the antibiotic

Table 4.—Experiment 3. The value of methionine additions to starter rations containing 20 percent Austrian peas supplemented with an antibiotic (New Hampshire chicks).

Ration No.	Supplement to ration	Av. wt in grams 4 weeks	Grams feed per gram gain	Percent growth of control
1 - Control	——	312	2.33	100
1 - "	Antibiotic	335	2.20	107
6 - 10% Corn 20% Peas	.05% Methionine	284	2.44	91
6 - "	.05% Methionine and Antibiotic	299	2.41	96
6 - "	.1% Methionine	308	2.35	99
6 - "	.1% Methionine and Antibiotic	331	2.32	106
7 - 10% Wheat 20% Peas	.05% Methionine	287	2.53	92
7 - "	.05% Methionine and Antibiotic	311	2.45	100
7 - "	.1% Methionine	302	2.46	97
7 - "	.1% Methionine and Antibiotic	327	2.28	105

permitted growth equal to that found for 2 pounds of methionine in the 20 percent pea meal rations and also equal to that for the control ration unsupplemented. Similarly, the addition of the antibiotic with 2 pounds of methionine per ton of feed permitted growth equal to the antibiotic-supplemented control.

Pea Meal Rations Fed as Crumbles

The influence of preparing the feed as crumbles was investigated in an experiment in which ration 6, containing 20 percent peas and 10 percent corn, was studied with both methionine and antibiotic additions. Three hundred thirty-six straight-run New Hampshire chicks were divided into 24 lots at 1 day of age, wing-banded, and duplicate lots of 14 chicks each were fed rations containing the following additions:

Ration 1a - Control
" 1b - Control as crumbles
" 1c - Control plus antibiotic
" 1d - Control plus antibotic as crumbles
" 6a - (20 percent peas)
" 6b - 6a as crumbles
" 6c - 6a plus 0.05% methionine as crumbles
" 6d - 6a plus antibiotic and 0.05% methionine as crumbles
" 6e - 6a plus 0.1% methionine
" 6f - 6a plus 0.1% methionine as crumbles
" 6g - 6a plus 0.1% methionine plus antibiotic
" 6h - 6a plus 0.1% methionine, antibotic as crumbles

The crumbled rations were prepared by first pelleting and then running the pellets through a roller which was adjusted to break most of the pellets into finer particles. The antibiotic (oxytetracycline) was added to rations 1c, 1d, 6d, 6g, and 6h at the rate of 12 grams per ton of feed.

All rations were fed to the chicks for a period of 4 weeks. Chicks were weighed individually at weekly periods and feed consumption determined for the 4-week experiment. Because of inadequate facilities to carry all groups to 10 weeks of age, rations 1c, 6a, 6b, and 6e were discontinued at 4 weeks; all others were continued to 10 weeks and weekly weights obtained in addition to feed consumption data at 10 weeks.

Table 5.—Experiment 4. The effect of pelleting and subsequent crumbling of rations containing peas upon growth. (New Hampshire chicks)

Ration No.	Supplement to ration	Form of ration	Av. wt. in grams 4 weeks	Grams feed per gram gain	Percent growth of control
1a - Control	——	Mash	308	2.30	100
1b - "	——	Crumbles	326	2.44	106
1c - "	Antibiotic	Mash	330	2.31	107
1d - "	Antibiotic	Crumbles	367	2.27	119
10% Corn 6a - 20% Peas	——	Mash	287	2.45	93
6b - "	——	Crumbles	292	2.57	95
6c - "	.05% Methionine	Crumbles	302	2.48	98
6d - "	.05% Methionine Antibiotic	Crumbles	351	2.26	114
6e - "	.1% Methionine	Mash	297	2.42	96
6f - "	.1% Methionine	Crumbles	326	2.30	106
6g - "	.1% Methionine Antibiotic	Mash	326	2.36	106
6h - "	.1% Methionine Antibiotic	Crumbles	351	2.38	114

The results of growth, feed efficiency, and percentage growth index are summarized in Table 5 for the 4-week data and Table 6 for the 10-week data. Preparation of the feed as crumbles increased growth rate with all combinations of supplements including peas, supplementary methionine at 0.05 and 0.1 percent, and an antibiotic, either separately or in combinations. Ration 6, supplemented with 0.05 percent methionine, permitted growth

Table 6.—Results of Experiment 4 continued from 4 to 10 weeks of age. Number of rations reduced to 8 to accommodate facilities. Nos. 1c, 6a, 6b, 6e eliminated.

Ration No.	Supplement to ration	Form of ration	Average weights in pounds at biweekly periods				Pounds feed per pound gain -10 wks.	Percent growth of control
			4 weeks	6 weeks	8 weeks	10 weeks		
1a	——	Mash	0.68	1.37	2.10	2.85	3.12	100
1b	——	Crumbles	0.72	1.41	2.18	2.84	3.14	100
1d	Antibiotic	Crumbles	0.81	1.54	2.33	3.02	3.01	106
6c	.05% Methionine	Crumbles	0.67	1.28	1.96	2.70	3.24	95
6d	.05% Methionine Antibiotic	Crumbles	0.78	1.39	2.11	2.84	3.07	100
6f	.1% Methionine	Crumbles	0.72	1.40	2.16	2.84	3.14	100
6g	.1% Methionine Antibiotic	Mash	0.72	1.26	2.00	2.72	3.22	95
6h	.1% Methionine Antibiotic	Crumbles	0.78	1.48	2.24	2.96	3.11	104

equal to the control diet when the pea ration was crumbled. When the 20 percent pea ration was crumbled and an antibiotic was also included, 0.05 percent methionine was as effective as 0.1 percent and this combination was also equal to the control diet crumbled and supplemented with the antibiotic.

Experiment Station Flock Fed Peas to 28 Weeks of Age

The results of the previous experiments have shown that a starter ration containing 20 percent peas will permit excellent chick growth when properly supplemented with methionine. Therefore one-half of a regular Experiment Station replacement hatch of 1,050 White Leghorn chicks was fed a starter which included 20 percent Austrian peas (ration 6) and 0.1 percent methionine. The other half was fed a starter mash containing 30 percent corn and containing fish meal (5%), meat meal (8%), and soybean oil meal (9%) as protein supplements (ration 1). This permitted a test of the pea meal ration with a larger number of chicks under conditions similar to commercial feeding and rearing.

The two starter rations were fed for an 8-week period, at which time the cockerels were removed. The pullets were continued on developer rations similar to the starter mashes except for an adjustment in total protein to 17.5 percent. The methionine in the pea meal mash was reduced to 0.05 percent and grain feeding was also practiced from 8 to 28 weeks of age while the birds were on range. Body weights were recorded at biweekly periods up to 8 weeks and at 4-week intervals thereafter.

Table 7.—Experiment 5. Results of feeding a ration containing 20 percent Austrian peas plus 0.1 percent methionine to 525 Experiment Station Leghorns to 28 weeks of age*.

	Ration 1 pea meal			Ration 2 Control		
Average weight in pounds at:	Cockerels	Pullets	Average	Cockerels	Pullets	Average
2 wks.			0.25			0.26
4 wks.			0.63			0.65
8 wks.	1.65	1.41	1.53	1.72	1.45	1.58
12 wks.		2.27			2.33	
16 wks.		2.81			2.88	
20 wks.		3.49			3.54	
24 wks.**						
28 wks.		4.38			4.34	

* Pea meal developer mash fed from 8-28 weeks contained 0.05 percent methionine. Whole grain was fed in addition to the mash. Cockerel chicks removed at 8 weeks.

**No weights recorded because of blue comb outbreak.

The results of this experiment are summarized in Table 7. The growth rates at 2, 4, and 8 weeks of age were approximately the same for the two rations. This was true for both cockerels and pullets. The weights of the pullets from 8 to 28 weeks of age, while on range, were also approximately the same. No weights were recorded at 24 weeks because of an outbreak of "blue comb" disease.

LAYING RATIONS CONTAINING AUSTRIAN PEAS

All the White Leghorn pullets which had been reared on the pea meal ration to 28 weeks of age were divided into 4 lots and placed in 4 adjoining pens of an 8-pen laying house. Two of these lots were fed a laying ration containing 20 percent peas supplemented with 0.05 percent methionine. The amount of fish meal and meat meal was the same as in the control mash. The adjustment in protein supplied by peas was made by reducing the amount of soybean oil meal. The remaining two lots were transferred to a high-quality control laying mash.

The four remaining pens in the laying house were filled with an equal number of pullets which had been reared from 1 day of age to laying age on the high-quality starter and a developer mash. Two of these lots were fed the 20 percent pea meal laying mash and the remaining two fed a high-quality laying mash. Both mashes were fed in combination with a whole grain mixture. The grain mixture was fed in the evening in amounts to approximate one-half the total feed consumption. The two laying mashes are given in Table 8.

Table 8.—Experiment 1. Laying hens. Experimental rations.

Ingredient	Hen diets*		Chick diets	
	Control	Pea meal	Control	Pea meal
	Percent	Percent	Percent	Percent
Wheat bran	25.0	25.0	15.0	15.0
Ground oats	16.5	10.0	10.0	10.0
Ground barley	15.0	8.0	10.0	14.5
Ground corn	—	10.0	30.0	10.0
Wheat shorts	7.0	—	5.0	6.0
Dehyd. alfalfa meal	7.5	7.5	4.0	4.0
Herring fish meal	2.5	2.5	5.0	4.0
Meat meal	5.0	5.0	10.0	5.5
Soybean oil meal	16.0	7.5	7.0	4.5
Austrian peas	—	20.0	—	20.0
dl-Methionine	—	0.05	—	0.1
Riboflavin (BY-500)	1.0	1.0	1.0	1.0
Oyster shell flour	2.5	2.5	2.0	2.0
Steamed bone meal	1.0	1.0	—	1.0
Iodized salt	1.0	1.0	0.5	0.5
Manganese sulfate	0.0125	0.0125	0.0125	0.0125
A and D feeding oil	0.5	0.5	0.1	0.1
Sulfaquinoxaline			¼ lb./ton	¼ lb./ton

* Hen mash fed equal parts with whole grain consisting of wheat 50 parts - oats 25 parts - barley 25 parts.

Egg Production, Hatchability, and Subsequent Chick Growth Good

Data were obtained on egg production, feed consumption and feed efficiency, body weight gain, egg size, and livability. In addition, hatchability was determined for each feed and the chicks obtained were fed pea meal rations to determine any differences to be noted in feeding the pea meal diets through the second generation.

The laying mash, containing 20 percent peas and 0.05 percent methionine, gave results which in all respects were equal to those of the control mash containing fish meal, meat meal, and soybean oil meal as protein supplements. Egg production, egg size, body weight of birds, and hatchability of fertile eggs were quite similar regardless of the rations fed during the laying period or during the starting and growing period. These data are summarized in Table 9.

The chicks which were obtained from 2 hatches from the hens which had been fed either the control or the pea meal rations, from the day-old stage and continued throughout the laying period, were fed rations to determine if there was any difference in chick quality. The first hatch from each source was fed a ration containing 20 percent peas plus 0.1 percent methionine (Table 8). The results show that chicks obtained from hens fed peas grew as well to 4 and 8 weeks of age as chicks from hens fed the control ration.

The second hatch of chicks was divided equally into two groups and fed either a control ration or the pea meal ration (Table 8). Again there was no difference in the response of chicks as to their

Table 9.—Experiment 1. Laying hens. Effect of 20 percent Austrian pea ration upon egg production, hatchability, and subsequent chick growth during 10-month experiment. (Results are average of duplicate pens.)

Starter-grower mash fed	Control	Control	Pea meal	Pea meal
Laying mash fed	Pea meal	Control	Pea meal	Control
Original number of birds	70	70	70	70
Average wt. pullets - 28 wks.	4.34	4.34	4.38	4.38
Average wt. pullets end of laying year	4.73	4.84	4.67	4.78
Average percent egg production	58.4	57.2	61.7	61.3
Percent mash consumed	47.0	44.0	47.0	48.0
Percent scratch consumed	53.0	56.0	53.0	52.0
Pounds feed per doz. eggs	5.85	6.00	5.69	5.68
Average egg weight (oz. per doz.)	25.9	25.6	25.9	25.8
Percent mortality	20.0	18.6	12.9	2.9
Percent hatch fertile eggs	—	82.3	89.5	—
Subesequent chick growth in grams:				
Fed pea meal chick diet:				
Trial 1—				
4 wks.	—	265	267	—
8 wks.	—	581	595	—
Trial 2—				
4 wks.	—	280	292	—
Fed control chick diet:				
Trial 2—				
4 wks.	—	303	312	—

source. The chicks obtained from hens fed peas grew at a rate equal to chicks obtained from hens fed the control ration. Both sources of chicks fed the control mash were slightly heavier at 4 weeks than the pea meal-fed groups. This is the first of several trials in which the pea meal-methionine ration has not performed as well as the control chick ration. The difference in favor of the control ration was approximately 6.0 percent.

Value of Methionine Tested in Laying Ration

Rations containing 20 percent peas were fed to Single Comb White Leghorn pullets to determine the effect of including methionine in the laying mash. The control ration was supplemented with fish meal (2.5%), meat meal (5%), and soybean oil meal (18.0%). The 20 percent pea meal rations also contained fish meal (2.5%), meat meal (5.0%), and soybean oil meal (8.5%). This ration was also fed with supplements of 0.025 and 0.05 percent methionine added to the mash portion of the feed. Whole scratch feed of 50 percent wheat, 25 percent oats, and 25 percent barley made up approximately one-half the total feed, resulting in actual methionine intakes of approximately 0.0125 and 0.025 percent. The birds were started on the experimental feeds at about 5 months of age, on October 1, and the experiment was conducted for a period of 8 months.

Excessive laying flock mortality occurred during the experiment, resulting primarily from several reoccurrences of intestinal coccidiosis. Any differences which may have been present in the four test rations were not expressed in egg production, egg size, body size, or feed efficiency. Egg production was low for all groups, averaging only slightly over 50 percent for the 8-month period, at which time the experiment was terminated. Mash consumption was not maintained at a satisfactory level and the pounds of feed required to produce a dozen eggs was over 6 in all cases. Egg size and body size did not vary greatly between groups and, in general, both were slightly smaller than that of the previous year with the same strain of birds. Based on this and the previous year's study, it is difficult to evaluate specifically the need for methionine supplementation of laying mashes containing 20 percent pea meal. The results are summarized in Table 10.

Table 10.—Experiment 2. Laying hens. Methionine supplementation of 20 percent pea meal ration upon egg production factors. Experimental period - 8 months, October 1 to June 1 (results are average of duplicate pens).

Ration No.	1	2	3	4
Percent peas in mash	——	20.0	20.0	20.0
Percent methionine in mash	——	——	0.025	0.05
Original number of birds	70	70	70	70
Average percent egg production	52.8	50.3	56.4	49.8
Percent mash consumed	50.0	48.0	54.0	43.0
Percent scratch consumed	50.0	52.0	46.0	57.0
Pounds feed per doz. eggs	6.18	6.22	6.04	6.20
Average egg weight (oz. per doz.)	24.5	24.3	24.6	24.4
Average wt. pullets at beginning (lb.)	4.28	4.21	4.38	4.26
Average wt. pullets at end (lb.)	4.62	4.74	4.74	4.55
Percent mortality	30.0*	33.3	35.0	45.0

* High mortality due to several outbreaks of intestinal coccidiosis.

DISCUSSION

As has been previously demonstrated at the Idaho Experiment Station with Alaska peas, it was found in these studies that methionine was also the growth-limiting deficiency of Austrian winter peas. This component of protein must, along with other amino acids, be supplied at an adequate level to permit satisfactory chick growth.

Methionine is a limiting amino acid in many proteins. This has resulted in considerable effort by the chemical industry of the United States to produce it on a scale sufficient to supply the need of the poultry feed industry and at a cost sufficiently low to permit its use in poultry rations. Industry has succeeded in making methionine available at low cost to the poultry industry.

The first experiment in this study demonstrated the value of supplementing a pea meal ration with methionine by including methionine at 0.25 percent in a purified ration in which peas were used as a single protein supplement. It was demonstrated that growth rate could be increased about 12 times. Even greater improvement was obtained in feed efficiency when methionine was added.

This information obtained was then used to determine if methionine would improve a chick starter mash which contained Austrian peas. Methionine included at the rate of 2 pounds per ton of feed (0.1%) in a ration containing 30 percent peas improved growth over a ration with no added methionine, but the growth was about 10 percent below that of the control ration. The addition of methionine at 0.1 percent to a ration containing 20 percent peas resulted in growth and feed efficiency almost identical to that obtained with the control ration.

The addition of an antibiotic to a ration containing 20 percent peas and supplemental methionine resulted in further growth improvement. Supplementing this ration with 0.05 percent methionine and an antibiotic resulted in growth equal to the addition of 0.1 percent methionine. The use of 0.1 percent methionine in addition to the antibiotic permitted growth equal to the antibiotic-supplemented control.

Further growth improvement was obtained when the pea meal ration was pelleted and then fed as crumbles. The pea meal ration supplemented with 0.05 percent methionine, fed as crumbles, resulted in growth equal to the control and also equal to the pea meal ration to which was added 0.1 percent methionine. Although maximum growth was obtained when 0.1 percent methionine was included, it would appear that 0.05 percent addition would be more economical when an antibiotic was also included.

It has been demonstrated with large numbers of chicks that a starter mash containing 20 percent peas and 0.1 percent methionine was equal to the control starter. This pea meal ration, adjusted for a developer mash with 0.05 percent methionine, resulted in pullets of the same weight at 28 weeks of age as the controls. When these birds were fed a laying mash containing pea meal at 20 percent and methionine at 0.05 percent concentration in the mash portion of the feed, the results were equal to those obtained with the control laying mash. This was true whether the experimental birds were reared from day-old throughout the laying year on a pea meal starter, developer, and laying ration, or if the pea meal ration was fed during the laying period only.

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