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EFFECT OF AUTOCLAVING AND OF GAMMA RAY TREATMENT ON THE NUTRITIONAL  
VALUE OF DIFFERENT VARIETIES OF BEANS FOR CHICKENS

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Dry field beans are an important source of protein for humans and animals in the underdeveloped and the developing countries. However, the protein is of low quality. This is because either they are deficient in one or more amino acids or they possess growth inhibiting factors. An autoclaving treatment considerably improves the nutritional value of these beans. Although autoclaving and correcting amino acid deficiency of these beans gives very good growth response, the growth on these beans is still lower than that obtained on cowpeas and soybean meal containing diets. An antibiotic supplement also improves the nutritional value of beans in terms of growth, feed efficiency and protein efficiency. The following experiments were conducted to determine the effect of gamma ray treatment before or after an autoclaving treatment on the nutritional value of different beans.

Two experiments were conducted with White Mountain broiler chicks. They were fed different experimental diets from hatching to two weeks of age. The feed and water were provided ad libitum. All beans were included in the diet at a level of 50%. Soybean meal was used in the control diet at a level to supply protein, equivalent to that of protein from 50% beans (22.68%, Experiment 1; or 24.2%, Experiment 2). Beans were autoclaved either in whole or ground form as outlined in Table 1. Whole or ground beans were either irradiated before or after autoclaving at 15 psi for 10 or 30 minutes, depending upon the treatment. In one diet, additional amounts of amino acids (L-tryptophan, 0.12%; L-lysine, 0.2%; and DL-methionine, 0.1%) were added. In another diet, 4% fat was added at the expense of corn to study whether the growth depression associated with Red Mexican beans is related to energy availability.

#### RESULTS

Experiment 1. Irradiation of White beans before autoclaving, at 20.2 Mrads resulted in a significant improvement in body weight and feed efficiency. Similarly, irradiation of Michigan pea beans before autoclaving resulted in about a 7% improvement in body weight over the unirradiated beans. However, the difference between these two treatments was not large enough to be significant. Nutritionally, the Michigan pea beans appear to be better than the White beans, and appear to be as good as soybean meal after irradiating and then autoclaving.

Experiment 2. Autoclaving of Red Mexican beans for 30 minutes was more effective in improving their nutritional value than that of a 10-minute autoclaving treatment. This was true whether the beans were autoclaved in ground or whole form. Autoclaving treatments were more effective in promoting growth when the beans were autoclaved in the ground form than when they were autoclaved in whole form. The differences between autoclaving treatments of beans were significant. Irradiation of the beans with gamma rays significantly improved the body weights of chicks fed the differently autoclaved Red Mexican beans. The growth response to irradiation was not affected by the duration of auto-

TABLE 1.--Effect of autoclaving and/or gamma ray treatment on the nutritional value of White, Michigan pea and Red Mexican beans.

Test component	Auto. min.	Gamma-ray treatment Mrad.	Treatment of beans					
			Autoclaved		Autoclaved then irradiated		Irradiated then autoclaved	
			B.W.	G/F	B.W.	G/F	B.W.	G/F
<u>Experiment 1:</u>								
Soybean meal	--	--	230d	0.63d	--	--	--	--
Whole White beans	30	20.2	112a	0.36a	--	--	159b	0.46b
Whole Michigan pea beans	30	20.2	206c	0.56c	--	--	221cd	0.55c
<u>Experiment 2:</u>								
Soybean meal	--	--	227g	0.67i	--	--	--	--
Whole Red Mexican	30	20	110b	0.40b	166de	0.51efg	--	--
Ground Red Mexican	30	20	142c	0.43c	188f	0.53fgh	--	--
Whole Red Mexican	10	20	96a	0.34a	--	--	138c	0.44cd
Whole Red Mexican + amino acids	10	20	--	--	--	--	141c	0.44cd
Ground Red Mexican	10	20	109b	0.37ab	--	--	160d	0.48de
Ground Red Mexican + 4% fat	10	20	--	--	--	--	161d	0.50ef

\*Treatment means in each part followed by different superscripts differ significantly (P < 0.05).

claving or by the form in which the beans were autoclaved. Response to irradiation before or after autoclaving on growth was additive. Supplementation of the bean diet with three essential amino acids had no effect on chick growth and feed efficiency. Similarly, the additional increment of 4% fat did not help in overcoming the growth depressing effect of beans. The results indicate that the diets used in these experiments were not deficient in these essential amino acids and that the growth depressing action of beans was not due to a deficiency of metabolizable energy. The trend of feed efficiency improvement with autoclaving and/or irradiation was closely related to that of body weight improvement. Irradiation significantly improved the feed utilization.

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NUTRITIONAL VALUE OF MOISTURE STRESSED VARIETIES AND BREEDING LINES  
OF DRY BEANS (*Phaseolus vulgaris*) FOR CHICKS

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The nutritional value of Pinto, Roza Pink and Viva Pink, subjected to stressing by frequency of irrigation, and other varieties and breeding lines of dry field beans (*Phaseolus vulgaris*) was assayed using a chick growth assay. The crude protein content (% N x 6.25) was slightly higher in the moisture stressed lines (26.1-23.2) compared with not stressed (24.8-21.7) lines. For the biological assay, a standard basal premix was made which contributed 8% protein to all diets. The additional 6% protein was supplied from test material. Each sample was tested without supplemental methionine and with 0.2% added DL-methionine. No significant differences were observed in two week chick body weights and protein efficiency ratio between moisture stressed and not stressed beans (Tables 1 and 2). A significant increase in two week chick body weights was observed with 0.2% added DL-methionine. With methionine supplementation, a significant increase in PER was also observed in most of the breeding lines tested. When methionine was limiting, the difference among the different beans tested was relatively small and mostly insignificant. In contrast, when the limiting effect of methionine was corrected growth differences obtained were larger and the variability in nutritional value of a number of varieties was significant. The Pink beans were lower in value than some of the others. Soybean meal gave significantly better growth than any of the beans tested.