RAW MUNG BEANS AS A PROTEIN SOURCE FOR GROWING-FINISHING SWINE

C.V. Maxwell[1], D.S. Buchanan[1], W.G. Luce[2], M.D. Woltmann[3], W.R. Walker[4], W.N. Cannon[5], S.A. Norton[6] and R. Vencl[7]

Story in Brief

Four growing and three finishing trials were conducted to determine the value of mung beans as a replacement for soybean meal in swine diets. A control corn-soybean meal diet was fed in each trial along with levels of mung beans supplying from 10 to 67% of the supplemental lysine during the growing period and from 20 to 75% of the supplemental lysine in the finishing period. During the growing period, feeding mung beans up to 30% of the supplemental lysine (10.2% of the ration) resulted in gain and efficiency of gain similar to that observed in pigs fed the corn-soybean meal control diet. Feeding higher levels generally decreased performance. During the finishing phase, feeding increasing levels of mung beans resulted in a small but linear decrease in daily gain and a quadratic increase in feed required per unit of gain. This study indicates that mung beans can be used to replace up to 60% of the supplemental lysine (16.2% mung beans) in finishing pig diets with little effect on performance.

(Key Words: Growing-Finishing Swine, Mung Bean.)

Introduction

The mung bean is a large seeded legume that is an important source of dietary protein in tropical and subtropical countries. Oklahoma is the leading state in mung bean production in the U.S. with 50,000 to 70,000 acres in production. In the canning industry, undersized or split beans are of no economic value and have traditionally been utilized in livestock feeds.

Mung beans represent a potential protein source for swine since they contain 22 to 28% crude protein and are high in the limiting amino acid,

[1]Professor [2]Regents Professor [3]Graduate Student [4]Assistant Professor, University of Florida [5]Nutrablend, Neosho, MO [6]Continental Grain Company, Libertyville, IL [7]Herdsman

lysine. However, mung beans may contain a trypsin inhibitor (Gupta and Wagle, 1978) which may limit their use in swine diets. Preliminary chick studies indicated that mung beans could be used to supply up to 40% of the supplemental lysine without affecting performance. A comprehensive study involving four trials with growing (40 to 120 lb) and three trials with finishing (120 lb to market) swine have been conducted to determine the level of raw mung beans which can be included in growing-finishing swine diets without affecting performance.

Materials and Methods

A total of four trials involving 984 pigs during the growing phase and three trials involving 777 pigs during the finishing phase were conducted at the Southwestern Livestock and Forage Research Station, El Reno, Oklahoma. A common control corn-soybean meal diet was fed in each trial (Tables 1, 2). During the growing phase, pigs received diets in Treatments 1, 4, and 8 in Trial 1, Treatments 1, 6 and 7 in Trial 2, Treatments 1, 6 and 9 in Trial 3 and Treatments 1, 2, 3 and 5 in Trial 4. During the finishing phase, pigs received diets in Treatments 1, 3 and 6 in Trial 1, Treatments 1, 4 and 8 in Trial 2 and Treatments 1, 2, 5 and 7 in Trial 3. All diets were calculated to provide an increasing percentage of the supplemental lysine from mung beans at the expense of soybean meal. The percentage of lysine from soybean meal replaced by mung beans ranged from 0 to 67% during the growing phase and from 0 to 75% during the finishing phase. All diets were formulated on an equivalent lysine basis of .75% lysine for the growing phase and .62% lysine during the finishing phase. Two sources of mung beans were used during these trials. Mung beans used in Trials 1, 2 and 3 during the growing phase and Trials 1 and 2 during the finishing phase contained 1.86% lysine and mung beans used in Trial 4 of the growing phase and Trial 3 of the finishing phase contained 1.63% lysine. Diets were formulated using the analyzed lysine values.

Statistical analysis procedures were used which effectively combined analyses for the separate trials. Since Treatment 1 was common in each trial, comparison of the additional treatments could be made indirectly by using the comparison to Treatment 1. This technique to combine information from different experiments is similar to that employed by Tyler et al. (1983) and Luce et al. (1989).

Results and Discussions

Results of the combined trials are presented in this report. Graphic representation of responses are illustrated only in cases in which an effect ($P<.05$) of mung bean level was observed over all trials.

Table 1. Composition of experimental rations fed during the growing phase.

Ingredients	Treatments 1 Control	2 MB-10[a]	3 MB-20[a]	4 MB-25[a]	5 MB-30[a]	6 MB-34[a]	7 MB-42[a]	8 MB-50[a]	9 MB-67[a]
Corn, yellow	76.86	74.88	73.38	73.94	72.06	73.27	72.05	71.30	69.05
Soybean meal, 44%	19.53	17.66	15.82	14.88	13.98	12.89	11.44	10.00	6.59
Mung beans	--	3.73	7.06	7.50	10.20	10.15	12.83	15.50	20.65
Calcium carbonate	.82	.75	.75	.80	.72	.80	.76	.78	.75
Salt	.40	.40	.40	.40	.40	.40	.40	.40	.40
Vitamin -TM,mx[b]	.25	.25	.25	.25	.25	.25	.25	.25	.25
Tylan 10	.50	.50	.50	.50	.50	.50	.50	.50	.50
Calculated composition									
Lysine	.75	.75	.75	.75	.75	.75	.75	.75	.75
Calcium	.75	.75	.75	.75	.75	.75	.75	.75	.75
Phosphorus	.65	.65	.65	.65	.65	.65	.65	.65	.65

[a]Indicate the percentage of supplemental lysine supplied by mung beans. Mung beans containing 1.86% lysine were used in trials where Treatments 4, 6, 7, 8 and 9 were compared and mung beans containing 1.63% lysine were used in trials where Treatments 2, 3 and 5 were compared.

[b]Supplied 4,000,000 IU Vitamin A, 3,000,000 IU Vitamin D, 4 g riboflavin, 20 g pantothenic acid, 30 g niacin, 800 g choline chloride, 15 mg Vitamin B_{12}, 10,000 I.U. Vitamin E, 2 g menadione, 200 mg iodine, 90 g iron, 20 g manganese, 10 g copper, 90 g zinc and 100 mg selenium per ton of feed.

Table 2. Composition of experimental rations fed during the finishing phase.

Ingredients	Treatments 1 Control	2 MB-20[a]	3 MB-25[a]	4 MB-38[a]	5 MB-40[a]	6 MB-50[a]	7 MB-60[a]	8 MB-75[a]
Corn, yellow	82.32	79.55	79.96	79.21	76.97	77.60	74.56	75.22
Soybean meal, 44%	14.61	11.99	11.33	9.09	9.09	7.63	5.99	3.75
Mung beans	--	5.29	5.63	8.59	10.74	11.75	16.23	17.88
Dical	1.50	1.67	1.53	1.58	1.70	1.58	1.75	1.65
Calcium carbonate	.82	.75	.80	.78	.75	.80	.72	.75
Salt	.40	.40	.40	.40	.40	.40	.40	.40
Vitamin -TM m x[b]	.25	.25	.25	.25	.25	.25	.25	.25
Tylan 10	.10	.10	.10	.10	.10	.10	.10	.10
Calculated composition								
Lysine	.62	.62	.62	.62	.62	.62	.62	.62
Calcium	.70	.70	.70	.70	.70	.70	.70	.70
Phosphorus	.60	.60	.60	.60	.60	.60	.60	.60

[a]Indicates the percentage of supplemental lysine supplied by mung beans. Mung beans containing 1.86% lysine was used in trials when Treatments 3, 4, 6 and 8 were compared and mung beans containing 1.63% lysine was used in trials where Treatments 2, 5 and 7 were compared.

[b]Supplied 4,000,000 IU Vitamin A, 3,000,000 IU Vitamin D, 4 g riboflavin, 20 g pantothenic acid, 30 g niacin, 800 g choline chloride, 15 mg Vitamin B_{12}, 10,000 I.U. vitamin E, 2 g menadione, 200 mg iodine, 90 g iron, 20 g manganese, 10 g copper, 90 g zinc and 100 mg selenium per ton of feed.

During the growing phase, average daily gain decreased with increasing levels of mung beans in the diet (Figure 1; Quadratic effect, $P<.05$). These results indicate that the level of mung beans had little effect on gain at lower levels in the diet but affected gain more dramatically at higher levels. Average daily gain was similar in pigs on Treatments 1 to 5 but was reduced ($P<.01$) when mung beans in the diet were increased to more than 30% of the supplemental protein (Treatment 6). Pigs fed diets with higher levels than 30% of the supplemental lysine from mung beans (Treatment 7, 8 and 9) grew more slowly than those fed the control diet although difference were significant only at the two highest levels of mung beans (Treatment 8 and 9, $P<.01$). Least squares means for average daily gain for Treatment 1 to 9 were 1.49, 1.50, 1.53, 1.46, 1.56, 1.37, 1.44, 1.38 and 1.36 lb/day, respectively. Feed required per unit of gain followed a pattern similar to that observed for gain with pigs requiring more feed per unit of gain as mung beans in the diet increased (Figure 2; Quadratic effect, $P<.01$). As was observed for gain, level of mung beans in the diet had little effect on feed efficiency at lower

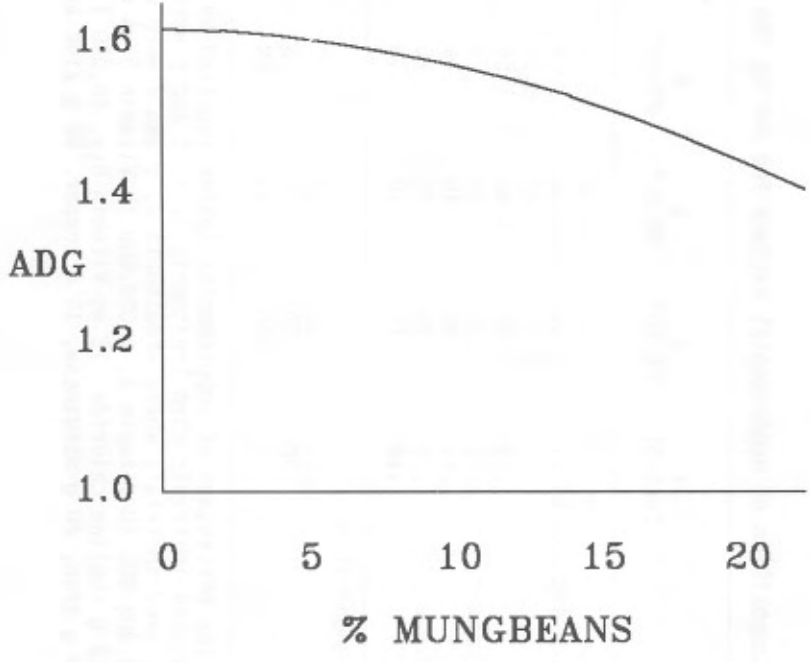

Figure 1. Effect of level of mung beans in the diet on average daily gain (ADG, lb) during the growing period.

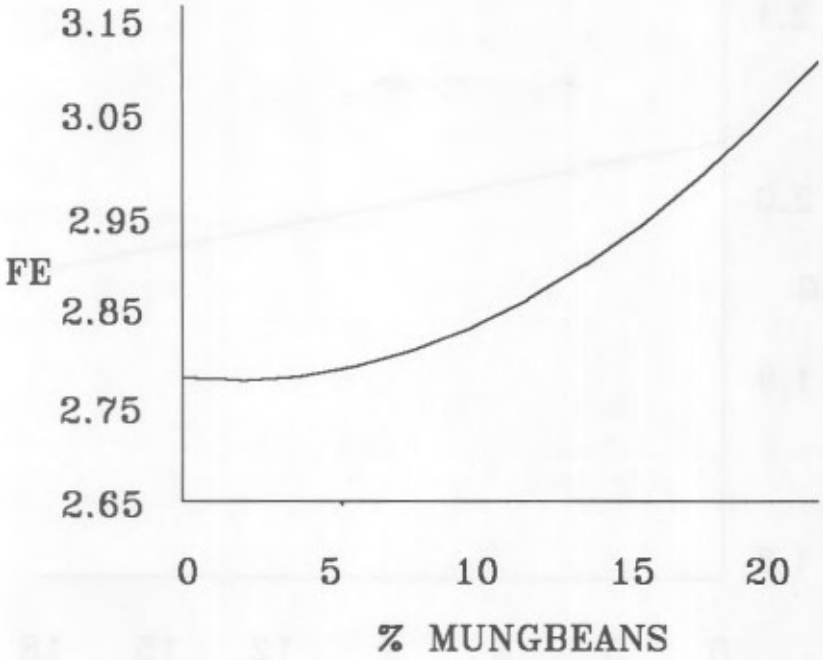

Figure 2. Effect of level of mung beans in the diet on feed efficiency (FE, lb feed/lb gain) during the growing phase .

levels in the diet but resulted in increased feed required per unit of gain at higher levels. Feed efficiency was similar in pigs fed up to 30% of the supplemental lysine from mung beans (Treatments 1 to 5). Least squares means were 2.78, 2.77, 2.78, 2.82, 2.79, 2.86, 2.83, 2.87 and 3.06 lb feed/lb gain for Treatments 1 through 9, respectively. It should be noted that feed required per unit of gain did not increase greatly until mung beans replaced 67% of the supplemental lysine where feed required per unit of gain was 10.1% higher than in pigs fed the control diet (Treatment 1 vs Treatment 9, $P<.01$). Increases in feed required per unit of gain in pigs on Treatments 6 and 8 approached signigicance ($P<.1$) when compared to pigs fed the control diet (Treatment 1). Average daily feed intake was similar among all levels of mung beans. This study suggests that mung beans can effectively replace up to 30% of the supplemental lysine (10.2% of the ration) in the diet of growing pigs without significantly affecting performance.

During the finishing period, average daily gain decreased linearly ($P<.01$) with increasing level of mung beans in the diet (Figure 3). Although the effect of increasing mung beans resulted in a linear reduction in gain over all levels, it should be noted that the magnitude of the reduction overall was

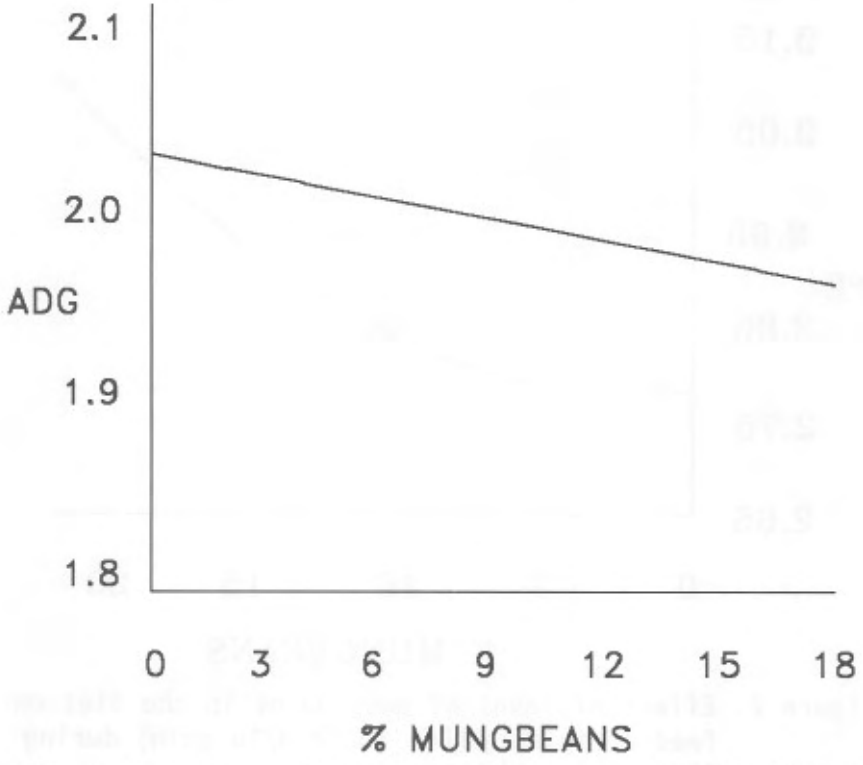

Figure 3. Effect of level of mung beans in the diet on average daily gain (ADG, lb) during the finishing period.

small. In fact, only in pigs fed diets containing 38 and 75% of the supplemental lysine from mung beans (Treatment 4 and 8) did the reduction in gain approach significance ($P<.07$ and $P<.06$, respectively) when the difference among the means were compared with pigs fed the control diet (Treatment 1). Gain in pigs fed other levels of mung beans was similar. Least square means for average daily gain for Treatment 1 through 8 were 2.00, 2.02, 2.10, 1.89, 1.99, 2.01, 2.07 and 1.90 lb/day, respectively. Feed required per unit of gain increased (Figure 4, Quadratic effect $P<.01$) with increasing level of mung beans. As was observed with the growing pig, feed efficiency of pigs fed the lower levels of mung beans was similar and feed required per unit of gain was increased ($P<.01$) only in pigs fed the highest level of mung bean supplementation (Treatment 1 vs Treatment 8). Least squares means for feed required per unit of gain for Treatment 1 through Treatment 8 were 3.58, 3.56, 3.39, 3.44, 3.53, 3.37, 3.64, 3.81, respectively. Average daily feed intake and adjusted backfat thickness was similar among

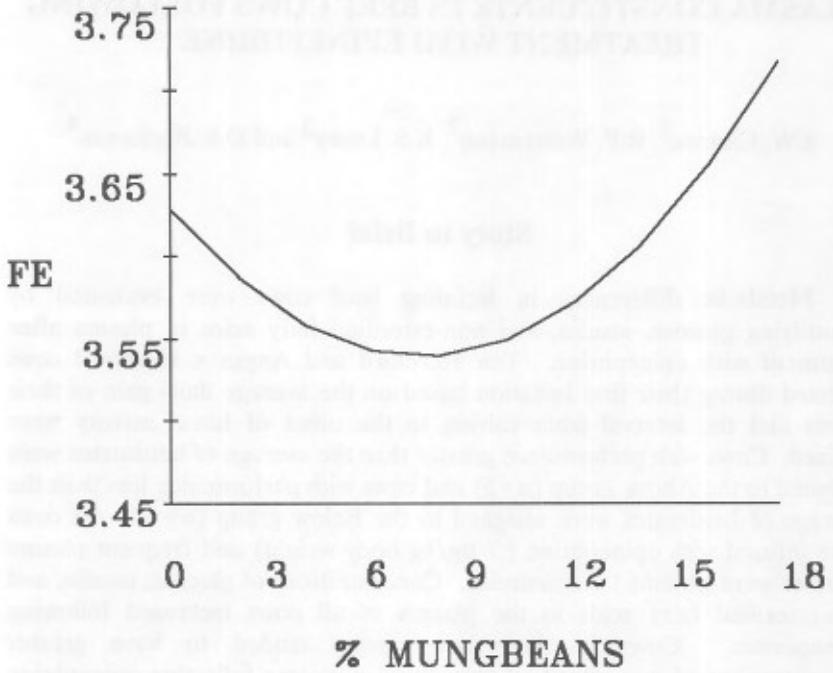

Figure 4. Effect of level of mung beans in the diet on feed efficiency (FE, lb feed/lb gain) during the finishing period.

all levels of mung beans. This study indicates that mung beans can be used to replace up to 60% of the supplemental lysine (16.2% mung beans) in finishing pigs with minimal effects on performance.

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