

Velvetbeans, Cottonseed Meal, and Peanut Meal As Protein Feeds for Fattening Steers in the Coastal Plain Area¹

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INTRODUCTION

The beef-cattle enterprise in the Coastal Plain area of southeastern United States has been growing in importance, particularly since it offers a practical means of utilizing land either withdrawn from cotton cropping or seeded to forages as a means of controlling soil erosion. The long grazing seasons and relatively mild winters, both favorable to cattle, minimize winter feed requirements.

A fairly large proportion of the hay and other feed crops raised in the region can be utilized for fattening cattle by the so-called dry-lot method. Since approximately 80 percent of the cost of fattening cattle by this method is for feed, either raised on the farm or purchased, it is important that feed combinations be chosen wisely if the cattle are to be fattened economically. The Coastal Plain area is especially fortunate in having a variety of concentrates—particularly protein-rich feedstuffs—available locally. Prominent among these are velvetbeans, cottonseed meal, and peanut meal. The object of the experiments reported in this bulletin, therefore, was to determine the relative values of these three concentrates as sources of protein when used to supplement locally produced feeds in fattening beef cattle in dry lot.

EXPERIMENTAL PROCEDURE

The steer-feeding experiments were begun late in the fall of 1934 and continued for 4 successive years. They were conducted cooperatively at the Georgia Coastal Plain Experiment Station, Tifton, Ga., by the

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In November of each year about 36 head of grade Hereford yearling steers, grading Medium to Good as feeders, were selected (fig. 1). They were divided into three groups as nearly alike as possible with respect to weight, conformation, and quality and were fattened as follows: Group 1, on velvetbeans fed dry and in the pod; group 2, on cottonseed meal containing 36 percent of protein; group 3, on peanut meal with 45 percent of protein. Although the three protein supplements differed with respect to their protein content, they were fed in quantities to supply approximately the same amount of protein to each group. The cottonseed meal and peanut meal were purchased locally.



FIGURE 1.—Representative feeder steers used in the experiments.

In addition to the protein supplement, each group of steers was also fed ear corn in the husk, which was cut into two or more pieces, and peanut straw, the byproduct from the threshing of peanuts. The protein concentrate fed to each group was sprinkled over the cut ear corn, but the roughage was placed in a separate trough and fed ad libitum. A mineral mixture of 2 parts, by weight, of bonemeal, 2 parts of raw rock phosphate, and 1 part of salt was available at all times.

The steers were fed once daily, in the morning. The quantities of feed were increased gradually as the experiment progressed and in accordance with the appetites of the steers. They were fed in well-drained lots of approximately $1\frac{1}{2}$ acres each, and containing no shelter. Individual weights of the animals were taken on 3 successive days at the beginning and end of each experiment and on 1 day at 28-day

intervals. At the close of each experiment the steers were trucked to Moultrie, Ga., a distance of approximately 27 miles, and slaughtered.

RESULTS OF EXPERIMENTS

EXPERIMENT 1 (1934-35)

Figure 2 shows that the relative positions of the three groups of steers in the first experiment, with respect to the gains, did not change throughout the experiment and the group 1 steers, fed velvet-

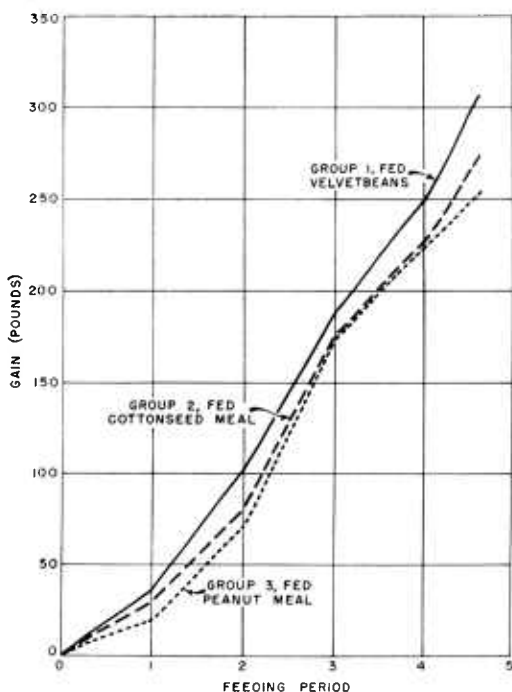


FIGURE 2.—Average cumulative gains of steers, by 28-day periods, during the 1934-35 experiment (129 days).

beans, gained at a somewhat more uniform rate than those in group 2, fed cottonseed meal, or group 3, fed peanut meal. However, from the beginning of the second 28-day period to the end of the third period, the rate of gain of the group 1 steers was accelerated sharply.

Table 1 shows that, during the 129-day feeding period, the gains of group 1 were 0.41 pound more per steer per day than those of group 3 and 0.26 pound more than those of group 2. The gains of group 1 were sufficiently greater than those of group 3 to be statistically significant, as determined by Snedecor's method.³ Group 2 gained 0.15 pound more per steer per day than group 3, but the difference was not important.

The cost of feed per 100 pounds of gain was much lower for group

³ SNEDECOR, GEORGE W. STATISTICAL METHODS APPLIED TO EXPERIMENTS IN AGRICULTURE AND BIOLOGY. 341 pp., illus. Ames, Iowa, 1937.

1 than for either of the other two groups. Group 1 steers also had a lower total feed cost, and group 2 had the highest cost. However, the differences among the three groups were comparatively small.

TABLE 1.—Summary of results of first experiment, Nov. 27, 1934, to Apr. 5, 1935 (129 days)

Item	Group 1, fed corn in husk, velvetbeans, and peanut straw	Group 2, fed corn in husk, cottonseed meal, and peanut straw	Group 3, fed corn in husk, peanut meal, and peanut straw
Steers used	number	12	12
Average initial weight at feed lot	pounds	557	553
Average final weight at feed lot	do	864	827
Average gain per steer	do	307	274
Average daily gain per steer	do	2.38	2.12
Total feed consumed per steer:			
Corn	do	1,776	1,845
Velvetbeans	do	670	
Cottonseed meal	do		320
Peanut meal	do		
Peanut straw	do	510	540
Minerals	do	6.7	7.4
Average ration:			
Corn	do	13.77	14.30
Velvetbeans	do	5.19	
Cottonseed meal	do		2.48
Peanut meal	do		
Peanut straw	do	3.95	4.19
Minerals	do	.05	.05
Feed required per 100 pounds of gain:			
Corn	do	579	673
Velvetbeans	do	218	
Cottonseed meal	do		117
Peanut meal	do		
Peanut straw	do	166	197
Minerals	do	2.2	2.7
Value of feed per 100 pounds of gain ¹	dollars	7.37	8.99
Initial cost per steer @ \$4.78 per 100 pounds of live weight	do	26.62	26.43
Cost of feed per steer	do	22.62	24.62
Total cost per steer at feed lot	do	49.24	51.05
Sale price per 100 pounds of live weight	do	8.50	7.79
Gross returns per steer	do	73.44	64.42
Profit per steer ²	do	24.20	13.37

¹ At the following prices per ton: Corn (in husk), \$18.75; velvetbeans (in pod), \$13; cottonseed meal, \$35; peanut meal, \$33; peanut straw, \$6; minerals, \$26.

² Difference between sale price at the station and the sum of purchase price and feed cost.

The steers fed velvetbeans appeared to be better finished than those fed either cottonseed meal or peanut meal and therefore commanded a higher average sale price per 100 pounds of live weight. The price for group 1 was \$0.71 more than for group 2 but only \$0.08 more than for group 3. Despite the fact that the steers receiving cottonseed meal made larger gains than those receiving peanut meal, the latter group sold for \$0.63 more per 100 pounds of live weight. The carcass grades indicated that there was no appreciable difference between the groups receiving velvetbeans and peanut meal. Both of these groups graded significantly higher than the group receiving cottonseed meal.

Because of greater daily gains, less feed cost per 100 pounds of gain, and higher selling price per 100 pounds of live weight, the group fed velvetbeans proved to be considerably more profitable than either of the other groups. The group receiving peanut meal returned \$6.20 less profit per steer, and the group receiving cottonseed meal returned \$10.83 less. Thus, it may be concluded from the results of the first experiment that velvetbeans fed dry and in the pod proved to be a more profitable source of protein concentrate for dry-lot feeding than either cottonseed meal or peanut meal and that the peanut meal was somewhat superior to cottonseed meal.

EXPERIMENT 2 (1935-36)

Figure 3 shows that in the first 28 days of the 1935-36 experiment the group 3 steers, fed peanut meal, gained slightly more rapidly than the group 2 steers, fed cottonseed meal, and considerably faster than the group 1 steers, fed velvetbeans. On the whole, however, they gained less rapidly than either the group 2 or the group 1 steers, especially

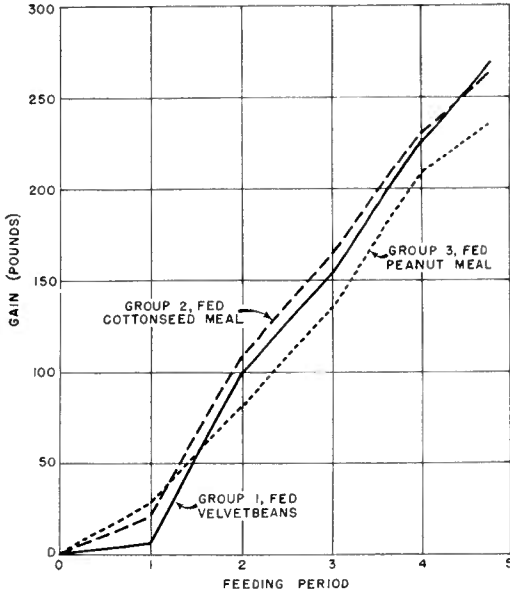


FIGURE 3.—Average cumulative gains of steers, by 28-day periods, during the 1935-36 experiment (134 days).

during the last 22 days of the experiment. Except during the first 28 days, when the group 1 steers gained at a somewhat slower rate than the steers in group 2, the gains of these two groups did not differ materially, although during the last 22 days of the experiment the steers in group 1 gained slightly more rapidly than those in group 2.

As shown in table 2, the relative differences with respect to daily gains, feed costs, and profit among the three groups were considerably less than in the initial experiment. Nevertheless, group 1 again made the largest average daily gains, but they were only 0.04 pound per steer per day more than those of group 2 and 0.26 pound more than those of group 3. These differences were not statistically significant. The cheapest gains were made by group 1. In this group, feed cost per 100 pounds of gain was \$0.48 less than that of group 2 and \$0.89 less than that of group 3. The group fed peanut meal showed the lowest total cost at feed lot largely because the animals did not consume so much corn or protein in relation to their initial weight as either of the other groups. On the other hand, the steers making the largest average daily gains throughout the test were in a more desirable

market condition and thus sold sufficiently higher on the average to compensate for the somewhat higher purchase and feed costs. The carcass grades of groups 1 and 2 were the same, on the average, and were superior to those of group 3 but not significantly so because of considerable spread in grade within the groups.

TABLE 2.—Summary of results of second experiment, Nov. 14, 1935, to Mar. 27, 1936 (134 days)

Item	Group 1, fed corn in husk, velvetbeans, and peanut straw	Group 2, fed corn in husk, cottonseed meal, and peanut straw	Group 3, fed corn in husk, peanut meal, and peanut straw
Steers used	number	11	11
Average initial weight at feed lots	pounds	637	635
Average final weight at feed lot	do	906	899
Average gain per steer	do	269	264
Average daily gain per steer	do	2.01	1.97
Total feed consumed per steer:			
Corn	do	2,190	2,201
Velvetbeans	do	678	
Cottonseed meal	do		336
Peanut meal	do		281
Peanut straw	do	369	447
Minerals	do	7.7	7.3
Average ration:			
Corn	do	16.34	16.43
Velvetbeans	do	5.06	
Cottonseed meal	do		2.51
Peanut meal	do		
Peanut straw	do	2.75	3.34
Minerals	do	.06	.05
Feed required per 100 pounds of gain:			
Corn	do	814	834
Velvetbeans	do	252	
Cottonseed meal	do		127
Peanut meal	do		120
Peanut straw	do	137	169
Minerals	do	2.9	2.8
Value of feed per 100 pounds of gain ¹	dollars	8.53	9.01
Initial cost per steer @ \$5.50 per 100 pounds of live weight	do	35.03	34.93
Cost of feed per steer	do	22.94	23.79
Total cost per steer at feed lot	do	57.97	58.72
Sale price per 100 pounds of live weight	do	7.06	6.96
Gross returns per steer	do	63.96	62.57
Profit per steer ²	do	5.99	3.85

¹ At the following prices per ton: Corn (in husk), \$16.25; velvetbeans (in pod), \$10; cottonseed meal, \$24; peanut meal, \$20; peanut straw, \$8; minerals, \$26.

² Difference between sale price at the station and the sum of purchase price and feed cost.

As in the initial experiment, the group fed velvetbeans proved to be most profitable because of greater gains and a higher average sale price. The group fed cottonseed meal gained 29 pounds more each but sold for only \$0.02 per 100 pounds of live weight more than the group receiving peanut meal. In this experiment profits were less than in the initial experiment, largely because the steers were valued at \$0.72 per 100 pounds higher as feeders, made less rapid gains throughout the experiment, and sold at a lower price per 100 pounds of live weight.

EXPERIMENT 3 (1936-37)

According to figure 4, except for a portion of the second and fourth periods in the 1936-37 experiment the steers in group 1, fed velvetbeans, made more rapid gains than either those in group 2, fed cottonseed meal, or group 3, fed peanut meal. In the last 14 days of the experiment there was a decrease in rate of gain in groups 2 and 3.

TABLE 3.—Summary of results of third experiment, Nov. 12, 1936, to Mar. 18, 1937 (126 days)

Item		Group 1, fed corn in husk, velvetbeans, and peanut straw	Group 2, fed corn in husk, cottonseed meal, and peanut straw	Group 3, fed corn in husk, peanut meal, and peanut straw
Steers used	number	12	12	12
Average initial weight at feed lot	pounds	650	615	631
Average final weight at feed lot	do	893	832	856
Average gain per steer	do	243	217	225
Average daily gain per steer	do	1.93	1.72	1.78
Total feed consumed per steer:				
Corn	do	1,861	1,959	1,943
Velvetbeans	do	659		
Cottonseed meal	do		333	
Peanut meal	do			281
Peanut straw	do	409	588	503
Minerals	do	10.0	8.6	9.2
Average ration:				
Corn	do	14.77	15.55	15.42
Velvetbeans	do	5.23		
Cottonseed meal	do		2.64	
Peanut meal	do			2.24
Peanut straw	do	3.25	4.67	4.47
Minerals	do	.08	.07	.06
Feed required per 100 pounds of gain:				
Corn	do	766	903	864
Velvetbeans	do	271		
Cottonseed meal	do		153	
Peanut meal	do			125
Peanut straw	do	169	271	250
Minerals	do	4.1	4.0	4.1
Value of feed per 100 pounds of gain ¹	dollars	11.26	13.39	12.49
Initial cost per steer, @ \$6.00 per 100 pounds of live weight	do	44.85	42.43	43.54
Cost of feed per steer	do	27.35	29.06	28.10
Total cost per steer at feed lot	do	72.20	71.49	71.64
Sale price per 100 pounds of live weight	do	9.60	8.86	9.25
Gross returns per steer	do	85.73	73.72	79.18
Profit per steer ²	do	13.53	2.23	7.54

¹ At the following prices per ton: Corn (in husk), \$21.25; velvetbeans (in pod), \$17; cottonseed meal, \$33; peanut meal, \$34; peanut straw, \$9; and minerals, \$26.

² Difference between sale price at the station and the sum of purchase price and feed cost.

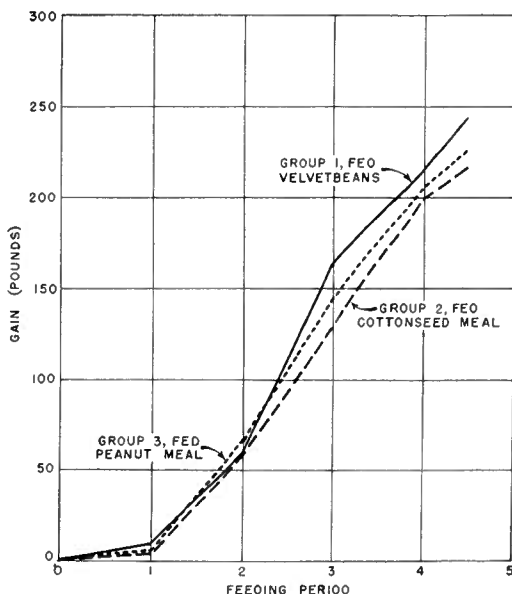


FIGURE 4.—Average cumulative gains of steers, by 28-day periods, during the 1936-37 experiment (126 days).

Table 3 shows that, as in the two previous tests, the group fed velvetbeans made the largest average daily gains, cheapest gains, sold at the highest price per 100 pounds of live weight, and returned the most profit. Because of considerable variability in total gains among the steers within the three groups, the difference in gains was probably significant statistically only between the group fed velvetbeans and that fed peanut meal. The last-mentioned group made slightly larger and considerably cheaper gains than the group receiving cottonseed meal. Moreover, the former group sold for \$0.39 more per 100 pounds of live weight and returned \$5.31 more profit per steer.

Although the average carcass grades were the highest for group 1, there was no significant difference among the groups in this respect.

During the feeding period of 1936-37, feed and feeder-cattle prices were noticeably higher than in the two previous years. Nevertheless, groups 1 and 3 returned more profit than in the previous year, largely because they sold at a higher price per 100 pounds of live weight than in the previous year.

EXPERIMENT 4 (1937-38)

According to figure 5, in the 1937-38 experiment the steers in group 1, fed velvetbeans, made the greatest gain during the entire experiment, except for the first period and a part of the third 28-day period when the steers in group 2, fed cottonseed meal, made somewhat greater gains. Both the group 1 and the group 2 steers gained more than those in group 3, and the difference was greatest toward the end of the experiment, when the rate of gain of the group 3 steers gradually decreased. The differences in gains between the steers in groups 1 and 2 and those in group 3 were found to be statistically significant.

TABLE 4.—Summary of results of fourth experiment, Nov. 3, 1937, to Mar. 23, 1938 (140 days)

Item		Group 1, fed corn in husk, velvetbeans, and peanut straw	Group 2, fed corn in husk, cottonseed meal, and peanut straw	Group 3, fed corn in husk, peanut meal, and peanut straw
Steers used	number	11	12	12
Average initial weight at feed lot	pounds	621	636	618
Average final weight at feed lot	do	915	922	860
Average gain per steer	do	296	286	242
Average daily gain per steer	do	2.11	2.04	1.73
Total feed consumed per steer:				
Corn	do	2,266	2,202	2,164
Velvetbeans	do	736		
Cottonseed meal	do		348	
Peanut meal	do			297
Peanut straw	do	307	435	430
Minerals	do	15.5	13.8	14.8
Average ration:				
Corn	do	16.19	15.73	15.46
Velvetbeans	do	5.26		
Cottonseed meal	do		2.49	
Peanut meal	do			2.13
Peanut straw	do	2.19	3.11	3.07
Minerals	do	.11	.10	.11
Feed required per 100 pounds of gain:				
Corn	do	768	770	894
Velvetbeans	do	249		
Cottonseed meal	do		122	
Peanut meal	do			123
Peanut straw	do	104	152	178
Minerals	do	5.3	4.8	6.1
Value of feed per 100 pounds of gain ¹	dollars	7.99	7.72	9.09
Initial cost per steer @ \$7.80 per 100 pounds of live weight	do	48.44	49.61	48.20
Cost of feed per steer	do	23.57	22.09	22.00
Total cost per steer at feed lot	do	72.01	71.70	70.20
Sale price per 100 pounds of live weight	do	8.34	8.11	7.77
Gross return per steer	do	76.31	74.77	66.82
Profit (+) or loss (-) per steer ²	do	+4.30	+3.07	-3.38

¹ At the following prices per ton: Corn (in husk), \$15; velvetbeans (in pod), \$14; cottonseed meal, \$21; peanut meal, \$26; peanut straw, \$8; minerals, \$26.

² Difference between sale price at the station and the sum of purchase price and feed cost.

As shown in table 4, group 2 made the cheapest gains of the three groups. The gains of both groups 1 and 2 were considerably cheaper than those of group 3.

Group 1 returned a profit of \$1.23 per steer more than group 2, whereas the steers in group 3 sold at a loss. In fact, the group 3 steers sold for less per 100 pounds of live weight than they were valued

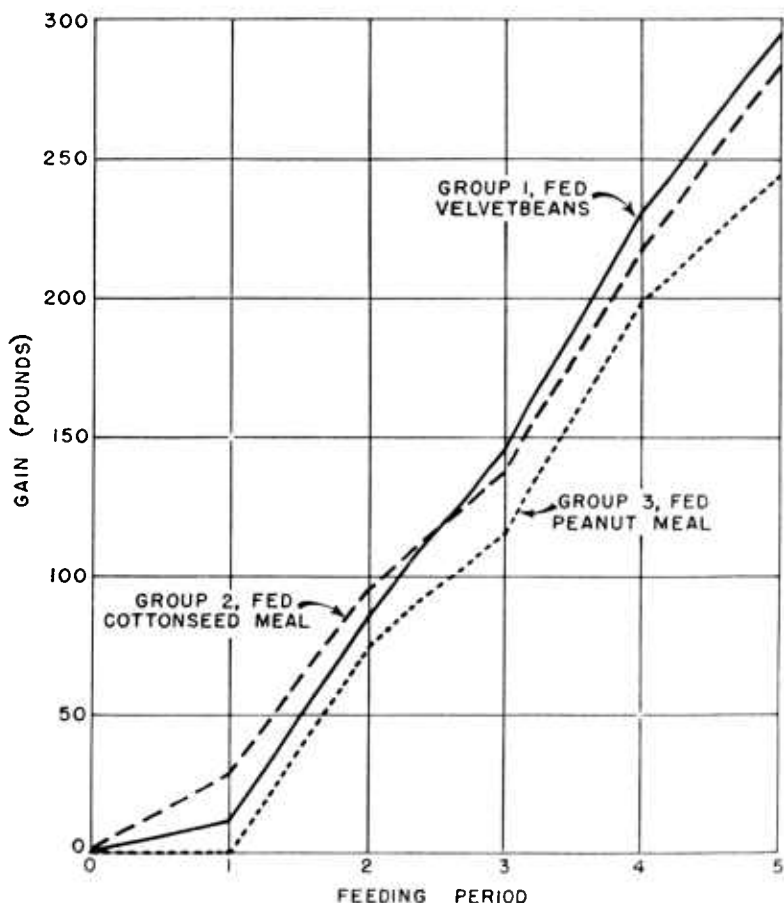


FIGURE 5.—Average cumulative gains of steers, by 28-day periods, during the 1937-38 experiment (140 days).

as feeders at the beginning of the experiment. The cost of feeder steers in this experiment was the highest for the 4 years; but feed prices were generally lower than those in the first and third years and were about the same, on the average, as those of the second year.

The carcass grades of the group fed velvetbeans were significantly higher than those of either of the other two groups. Although the group fed cottonseed meal graded higher than the group fed peanut meal, the difference was not statistically significant.

AVERAGE RESULTS OF THE FOUR EXPERIMENTS

Figure 6 shows that the average gains for the four experiments of the steers in groups 1 and 2, fed velvetbeans and cottonseed meal, respectively, were consistently greater in each 28-day period than those of the steers in group 3, fed peanut meal. Group 1 steers gained somewhat more than the group 2 steers, except during the first 56 days.

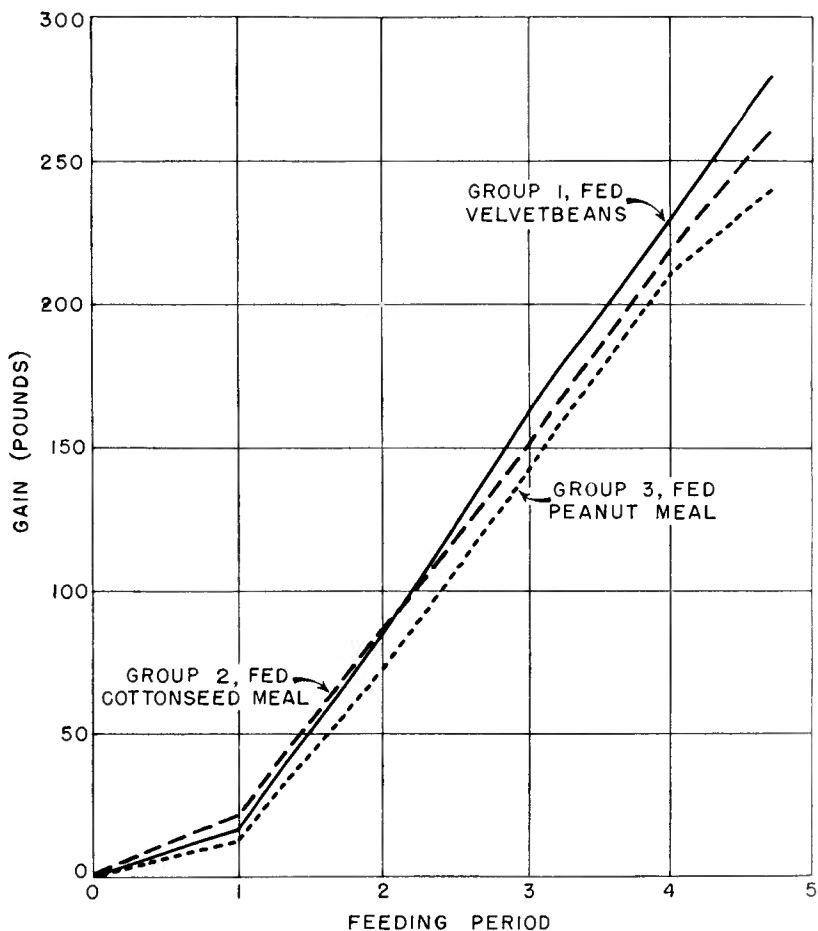


FIGURE 6.—Average cumulative gains of steers, by 28-day periods, for the four experiments 1934-38 (132 days).

In the final analysis (table 5), the average daily gains of group 1 were significantly greater than those of group 3 but not of group 2. In three of the four experiments the group receiving cottonseed meal made larger gains than the group receiving peanut meal. A somewhat larger quantity of cottonseed meal than of peanut meal was consumed. As already stated, however, the cottonseed meal contained only 36

percent of protein, whereas the peanut meal contained 45 percent. Considerably less roughage was consumed by group 1 than by the other groups, yet all groups were fed all the roughage they would eat. On an average, for the four experiments, the least expensive gains were made by the group fed velvetbeans, followed by the group fed cottonseed meal.

TABLE 5.—Summary of average results of the four experiments (132 days)

Item	Group 1, fed corn in husk, velvetbeans, and peanut straw	Group 2, fed corn in husk, cottonseed meal, and peanut straw	Group 3, fed corn in husk, peanut meal, and peanut straw
Steers used	number 46	47	47
Average initial weight at feed lot	pounds 616	609	597
Average final weight at feed lot	do 894	869	836
Average gain per steer	do 278	260	239
Average daily gain per steer	do 2.11	1.97	1.81
Total feed consumed per steer:			
Corn	do 2.014	2.049	2.018
Velvetbeans	do 685		
Cottonseed meal	do	334	
Peanut meal	do		281
Peanut straw	do 402	504	402
Minerals	do 9.9	9.3	9.6
Average ration:			
Corn	do 15.26	15.52	15.29
Velvetbeans	do 5.19		
Cottonseed meal	do	2.53	
Peanut meal	do		2.14
Peanut straw	do 3.05	3.82	3.73
Minerals	do .07	.07	.07
Feed required per 100 pounds of gain:			
Corn	do 724	788	844
Velvetbeans	do 246		
Cottonseed meal	do	128	
Peanut meal	do		118
Peanut straw	do		206
Minerals	do 145	194	4.0
Value of feed per 100 pounds of gain	dollars 3.6	3.6	10.00
Initial cost per steer	do 38.60	38.42	37.09
Cost of feed per steer	do 24.16	24.91	23.89
Total cost per steer at feed lot	do 62.76	63.33	61.58
Sale price per 100 pounds of live weight	do 8.37	7.93	8.09
Gross returns per steer	do 74.83	68.91	67.63
Profit per steer ¹	do 12.07	5.58	6.05

¹ Difference between sale price at the station and the sum of purchase price and feed cost.

Throughout the four experiments, the group fed velvetbeans produced more desirable carcasses and brought higher sale prices than either of the other groups. In 2 of the 4 years the group fed peanut meal sold for more than the group fed cottonseed meal, despite the fact that the latter group made larger average gains in 3 of the 4 years.

On the average, for the 4 years, the steers fed velvetbeans were decidedly the most profitable of the three groups because of consistently larger and less expensive gains and a higher sale price per 100 pounds of live weight. The profit on this group was \$6.49 per head more than group 2 and \$6.02 more than group 3. In 2 of the 4 experiments, the higher sale price per 100 pounds of live weight of the group fed peanut meal than of the group fed cottonseed meal was sufficient to offset smaller gains, resulting in \$0.47 more profit per steer.

SUMMARY AND CONCLUSIONS

Experiments to determine the relative feeding value of three protein concentrates when fed to steers in dry lot were begun in the fall of

1934 and continued for four successive winter feeding periods. The experiments were conducted cooperatively at the Georgia Coastal Plain Experiment Station, Tifton, Ga., by the Bureau of Animal Industry, United States Department of Agriculture, the Georgia Experiment Station, and the Georgia Coastal Plain Experiment Station.

Velvetbeans fed dry and in the pod, cottonseed meal containing 36 percent of protein, and peanut meal containing 45 percent of protein were fed to three groups of Medium to Good grade Hereford feeder steers for an average period of 132 days for the four experiments. Each group of steers was also fed ear corn in the husk, cut into pieces, and peanut straw, the latter being fed ad libitum.

Steers fed velvetbeans made larger and cheaper gains, displayed a higher degree of finish at the close of the experiment, and yielded more desirable carcasses than steers receiving cottonseed meal or peanut meal. The group fed velvetbeans consistently brought a higher price per 100 pounds of live weight at market and yielded considerably more profit per steer than either of the two other groups. In these experiments velvetbeans fed dry and in the pod proved to be a more desirable source of protein concentrate for fattening steers in dry lot than either cottonseed meal or peanut meal.

The steers fed cottonseed meal made more rapid and cheaper gains than those fed peanut meal, but the latter feed resulted, on the average, in a higher selling price per 100 pounds of live weight and produced slightly more desirable carcasses than did the cottonseed meal. Moreover, the higher sale price of the group fed peanut meal slightly more than offset the added gain and cheaper feed costs per 100 pounds of gain of the group fed cottonseed meal. Thus, within the limits of these series of experiments, peanut meal was slightly superior to cottonseed meal.

