A Preliminary Report . . .

# The Acceptability of Cull Pinto Beans in Rations for Growing Pigs

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**The 1974 crop year was an unusual one from several standpoints. One of the undesirable attributes of the crop year was the early frost which seriously damaged several crops. Pinto beans were especially hard hit, with the extent of the loss varying from minimal to total loss. Attempts to utilize cull pinto beans as a portion of livestock feeds were hindered by a lack of information relative to the feeding value of cull pinto beans. The evaluation reported in this article represents an attempt to provide answers concerning the feeding value of cull pinto beans for non-ruminants.**

North Dakota farmers have been exceptional in their acceptance of "new" crops because of the obvious facet of diversification of income. The rate of diversification is highest when the non-traditional crop offers a rate of return equal to or greater than that obtained with the cereal grains. When a "climatic mishap" such as an early frost occurs and renders the crop unfit as a human food product, the first method of salvaging the harvest is through incorporation in animal feeds. Information is available concerning the use of many types of beans in animal feeds, but recent information concerning pinto beans is lacking.

The literature suggests that many of the beans may contain as many as five potentially detrimental materials of varying toxicities. Most of these materials can be eliminated by soaking and moist cooking; thus the rationale for our methods of cooking beans for table use. Our intention was to determine if cull pinto beans could be used in swine rations on an uncooked basis, if possible, and to determine the optimum level of incorporation of cull pinto beans into rations for growing-finishing swine.

Our initial evaluation of cull pinto beans was with small samples of materials that were unprocessed or had been heated to various temperatures in an infra-red "cooker".[1] The opinion of several individuals (all non-professional graders) was that the beans were essentially mature and might have graded between 90-95 per cent No. 1 beans. The obvious testing route was with growing rats.

A basal barley-soybean meal ration was formulated, and raw or heated pinto beans were incorporated at a level of 20 per cent of the ration. Pinto beans replaced barley and soybean meal in proportions to maintain a level of 16 per cent crude protein in the final ration. Performance was not apparently influenced by level of pinto beans in the ration or the temperature to which the beans had been heated. Digestibility data suggested that the energy content of the beans was slightly greater than that of barley and the digestibility of the crude protein at approximately 50-60 per cent was not improved by heating.

Subsequently, a considerable quantity of cull pinto beans was made available for evaluation.[2] Examination of this material indicated the presence of a considerable percentage of immature and frost damaged pinto beans. The sample of pinto beans was immediately utilized in an evaluation of the acceptability of this material as an ingredient in swine rations. Levels of pinto beans chosen for evaluation were 0, 10, 20 or 30 per cent of rations containing oats as the grain portion of the ration. A second swine experiment was conducted to determine the effects of heat treatments upon the utilization of cull pinto beans by swine.

The pinto beans replaced oats and soybean meal in proportions to maintain approximately equal levels of crude protein in the experimental rations. All rations were pelleted and contained added minerals and vitamins at uniform levels. The pigs utilized in this experiment had an average initial weight of approximately 50 pounds.

Samples of the basal ration (no pinto beans) and the ration containing 20 per cent cull pinto

[1]*The samples of unheated and heated pinto beans were generously provided by Dencel Simon, Mayville.*

[2]*Beans provided by the courtesy of Craig Hawker, Wickes Agriculture, Mayville.*

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**Table 1. Results of feeding cull pinto beans to swine — 42 days.**

| Item | Level of pinto beans in ration[1] | | | |
|---|---|---|---|---|
| | 0% | 10% | 20% | 30% |
| No. of pigs | 10 | 10 | 10 | 10 |
| Av. initial wt., lb. | 50.2 | 49.3 | 50.1 | 49.8 |
| Av. final wt., lb. | 112.4 | 83.8 | 58.2 | 50.7 |
| Av. daily gain, lb. | 1.48 | 0.82 | 0.19 | 0.02 |
| Av. feed consumed/day, lb. | 4.61 | 3.41 | 2.43 | 2.37 |
| Av. feed per lb. gain, lb. | 3.12 | 4.15 | 12.60 | 110.56 |

[1]*The basal ration was an oats-soybean meal mixture formulated to contain 15% crude protein. All rations were pelleted.*

beans were collected during the swine experiment for evaluation of energy and protein digestibility with rats. The two rations were finely ground and fed to six rats in a 21-day growth and digestibility trial.

A second swine experiment was conducted from the quantity of cull pinto beans that were used in the initial swine experiment. The purpose of the second experiment was to investigate the effects of potential "on the farm" processing methods for increasing the utilization of the cull pinto beans.

**Results and Discussion**

The initial evaluation using the laboratory rat and the small samples of fairly high-quality pinto beans has been partially discussed previously. All rats gained rapidly and efficiently and the cull pinto beans were found to contain a digestible energy level comparable to that of high-quality barley and moderately high levels of crude protein. Unfortunately, the digestibility of this protein was only 50 to 60 per cent, resulting in a digestible protein content of 11 to 13 per cent. As all rats performed well when fed the experimental diets, no effect of heat treatment was observed for either performance or digestibility data.

As noted previously, the material available in quantity and used in the swine experiments and the second rat experiment were markedly different from the initial, smaller samples. Incorporating the lower quality cull pinto beans had an immediate effect upon the weight gain and feed consumption of growing pigs; a very negative effect.

Weight gain during the initial 15-day period was essentially halved with each increasing 10 per cent incorporation of cull pinto beans. Thus, the gain of the pigs fed the ration containing 20 per cent pinto beans was approximately 25 per cent of the gain of the pigs fed the oats basal ration (no pinto beans). Feed consumption of the pigs offered pinto bean rations (10, 20 or 30 per cent) was approximately 70 per cent of the feed intakes of the lots receiving the basal ration.

Time did little to improve the conditions just described. This phase of the swine experiment was terminated after 42 days and the results are presented in Table 1. The lowest level at which pinto beans were used (10 per cent) produced a depression upon performance criteria (rate of gain and efficiency of feed utilization), but a more drastic effect was obtained by the incorporation of 20 per cent cull pinto beans into the experimental rations. While the feeding of 20 per cent cull pinto beans was highly detrimental to the performance of growing pigs, feeding 30 per cent pinto beans was an absolute disaster. Note that the 10 pigs given the 30 per cent ration **collectively** gained 9 pounds in 42 days.

If we observe recommended procedures for preparing food-grade pinto beans for consumption in the home, we would soak the beans overnight, drain the water and then cook well in fresh water and drain again before serving. This procedure is thought to effectively eliminate the "anti-metabolic" factors in the beans. However, the trypsin inhibitor in soybeans can be destroyed by dry heating and does not require moist heating, as do most beans used for food. With these thoughts in mind, a second swine experiment was conducted with cull pinto beans which had been subjected to moderate dry heat or moist heat plus dry heat. Cull pinto beans from the materials used in the first swine experiment were also used in the second experiment with growing pigs.

One large sample of cull pinto beans was placed in a drying oven and another was cooked for 3 hours in a "barley cooker" (familiar to most beef exhibitors), drained of excess water and then placed in the larger drying oven. These samples, termed the heated pinto beans, and the moist heated pinto beans, respectively, were incorporated at a level of 20 per cent into rations similar to those used in the first swine experiment.

Dry heat had no effect upon improving the feeding characteristics of pinto beans (see Table 2),

**Table 2. Effect of heat processing upon feeding qualities of cull pinto beans — 28 days.**

| Item | Treatment | % of Pinto beans | | |
|---|---|---|---|---|
| | | 0% | 20% Dry heat | 20% Moist heat |
| No. of pigs | | 10 | 9 | 10 |
| Av. initial wt., lb. | | 41.7 | 41.0 | 41.5 |
| Av. final wt., lb. | | 78.2 | 46.8 | 64.5 |
| Av. daily gain, lb. | | 1.30 | 0.21 | 0.82 |
| Av. feed consumed/day, lb. | | 3.83 | 2.19 | 3.61 |
| Av. feed per lb. gain, lb. | | 2.94 | 10.62 | 4.39 |

while moist heating produced a moderate improvement in performance. The second experiment was terminated on the 28th day as the effectiveness of the processing methods was readily apparent.

Only the basal ration (oats-soy) and the ration containing 20 per cent cull pinto beans (both rations were from the first swine experiment) were fed to rats in the second growth and digestion experiment. The growth rate of rats was not reduced as markedly by feeding 20 per cent cull pinto beans as the reduction noted in swine. Feed per unit gain was influenced similarly in both rats and swine. Digestible energy was reduced in the pinto bean ration and the digestibility of the total crude protein was reduced from 80 per cent in the oats-soy basal to 70 per cent in the ration containing 20 per cent cull pinto beans. Digestibilities of calcium, phosphorus and magnesium were not apparently altered by the presence of pinto beans in the ration. Digestibilities of fibrous components were highest in the pinto bean ration, primarily because of the lower levels of fiber in the ration containing 20 per cent cull pinto beans. The digestible energy content of the cull pinto beans, estimated by difference, was considerably lower than that of the oats used as the major ingredient in the ration.


**Summary**

Cull pinto beans were utilized in two experiments with growing swine and two growth and digestibility experiments with rats.

Cull pinto beans containing primarily immature and frost damaged beans were not acceptable at levels as low as 10 per cent of the total ration for growing pigs. These cull pinto beans were not improved by drying and were only moderately improved by moist "cooking" followed by drying. The use of 20 per cent cull pinto beans in swine rations reduced the digestible energy content of the ration for rats and the digestible energy content of the cull pinto beans (estimated by difference) was less than that of good quality oats.

A smaller quantity of cull pinto beans of higher quality was fed to rats. Some of these materials had been heated by infra-red irradiation to various temperatures. Samples of the higher quality materials were utilized equally by the rats. The value of these observations is doubtful because of the observation that rats may be somewhat less sensitive than growing swine to the "toxic" factors in cull pinto beans.

At this time, the incorporation of pinto beans into rations for growing pigs cannot be recommended to North Dakota swine producers.



**Buchanan . . .** from page 2


let ewes with Border Leicester rams, mated to a black face ram (Suffolk or Hampshire).

The Columbia ewe, however, continues as the typical and most popular ewe! Ever wonder why?

From 1880 to 1950, the saga of beef cattle development continued down a very narrow path. Selection of easier fattening, earlier maturing strains of the English and Scottish breeds continued to improve the commercial English and Texas Longhorn base of the western beef industry.

It became evident to practical cattlemen that selection for earliness of maturity had been accompanied by reduction of mature size and a correlated reduction in rate of gain. This realization occurred at the same time that performance testing techniques were developing. Semen salesmen appeared on the scene with semen of the so-called exotic breeds that could be advertised as larger than the American versions of the English breeds. It seems that our proximity to the Canadian supply made North Dakota a vulnerable market for the trials of the newer breeds. We tended to forget that the original Shorthorn, Angus and Hereford stocks were as large or larger than the breeds being introduced. Newness and a limited supply have always had an appeal that resulted in high price. The result!!—in the early 1970's it seemed to the casual observer that the old established breeds would be replaced. But 1976 sees the popularity of these established breeds at new highs. The breeders who have attempted to produce breeding animals of the modern kind are once again finding a market for their wares. The commercial herds once again have reverted to their conventional colors even though their type and scale have been altered.

Livestock types and popularity are not the only part of the agricultural scene subject to change. The conventional tractor is being replaced with the 4-wheel drive. The conventional tractor with bucket loader is being replaced with skid

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NORTH DAKOTA STATE UNIVERSITY
of Agriculture and Applied Science
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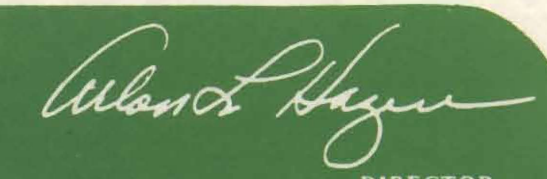
Fargo, North Dakota 58102
Publication



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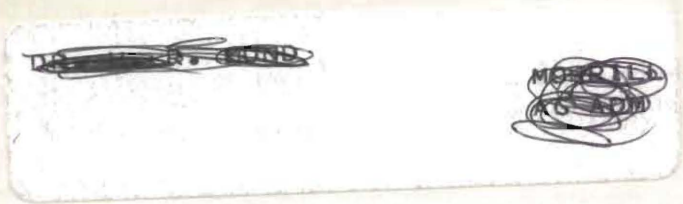

BULK THIRD-CLASS

loaders and both replaced with liquid manure systems including lagoons.

The North Dakota farmer continues to be proud of the productive capacity of his fields, but since the time of World War II he has developed great admiration for commercial fertilizers.

North Dakotans still view their state as a grain-producing state, with livestock contributing 30 to 40 per cent of the agricultural income. In all other states there is a close correlation between feed grain production and livestock finishing. The three states that bound us derive the bulk of their income from livestock and livestock products. I believe few agricultural regions have continued for much over 100 years as a one-crop producing area. Livestock production has increased in importance in the produce growing areas of Delaware, Maryland and New Jersey. So, too, have the production systems shifted in the cotton, tobacco and corn producing areas of the U.S. These shifts in many cases served only to aid in soil conservation, not in the complete elimination of the original crop.

North Dakota is rapidly approaching its centennial. Could some of these changes occur here? Could North Dakota increase its cow numbers by more efficient utilization of straws and chaff for winter feed of cow herds? Could North Dakota grasslands carry more cows through adoption of a sounder grass management program, including more judicious use of non-bloating legumes, deferred and/or rotational grazing and expanded use of natural and commercial fertilizers? Could young cattle be carried to heavier weights by expanded use of by-products of the grain industry, including damaged grains due to weather or machine damage, nonplump barley, screenings including cracked grain and weed seeds? Could the pounds of beef marketed be doubled without any reduction in acres or in dollar value of the state's wheat and barley crops?

Is the life style of the western rancher who hates to see the face of the land he loves destroyed by unreclaimed strip mining worth saving? Perhaps the values our young men develop in the varied agricultural pursuits caross this broad state contribute to their adaptability so sought by corporate recruiters for the nation's industries. Look again, also, at the proportion of these men who in later years yearn to return to the slower pace of the rural areas more closely associated with the soil. Could the appreciation of our way of life and the quality of life we know in North Dakota be strong enough to ensure that coming generations could grow up with a pony, a dog and elbow room?

The wheels of change turn slowly. Thank God. Will they slowly grind us or will they grind for us?