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Tankage, A Protein Supplement for Fattening Beef Calves

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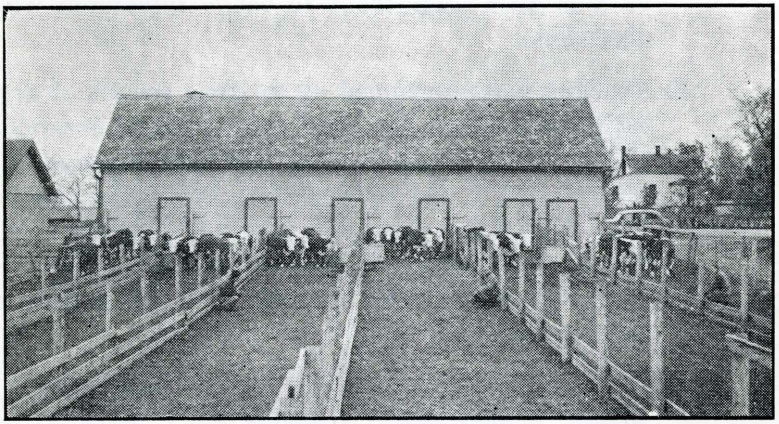

Calves in Feeding Yards—Third Year.
Feeding shed in background.

ANIMAL HUSBANDRY DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
South Dakota State College of Agriculture and Mechanic Arts
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Summary

1. The results of this experiment indicate that dry-rendered tankage, when used as a protein supplement for cattle, is not so palatable as linseed oil meal or cottonseed meal.

2. There is no evidence that dry-rendered tankage fed as a protein supplement to cattle interfered with digestion.

3. Yearling bulls consumed up to three pounds of dry-rendered tankage per head daily without becoming sick but after 33 days of feeding some tankage was refused and it was necessary to reduce the amount fed. Calves fed corn and wild hay consumed one pound of tankage per head daily while those fed corn and alfalfa hay ate only one-half pound of tankage per head daily.

4. Tankage and linseed oil meal mixed equal parts by weight proved more palatable than tankage fed alone.

5. Calves that were fed tankage, a protein supplement obtained from an animal source, in addition to corn and alfalfa hay did not make as rapid gains as those fed linseed oil meal and cottonseed meal, protein supplements obtained from plant sources. These calves, however, were well finished at the end of the feeding trials and were rated above those fed corn and alfalfa only.

6. The mixture of tankage and linseed oil meal, a protein supplement obtained from both animal and plant sources, did not prove superior in these feeding trials to either linseed oil meal or cottonseed meal fed as the only protein supplement though it did prove superior to tankage alone.

Tankage, A Protein Supplement For Fattening Beef Calves

By James W. Wilson and Turner Wright

Introduction

The results of feeding dry-rendered tankage, for three different years to cattle as a supplement to corn and hay, are included herein.

The market affords protein supplements of both animal and vegetable origin. Tankage in the different forms is a by-product of the slaughter-house where animals are processed for human consumption, while linseed oil meal, cottonseed meal and soybean oil meal are vegetable by-products obtained in the process of extracting the oil from these oil bearing seeds for commercial purposes.

It is frequently claimed that it is not necessary to feed these protein concentrates providing a roughage in the form of alfalfa or some other leguminous hay is available; therefore, a lot of calves each year was fed shelled corn and alfalfa hay without a protein supplement to note the results. This lot is referred to as the check lot.

Experimental feeding has shown that animals of all kinds, for the best results in fattening, should receive both protein and carbohydrates in the feed. If the ration most readily available does not contain these nutrients in sufficient quantity, they should be supplied.

Tankages made by two different processes are available for feeding. These are known as steam-rendered tankage and dry-rendered tankage. The steam-rendered tankage is made by applying steam direct to the offal. The tankage made by this process usually contains about 60 percent protein. The dry-rendered product is made by cooking in a steam jacketed vat. It contains a little less protein, is lighter in color, and has much less odor than the steam-rendered.

The vegetable protein concentrates fed in this experiment are not new on the market; neither is the feeding of them new but the feeding of tankage in beef production is a comparatively recent practice.

Several experiment stations in the Corn Belt, where the highly carbonaceous grains are grown, have been considering this phase of feeding recently.

Morrison in his new edition of the book on "Feeds and Feeding" makes the following statement: "Because fattening calves need more protein than older cattle there is more benefit from feeding them a protein supplement in addition to corn grain, corn or sorghum silage

and legume hays." He further states "that in eight experiments the addition of 1.5 pounds per head daily of linseed oil meal or cake to the ration of corn grain, corn silage and alfalfa hay increased the daily gain from 2.01 to 2.29 pounds and raised the selling price 42 cents per 100 pounds. In these experiments each 100 pounds of linseed oil meal were worth as much as 230 pounds of corn grain considering all factors. The average net return per head over feed costs was $2.60 more for supplement fed calves, being greater than those fed no supplement in all except one of the tests."

Purpose

The purpose of this series of experiments was to learn first, whether tankage was palatable to cattle? Second, would its feeding interfere materially with digestion? Third, how much could an animal eat without becoming sick? Fourth, could tankage be substituted for linseed oil meal? Fifth, would calves fatten as readily and be in as good condition as those fed the vegetable protein concentrates?

Other Experimental Results*

At the Indiana Station tankage was substituted for cottonseed meal in a feed combination of shelled corn, cottonseed meal, clover hay, and corn silage for fattening steers. The steers showed a marked aversion to the tankage on the first feed but after a few feeds ate it with relish. The results obtained did not indicate any superiority of meat meal tankage over cottonseed meal as a supplemental feed for fattening steers except a slight advantage in finish.

It was found at the Minnesota Station in two experiments that dry-rendered tankage was a suitable substitute for linseed meal for growing and fattening young heifers; also that there was no advantage in feeding both tankage and linseed meal as either fed alone proved as suitable as a mixture of the two. The cattle in these experiments after the first week of becoming accustomed to the tankage ate it readily.

The addition of tankage to a mixture of linseed meal and cottonseed meal fed with shelled corn, corn silage, and mixed hay to fattening calves at the Ohio Station increased the rate of gain and reduced the feed requirement for 100 pounds of gain. It was concluded from these results that a mixture of animal and vegetable proteins was superior to a mixture of vegetable proteins alone. In this experiment no difficulty was experienced in getting the calves to eat the supplement containing the tankage.

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* Indiana Bul. 428: Minn. Sta. mimeo. rpt. B-31: Ohio Bimo. Bul. 159; Olson, Totman, and Wallis, Journal of Dairy Science, May, 1936.

The Dairy Department of the South Dakota State College fed tankage to dairy cows in 1934-35. Considerable difficulty was experienced in getting the cows to eat the tankage. Some cows consistently refused to eat it. Only four cows in the entire herd would eat it in any considerable amount. It is interesting to note that in these tests the tankage did not flavor the milk in any way.

The Preliminary Experiment

During the summer of 1934, a dry year when feeds of all kinds were comparatively scarce and unusually high in price, inquiries were received as to the value of tankage as a protein supplement for fattening cattle.

On September 8, eight yearling bulls were divided into two lots of four head each. Each lot was fed an equal quantity of ground corn and Sudan grass hay. One lot received one-fourth of a pound of linseed oil meal and the other lot one-fourth of a pound of dry-rendered tankage per head daily. These supplements were increased gradually.

After feeding for 55 days one bull in the lot that received tankage died. At this time these bulls were eating 3 pounds of tankage per head daily, the same as bulls in other lot were eating linseed oil meal. The post-mortem examination by the college veterinarian of the bull that died showed positive evidence of hemorrhagic septicemia but no evidence of digestive trouble due to feeding tankage. The other three bulls were continued on the tankage ration. After 33 days of feeding the bulls began to leave some tankage and the amount fed was reduced to 2 pounds per head daily.

During the feeding period, the four bulls that received the linseed oil meal made an average gain per head of 313 pounds while the three bulls that received tankage made an average gain per head of 276 pounds.

The Experiment

The experiment covered periods of three different years beginning April 4, 1935 and ending October 15, 1938. The beginning date for the first year was April 4 and continued for 240 days. The second year the beginning was on April 1, 1936, and continued for 240 days. The third year the beginning was on January 18, 1938, and was continued for 270 days. The periods of this experiment included the heat of the summer and cold of the winter and the early spring and fall. Fat cattle in the dry-lot do not make as large gains during hot weather and fly time as they do during early spring and late summer. For example, the check lot or the one that received shelled corn and alfalfa hay, based on catch weights, made nearly twice the gain during a 30-day period in the fall as they did

during hot weather, notwithstanding the fact that the shed was darkened and kept well bedded.

The 85 calves used during the three different years were grade Herefords purchased in Hand county, South Dakota. Each year they were selected to insure uniformity as to conformation, age, size and weight. On arrival at the station they were taught to eat grain before being weighed up on three successive days for the experiment. However, for the first trial the calves were used in a Russian Thistle experiment before being put in the tankage experiment. They were relotted when started on tankage experiment so that each new lot included one calf from each of the five lots in the thistle experiment.

They were fed as follows:

Lot I—Shelled corn and alfalfa hay

Lot II—Shelled corn alfalfa hay and linseed oil meal

Lot III—Shelled corn, alfalfa hay and cottonseed meal

Lot IV—Shelled corn, alfalfa hay and dry-rendered tankage

Lot V—Shelled corn, alfalfa hay and a mixture of linseed oil meal and tankage, half and half by weight

Lot VI—Shelled corn, wild hay and tankage.

Feeds

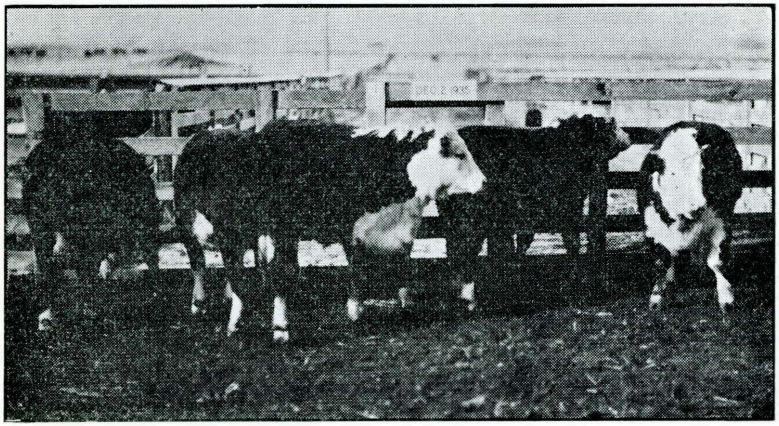
The feeds used were all purchased in the local market. They were weighed out both morning and evening and each lot given what it would clean up. In each case the protein supplement was mixed with the shelled corn. Pigs were put in yards to clean up the waste.

The following is the average of the analyses of the feeds fed for the first and second years of the experiment as furnished by the Station Chemist, Mr. Alvin L. Moxon:

Average of Analyses of Feeds

	Moisture	Ash	Protein	Fat	Crude Fiber	Nitrogen Free-Extract
Shelled corn	7.77	1.33	9.66	3.43	1.49	76.30
Alfalfa hay	5.23	6.15	13.03	1.64	32.91	41.03
Wild hay	3.19	6.06	7.19	2.02	32.79	48.75
Dry-rendered tankage	4.62	18.18	58.47	8.88	2.62	7.22
Linseed oil meal	11.04	5.92	37.14	5.69	6.91	33.28
Cottonseed meal	5.45	6.68	39.72	6.84	9.63	31.65

These analyses except for being somewhat lower in moisture in most cases and consequently higher in total dry matter are comparable with the averages of a large number of analyses for the same feeds given in "Feeds and Feeding" by Morrison.



Calves at end of first year
Shelled corn and alfalfa hay

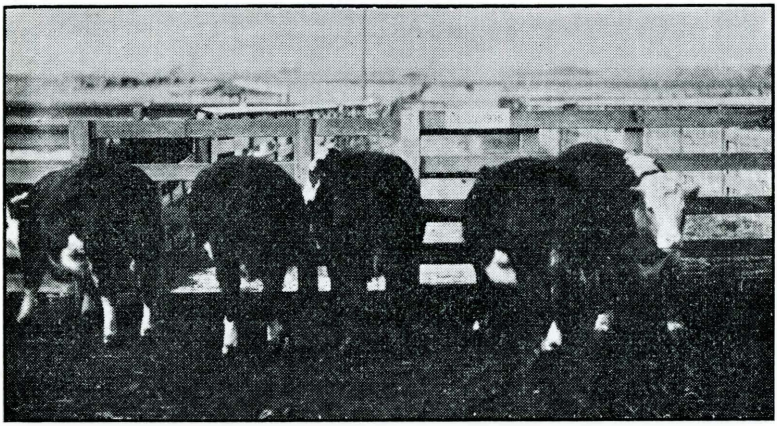
LOT I.

	First Year	Second Year	Third Year
Number of days fed	240	240	270
Av. weight at beginning	465	513	448
Av. weight at end	1029	1090	971
Av. gain per head	563	578	527
Av. gain per head daily	2.35	2.40	1.95
Shelled corn for 100 pounds of gain	672.96	583.00	644.67
Alfalfa hay for 100 pounds of gain	280.31	249.23	300.53

The average consumption of feed for 100 pounds of gain for the three years was 632.87 pounds of corn and 275.92 pounds of alfalfa hay. This was the highest average requirement of feed for 100 pounds of gain for any of the lots.

These calves made comparatively large gains. The gains evidently were made in the form of growth instead of fat, because not in a single instance did any of the appraisers, either year, rank this lot of calves the best. This coincides with the results of a former experiment reported in Bulletin 293 of this station when this ration was fed to the check lot.

Only 4 of the 15 calves, when valued (See Table I, page 12), were well enough finished to bring the top price.



Calves at end of first year
Shelled corn, alfalfa hay and linseed oil meal

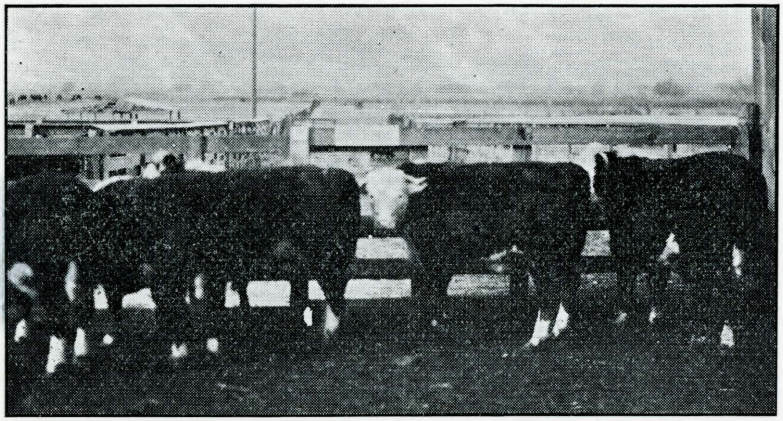
LOT II.

	First Year	Second Year	Third Year
Number of days fed	240	240	270
Av. weight at beginning	468	514	450
Av. weight at end	1049	1094	1067
Av. gain per head	581	581	617
Av. gain per head daily	2.42	2.42	2.28
Shelled corn for 100 pounds of gain	618.37	583.56	577.55
Alfalfa hay for 100 pounds of gain	236.64	223.89	256.61
Linseed oil meal for 100 pounds of gain	40.08	40.93	45.06

The average consumption of feed for the three years for 100 pounds of gain was 592.85 pounds of shelled corn, 239.40 pounds of alfalfa hay and 42.08 pounds of linseed oil meal.

There was something about the calves in this lot each year that attracted attention. Perhaps their comparative blocky appearance and their finish appealed to the appraisers as the average selling price was 19 cents more per hundred than for the check lot.

Only 6 calves, when finished, out of the 15 head were rated by the appraiser as being among the highest priced for the year.



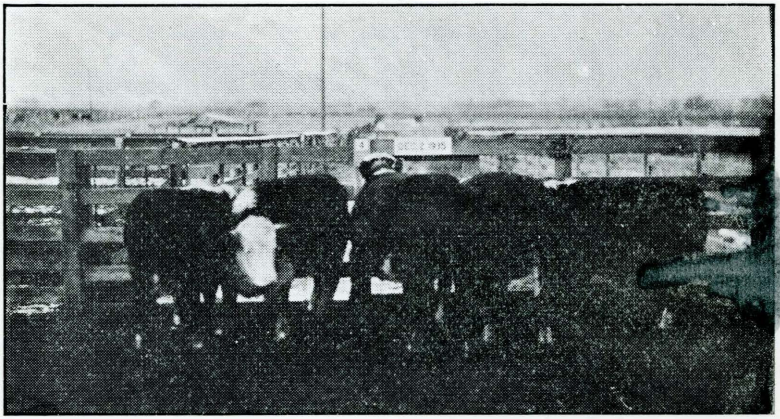
Calves at end of first year
Shelled corn, alfalfa hay and cottonseed meal

LOT III.

	First Year	Second Year	Third Year
Number of days fed	240	240	270
Av. weight at beginning	471	517	439
Av. weight at close	1066	1106	1050
Av. gain per head	595	589	611
Av. gain per head daily	2.48	2.45	2.26
Shelled corn for 100 pounds of gain	626.20	585.58	585.42
Alfalfa hay for 100 pounds of gain	228.08	271.90	229.09
Cottonseed meal for 100 pounds of gain	38.66	40.25	45.86

The average consumption of feed for the three years for 100 pounds of gain was 598.99 pounds of shelled corn, 253.02 pounds of alfalfa hay and 41.63 pounds of cottonseed meal.

As a rule cottonseed meal is cheaper in the market than linseed oil meal and more of it should be fed in the production of baby beef. The 15 calves fed on cottonseed meal with their shelled corn and alfalfa hay were the only ones to bring the top of the market each year without any cutting in price. This in itself is evidence that cottonseed meal caused a superior finish and a greater uniformity not found in the other lots.



Calves at end of first year
Shelled corn, alfalfa hay and dry-rendered tankage

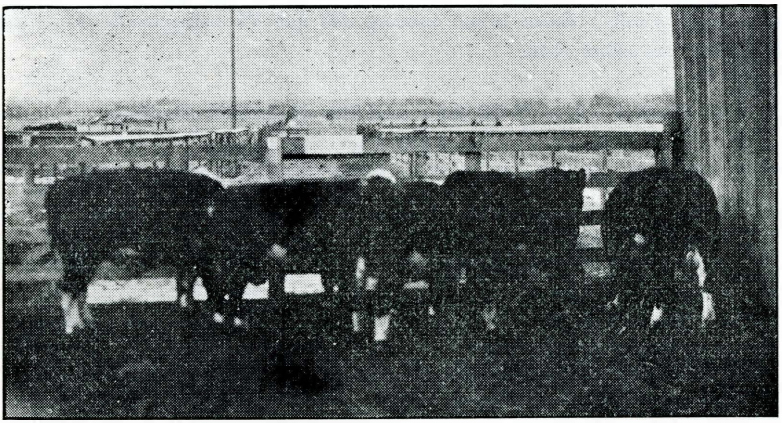
LOT IV.

	First Year	Second Year	Third Year
Number of days fed	240	240	270
Av. weight at beginning	463	513	448
Av. weight at end	1054	1068	964
Av. gain per head	591	555	516
Av. gain per head daily	2.46	2.31	1.08
Shelled corn for 100 pounds of gain	645.66	576.10	648.13
Alfalfa hay for 100 pounds of gain	224.71	306.21	304.33
Dry-rendered tankage for 100 lbs. of gain	20.15	21.66	24.92

The average consumption of feed, for the three years, for 100 pounds of grain was 623.20 pounds of shelled corn, 276.80 pounds of alfalfa hay and 22.13 pounds of dry-rendered tankage.

Some difficulty was experienced each year to get the calves to eat the dry-rendered tankage. While they ate it fairly well after becoming accustomed to it they often would try to eat the corn and leave the tankage. There was no time during the three trials when the calves fed tankage ate the protein supplement with the same degree of relish as the calves fed linseed meal and cottonseed meal. When finished these calves brought 27 cents per hundred less than those of Lot III that received the cottonseed meal. Only 5 of the 15 head, during the three years, brought the top price.

Because of the high protein content of the dry-rendered tankage it was not necessary to feed as much of the supplement as to calves in Lots II and III.



Calves at end of first year

Shelled corn, alfalfa hay and mixture dry-rendered tankage and linseed oil meal, half and half by weight

LOT V.

	First Year	Second Year	Third Year
Number of days fed	240	240	270
Av. weight at beginning	468	517	442
Av. weight at end	1055	1099	1039
Av. gain per head	587	582	597
Av. gain per head daily	2.44	2.42	2.20
Shelled corn for 100 pounds gain	679.75	619.00	599.89
Alfalfa hay for 100 pounds of gain	160.36	265.67	268.63
Pounds of protein mixture for 100 lbs. of gain	30.20	30.73	33.40

The average consumption of feed for the three years for 100 pounds of gain was 632.74 pounds of shelled corn, 231.66 pounds of alfalfa hay and 31.46 pounds of the mixture of half linseed oil meal and half dry-rendered tankage.

These results indicate an advantage in feeding the mixture. Fourteen of the 15 calves, during the three years, were valued at the highest price. Because of this fact it is evident that this mixture furnished a more suitable protein supplement than either the tankage or the linseed oil meal.

Lot pictures of the calves were not taken at the end of the second year, consequently there is no picture for lot VI comparable to those shown for the other lots.

Shelled Corn, Wild Hay and Dry-Rendered Tankage
LOT VI.

	Second Year	Third Year
Number of days fed	240	270
Av. weight at the beginning	515	437
Av. weight at end	971	970
Av. gain per head	456	533
Av. gain per head daily	1.89	1.97
Shelled corn for 100 pounds of gain	641.43	601.33
Wild hay for 100 pounds of gain	325.39	290.53
Dry-rendered tankage for 100 pounds of gain	31.84	46.81

The average consumption of feed for the two years was 619.79 pounds shelled corn, 306.57 pounds of wild hay and 39.92 pounds of dry-rendered tankage.

More tankage was required for 100 pounds of gain in Lot IV that received the alfalfa hay and tankage. A pound per head daily was the usual feed but at the end of the experiment the amount was even less than this. We believe that had the supplement been either linseed oil meal or cottonseed meal it would have been eaten more readily. These calves were rated the lowest in price each of the years.

TABLE 1. Prices of Cattle at End of Experiment Each Year

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI
First Year	4 @ $11.50	4 @ $11.50	5 @ $11.50	5 @ $11.50	4 @ $11.50	
	1 @ 11.00	1 @ 10.75			1 @ 11.00	
Second Year	2 @ 10.75	4 @ 11.25	5 @ 11.50	4 @ 11.25	5 @ 11.50	4 @ 11.00
	3 @ 11.25	1 @ 11.75		1 @ 10.50		1 @ 10.00
Third Year	3 @ 11.25	4 @ 11.25	5 @ 11.50	4 @ 11.25	5 @ 11.50	4 @ 11.00
	2 @ 10.75	1 @ 11.75		1 @ 10.50		1 @ 8.50
Average	$11.15	$11.35	$11.50	$11.25	$11.45	$10.65

Calves that received cottonseed meal with their shelled corn and alfalfa hay (Lot III) were rated the best of the lots and sold straight each year. Calves that received the half ration of dry-rendered tankage and half linseed oil meal (Lot V) were rated second, 14 of the 15 head bringing the top of the market or the same as was paid for the calves that received the cottonseed meal.

TABLE II. Dressing Percent

	LOT I	LOT II	LOT III	LOT IV	LOT V	LOT VI
First Year	63.0	63.0	63.0	65.0	63.0	
Second Year	60.3	60.8	61.1	60.9	61.3	58.7
Third Year	62.4	62.2	62.0	62.4	62.6	61.0

There was no evidence of any of the steers being overdone before slaughter. The carcasses were examined in the cooler and they were found to be firm. It was noticeable that carcasses of Lot III fed the cottonseed meal had a slight yellow tinge. This would not be objectionable to the trade.

TABLE III. Summary of the Three Trials, A Total of 15 Calves for Each Lot, Fed an Average of 250 Days.

	Shelled Corn, Alfalfa Hay	Shelled Corn, Linseed Meal, Alfalfa Hay	Shelled Corn, Cottonseed Meal, Alfalfa Hay	Shelled Corn, Tankage, Alfalfa Hay	Shelled Corn, Tankage, Linseed Meal, Alfalfa Hay
	LOT I	LOT II	LOT III	LOT IV	LOT V
Av. initial weight per calf	475.5	477.5	475.7	475.1	476.2
Av. final weight per calf	1031.8	1070.5	1074.3	1028.7	1064.6
Total gain per calf	556.3	593.0	598.4	553.6	588.4
Av. daily gain per calf	2.23	2.37	2.39	2.21	2.35
Feed consumed for 100 lbs. gain:					
Shelled corn	632.87	592.85	598.99	623.2	632.74
Linseed oil meal		42.08			15.73
Cottonseed meal			41.63		
Tankage				22.13	15.73
Alfalfa hay	275.92	239.40	253.02	276.8	231.66
Av. cost of feed for 100 pounds of gain	$7.70	$8.17	$8.07	$8.17	$8.27
Initial cost per cwt.	$8.70	$8.70	$8.70	$8.70	$8.70
Selling value	$11.15	$11.35	$11.50	$11.25	$11.45
Margin per head above initial cost plus cost of feed	$30.84	$31.51	$33.86	$29.17	$31.81

In determining the cost of feed shelled corn was valued at 56 cents per bushel, alfalfa hay at $10 per ton, linseed oil meal at $50 per ton, cottonseed meal at $40 per ton, dry-rendered tankage at $50 per ton, and wild hay at $6 per ton.

The results presented in the summary show that there was practically no difference in the rate of gain for the calves in Lot I fed corn and al-

falfa and for those in Lot IV fed corn and alfalfa supplemented with tankage. The addition of tankage to the ration resulted in a slight saving in the amount of corn required to produce 100 pounds of gain and increased the value of the calves slightly but these advantages were more than offset by the increased cost of the ration.

The addition of the protein supplements obtained from plant sources, linseed oil meal and cottonseed meal to a corn and alfalfa ration, increased the rate of gain and produced higher finished cattle with a higher final value. The use of these supplements reduced the amount of corn required to produce 100 pounds of gain but increased the cost of the ration. When the increase in value of the original weight of the calves is considered, however, there was a slight advantage in favor of the use of these supplements.

Replacing part of the linseed oil meal in the ration with tankage as shown by the results of Lots II and V did not result in any material gain. There was an increase in the final value of the calves but this was practically offset by a similar increase in the cost of 100 pounds of gain.

Tankage and linseed oil meal mixed equal parts by weight gave better results as a supplement to corn and alfalfa than tankage alone. This is indicated by the results obtained from Lots IV and V. The calves getting the mixed supplement ate more corn and more of the supplement but less alfalfa hay for 100 pounds of gain than those fed tankage alone. This resulted in faster gains and a higher final value each year. The more favorable showing for the linseed meal and tankage mixture probably was due to the increase in palatability as compared with the tankage alone. The calves fed the mixture consistently ate it with more relish than was shown by the calves fed tankage.

TABLE IV. Gains on Hogs Following Calves

	Shelled Corn, Alfalfa	Shelled Corn, Alfalfa Hay, Linseed Meal	Shelled Corn, Alfalfa Hay, Cottonseed Meal	Shelled Corn, Tankage, Alfalfa Hay	Shelled Corn, Alfalfa, Hay, Linseed Meal, Tankage	Shelled Corn, Wild Hay, Tankage
	LOT I	LOT II	LOT III	LOT IV	LOT V	LOT VI
First Year	162	200	196	196	165	
Second Year	187	175	167	138	124	99
Third Year	197	174	192	205	325	133
Average	182	183	185	179	204	116

Enough pigs were put in each lot to pick up the waste. Their difference in gains are not of importance as far as the feed fed the calves is concerned. One would naturally expect larger gains in lots that received tankage than in other lots.

TABLE V. Comparison of Alfalfa and Wild Hay When Supplemented With Tankage for Fattening Calves; Summary of Two Trials, 10 Calves for Each Lot, Fed an Average of 255 Days.

	Shelled Corn, Tankage, Alfalfa Hay	Shelled Corn, Tankage, Wild Hay
	LOT IV	LOT VI
Av. initial weight per calf	481.0	476.2
Av. final weight per calf	1016.0	970.6
Total gain per calf	535.0	494.4
Av. daily gain per calf	2.10	1.94
Feed consumed for 100 lbs. gain:		
Shelled corn	610.81	619.79
Tankage	23.22	39.92
Alfalfa hay	305.56	
Wild hay		306.57
Initial cost per 100 pounds	$9.85	$9.85
Cost per 100 pounds gain	$8.21	$8.11
Selling value	$11.10	$10.65
Margin per head over initial cost plus cost of feed	$21.48	$16.36

This comparison shows but little difference in the cost of feed for 100 pounds of gain for the two lots. The calves fed the wild hay consumed slightly more corn and considerably more tankage for 100 pounds of gain but this was more than offset by the lower value of the hay. The main difference was a faster rate of gain and a much higher selling value for the calves fed the alfalfa hay. In considering these results the fact that tankage is not a very palatable supplement for cattle should be kept in mind.