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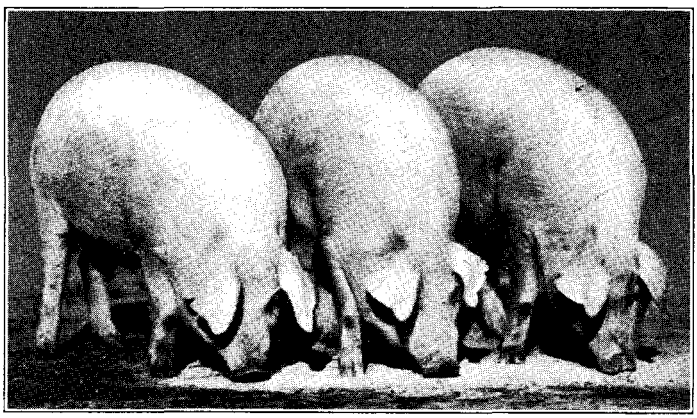
A COMPARISON OF WHEAT BY-PRODUCTS FOR GROWING PIGS

E. F. FERRIN AND M. A. McCARTY
DIVISION OF ANIMAL HUSBANDRY



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A COMPARISON OF WHEAT BY-PRODUCTS FOR GROWING PIGS

E. F. FERRIN and M. A. MCCARTY[1]

Minnesota is the leading state in the wheat milling industry. As a consequence a large volume of wheat by-products is produced, one of the principal uses of which is as feed for hogs. Standard middlings (wheat shorts) flour middlings, and red dog flour are the grades commonly fed to pigs. From the standpoint of the feeder there are no very definite guides for intelligently selecting one of these feeds in preference to others or for calculating accurately whether or not it will pay to buy any one of them.

Objects and Plan of Experiment

From July to November, 1923, and again in 1924, four lots of growing pigs were fed in order to study the comparative feeding values of these three wheat by-products and to determine if it is profitable to add any one to an otherwise desirable ration. It is logical to assume that if they are desirable and profitable when added to a ration already known to be suitable, they will be of greater value when added to other less complete rations. One of the most severe tests which could be given them was to add one of the mill feeds to a ration of corn and tankage fed to pigs on alfalfa pasture. When pigs are fed in dry lot there is a greater need for wheat by-products than when green crops are available. Accordingly, alfalfa pasture at the rate of one-third to one-half an acre was provided for each group of ten pigs.

Quality of Wheat By-Products Used

Standard middlings, flour middlings, and red dog flour each vary considerably in analysis, depending upon the wheat from which they are milled, the process of milling, and the inclusion or exclusion of ground screenings with the middlings. As the addition of ground screenings is one of the largest factors causing variation in the analysis of middlings, it was decided to use feeds not containing screenings. To designate such a product the word "pure" is employed in the milling trade.

The State Dairy and Food Commission assisted materially in the preliminary work by providing average analyses of pure standard middlings, pure flour middlings, and red dog flour representative of the average milling in the state. After this information was had it was

[1] The feeding was supervised by O. A. Morris, herdsman.

necessary to get enough of each of the three grades of feed showing approximately the determined analysis, to conduct the trials. This was possible through the courtesy of C. H. Bailey, superintendent of the state experimental mill.

The average analysis of representative feeds as produced in the state was reported by H. J. Hennessy, chief feed inspector, as follows:

	Moisture	Protein	Fat	Fiber	Ash	Nitrogen-free extract
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Pure standard middlings	9.7	16.9	5.6	6.7	4.26	57.08
Pure flour middlings	10.6	17.3	4.9	4.3	3.42	59.40
Red dog flour	11.2	17.2	4.0	2.6	2.72	62.30

Plan of Feeding

Corn and tankage were used as the basal ration. In order that the addition of any one of the mill feeds to the combination of corn and tankage would not form a radically different ration, the nutritive ratios were kept nearly similar in all lots. The pigs were fed twice daily by giving the shelled corn dry in troughs and feeding the tankage or tankage and mill feed as slop.

Ration I. Yellow shelled corn, tankage, alfalfa pasture.

Ration II. Yellow shelled corn, standard middlings, tankage, alfalfa pasture.

Ration III. Yellow shelled corn, flour middlings, tankage, alfalfa pasture.

Ration IV. Yellow shelled corn, red dog flour, tankage, alfalfa pasture.

From the time the pigs were started on feed until an average weight of 100 pounds each was reached, Lot I received 90 per cent corn and 10 per cent tankage. From the weight of 100 pounds until the close of the feeding period, 95 per cent corn and 5 per cent tankage were fed. Lots II, III, and IV at the beginning of the trial received 65 per cent corn, 30 per cent wheat by-product, and 5 per cent tankage. After reaching 100 pounds average weight per pig, they were fed 75 per cent corn, 23 per cent mill feed, and 2 per cent tankage.

A mineral mixture consisting of 40 per cent bonemeal, 40 per cent air-slaked lime, and 20 per cent salt was provided for each lot of pigs. Water was kept before the pigs in each lot in an automatic fountain.

The summer of 1923 was very dry and as a result the alfalfa became hard and woody. There was a lack of fresh green feed for the pigs, but there was always some grazing to be had. The pigs did not graze as much in August as in July or September.

The 1923 Results

The pigs used in this trial were farrowed between the middle of March and the middle of April, 1923, and were raised in the University herd. Seven Duroc-Jersey and 3 Poland China pigs constituted each lot. They were in thrifty growing condition and made good gains throughout the trial. As each lot reached an average weight per pig of 200 pounds, it was weighed out of the experiment.

TABLE I

COMPARISON OF WHEAT BY-PRODUCTS JULY 10 TO NOVEMBER 5, 1923

	Lot I	Lot II	Lot III	Lot IV
	Shelled corn tankage ..... minerals alfalfa pasture	Shelled corn tankage standard middlings minerals alfalfa pasture	Shelled corn tankage flour middlings minerals alfalfa pasture	Shelled corn tankage red dog flour minerals alfalfa pasture
Days on feed	118	115	111	116
Average initial weight, lbs.	66.00	66.00	66.80	66.96
Average final weight, lbs.	200.00	200.00	200.30	199.96
Average daily gain, lbs.	1.12	1.15	1.20	1.12
Feed for 100 lbs. gain, lbs.				
Yellow shelled corn (14 per cent moisture)	372.00	300.16	285.76	301.60
Tankage	25.24	16.05	15.38	16.46
Standard middlings		84.86		
Flour middlings			81.18	
Red dog flour				87.03
Total feed for 100 lbs. gain, lbs...	397.24	401.07	382.32	405.09
Feed cost of 100 lbs. gain*				
Ten-year pre-war prices	$4.74	$4.53	$4.44	$4.78
Minneapolis quotations during time of trial.....	$6.47	$6.22	$6.06	$6.56

* Not including pasture and minerals.

	Average Minneapolis feed prices during the ten-year pre-war period, July to October inclusive	Average Minneapolis quotations July to October inclusive, 1923
Shelled corn No. 2 yellow.....	$ 0.60	$ 0.86 per bushel
Tankage	60.00	60.00 per ton
Standard middlings	19.25	26.50 per ton
Flour middlings	22.00	29.75 per ton
Red dog flour	24.25	33.00 per ton

The costs of gains have been calculated on two schedules of prices. The average prices from July to October during the ten-year pre-war period have been used as one series, because of the general opinion that these years measured normal conditions more accurately than any period since 1913. Prices for the summer months of 1923 are also used to give a more recent standard for feed costs.

Using either set of figures, the differences in costs of gain are so small that too much emphasis can not be placed upon them. Fifty cents

covers the range from lowest to highest total in either tabulation. The fair conclusion to draw in this instance is that either grade of middlings reduced the cost of gains slightly as compared with rations of corn and tankage or corn, tankage, and red dog flour.

It is apparent that when a mill feed costing less per pound than corn is added to the corn-tankage combination, the costs of gains are reduced. This applies to both standard middlings and flour middlings. When the mill feed is more expensive than corn, as with red dog flour, gains may not be secured at a cheaper cost. The mill feed is a partial substitute for corn and to a greater extent economically replaces high-priced tankage.

Averaging feed consumption for 100 pounds gain in the three lots receiving mill feeds and comparing these averages with the figures for Lot I, it develops that 84 pounds of wheat by-product replaced 76 pounds of corn and 8.25 pounds of tankage. While the cost of 84 pounds of mill feeds at 1923 prices was $1.25, the combined cost of the corn and tankage was $1.41. Here is a small saving in favor of adding a mill feed to the corn and tankage ration fed with alfalfa pasture.

The addition of a mill feed to a corn, tankage, and alfalfa pasture ration was desirable not alone from the standpoint of a slight saving in cost of gains, but also in improved appearance of the pigs. This was noticeable chiefly in the smoother coats of hair shown by pigs receiving a mill feed as contrasted with those receiving none. This is a small item overlooked by the average observer but is nevertheless an indication of more satisfactory rations than the ration received by Lot I.

Daily gains in each of the four lots were satisfactory, and there is no great difference when all lots are considered. But the margin of one week's time in favor of Lot III as compared to Lot I at the conclusion of the trial amounts to an appreciable item when many pigs are fed.

Exact duplication of results when animals are lot fed is highly improbable even under the most carefully supervised conditions, hence it is unjustifiable to draw positive conclusions when differences are small. This was one of the reasons for duplicating the trial with the same rations in 1924.

Results in 1924

On the same date, July 10, four lots of pigs farrowed and raised as had been those used the preceding year, were started under conditions similar to the feeding program of 1923. Special lots of standard middlings, flour middlings, and red dog flour were again obtained from the state experimental mill. The pigs were 11 pounds heavier in weight at the beginning of the trial in 1924, than were those fed in 1923, on

the same date, because they averaged two weeks older. It was not possible to start these pigs on feed earlier in the season because it was necessary to wait until the alfalfa had made a good growth following the harvesting of a cutting of hay. In both years one crop of hay was cut late in June from the experimental lots.

The feeds were apportioned exactly as they were in 1923. The amounts given daily varied somewhat from the amounts fed the previous year on account of the heavier weight of the pigs. The alfalfa pasture was better in 1924 than in 1923 because of more frequent rains. The pigs did not graze as much as during the preceding summer, probably because their appetites were more quickly satisfied. Details of housing, feeding, watering, and supplying a mineral mixture were taken care of as in 1923.

TABLE II

COMPARISON OF WHEAT BY-PRODUCTS JULY 10 TO NOVEMBER 3, 1924

	Lot V	Lot VI	Lot VIII	Lot VIII
	Shelled corn tankage ..... minerals alfalfa pasture	Shelled corn tankage standard middlings minerals alfalfa pasture	Shelled corn tankage flour middlings minerals alfalfa pasture	Shelled corn tankage red dog flour minerals alfalfa pasture
Days on feed	116	115	116	110
Average initial weight, lbs.	77.86	77.83	77.06	77.76
Average final weight, lbs.	199.60	201.53	207.16	200.10
Average daily gain, lbs.	1.05	1.07	1.12	1.11
Feed for 100 lbs. gain, lbs.				
Yellow shelled corn (14 per cent moisture)	350.43	289.39	281.75	271.20
Tankage	25.94	16.88	16.39	16.25
Standard middlings		87.51		
Flour middlings			85.05	
Red dog flour				84.03
Total feed for 100 lbs. gain, lbs...	376.37	393.78	383.19	371.48
Feed cost of 100 lbs. gain*				
Ten-year pre-war prices	$4.53	$4.47	$4.48	$4.41
Minneapolis quotations during time of trial.....	$7.35	$7.08	$7.10	$7.10

* Not including pasture and minerals.

	Average Minneapolis feed prices during the ten-year pre-war period, July to October inclusive	Average Minneapolis quotations July to October inclusive, 1924
Shelled corn No. 2 yellow.....	$ 0.60	$ 1.05 per bushel
Tankage	60.00	60.00 per ton
Standard middlings	19.25	26.00 per ton
Flour middlings	22.00	31.25 per ton
Red dog flour	24.25	36.50 per ton

Even less difference in the cost of gains on the four different rations was found than in 1923. Twenty-seven cents covers the range from lowest to highest cost of 100 pounds gain. It is noticeable, however, that in 1924 corn was higher in price per pound than any one of the

mill feeds and in consequence Lots VI, VII, and VIII all show cheaper costs of gain than Lot V.

The replacement of corn and tankage by mill feeds during the second year was 85.5 pounds of mill feed for 70 pounds of corn and 9.5 pounds of tankage. The cost of 85.5 pounds of mill feeds at 1924 prices was $1.33; the combined cost of the corn and tankage was $1.60. There was in 1924 as in 1923 a small saving by adding a mill feed to a corn and tankage ration.

Observations of the lots of pigs during the progress of the experiment resulted in Lot V always being ranked last. During much of the time Lot VIII ranked first, but on one occasion Lot VII was at the top. This ranking was based merely upon the appearance of the pigs and consisted in this experiment chiefly in differences in smoothness of hair, as all lots were thrifty and gaining at a reasonable rate.

Daily gains in 1924 averaged less than in 1923, altho there is not much difference. In the time required to reach a weight of 200 pounds per pig, Lot VIII had a margin of six days over Lot V. Had Lot VII been weighed out at approximately 200 pounds, the length of time on feed for this lot probably would have been 110 days. Daily appetites of pigs vary enough sometimes to change the weights several pounds.

On the whole the figures check closely in all items for both years. In each year the pigs fed corn and tankage gained more slowly than other lots. Results are a little more favorable for pigs fed red dog flour the second year than the first, both in rate of gain and amount of feed to produce 100 pounds gain, but the differences are small.

Average of the Two Trials

As no considerable variations occur to make averages inaccurate, it is possible to report the combined results in one table as the findings of the two years.

From the average of the two years' work little difference in cost of gains is found among the four rations. The rations including either standard middlings or flour middlings have a slight advantage over the corn and tankage, and the corn, tankage, and red dog flour combinations. It is apparent that if each of the mill feeds can be bought at a price per pound not higher than corn it is profitable to substitute one of them for about 25 per cent of the corn and 40 per cent of the tankage. This applies only for rations as fed in this experiment to growing pigs on alfalfa pasture. Basing the choice of the three mill feeds on both rate of gain and amount of feed to produce 100 pounds gain, it will fall on flour middlings. When the cost of gains is considered, flour middlings have a slight preference assuming normal differences in prices of standard middlings, flour middlings, and red dog flour.

TABLE III

COMPARISON OF WHEAT BY-PRODUCTS, 1923 AND 1924
Average of Tables I and II

	Lots I and V	Lots II and VI	Lots III and VII	Lots IV and VIII
	Shelled corn tankage ..... minerals alfalfa pasture	Shelled corn tankage standard middlings minerals alfalfa pasture	Shelled corn tankage flour middlings minerals alfalfa pasture	Shelled corn tankage red dog flour minerals alfalfa pasture
Days on feed	117	115	111	113
Average daily gain, lbs.	1.09	1.11	1.16	1.12
Feed for 100 lbs. gain, lbs.				
Shelled corn	361.22	294.78	283.76	286.40
Tankage	25.59	16.47	15.89	16.36
Standard middlings		85.19		
Flour middlings			83.12	
Red dog flour				85.53
Total feed for 100 lbs. gain, lbs...	386.81	397.44	382.77	388.29
Feed cost of 100 lbs. gain*				
Average 1923 and 1924....	$6.96	$6.67	$6.61	$6.88

* Not including pasture and minerals.

Shelled corn, per bushel	$ 0.96
Tankage, per ton	60.00
Standard middlings, per ton	26.25
Flour middlings, per ton	30.50
Red dog flour, per ton	34.75

A wheat by-product added to corn and tankage increased the daily gains slightly and accordingly reduced the time necessary to grow pigs to a 200-pound average weight. The advantage in gain in weight daily amounted to from two hundredths to seven hundredths of a pound. In 114 days, the average length of the feeding periods, the increase in gain per pig was from 3 to 8 pounds, an appreciable item on a large number of pigs. On the basis of time required to grow 70-pound pigs to 200 pounds, adding a wheat by-product to corn and tankage saved from 2 to 6 days. From either viewpoint the mill feeds are desirable.

The variations in total amounts of feeds to produce 100 pounds gain with any of the four rations are so slight that no differences can be made on this score.

Replacement Values of the Mill Feeds

Calculating the replacement values of standard middlings, flour middlings, and red dog flour it is found that if tankage sells at the normal price of $60 per ton, to break even on the purchase price of the mill feeds.

When corn is—	Standard middlings should sell for not more than	Flour middlings should sell for not more than	Red dog flour should sell for not more than
75 cents per bushel	$25.75	$30.45	$28.70 per ton
$1.00 per bushel	34.40	40.60	38.30 per ton
$1.25 per bushel	43.00	50.75	47.85 per ton

Conclusions

1. It is profitable to substitute a wheat by-product for a part of the corn and the tankage fed to growing pigs on alfalfa pasture provided the mill feed does not cost more per pound than corn.

2. Such a substitution increases daily gains slightly and accordingly reduces the time necessary to bring pigs to market weight.

3. The use of either grade of middlings or of red dog flour contributes toward improved thrift and health of the pigs.

4. When a choice is made of the three feeds—standard middlings, flour middlings, and red dog flour—if the differences in price are normal, flour middlings should be given the preference.

5. It is possible that under conditions differing widely from those prevailing in this trial, different comparative values might be found for the several wheat by-products.