
Oregon Agricultural College Experiment Station

Department of Animal Husbandry

Finishing Pigs for Market

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FINISHING PIGS FOR MARKET

This bulletin is prepared with a view to putting before the stockmen of the State the results of the experimental work in pig feeding that has been conducted through a series of years by the Oregon Experiment Station at Corvallis and at the Eastern Oregon Branch Experiment Station at Union. We have made no attempt to include all the data involved in these experiments but on the contrary have tried to state only the results as applicable to the pig-feeding business in Oregon. We have made reference to the work of stations outside of Oregon having any bearing on the question under discussion.

All of the data upon which this bulletin is based are on file, and full details of any of the tests can be furnished on request. No positive statements are made which have not been thoroughly proved by repeated tests.

As the title indicates, this bulletin deals with the finishing of pigs for market rather than with growing the younger pigs or feeding the brood sows. These latter subjects are reserved for later publications.

The larger number of the pigs marketed in Oregon are of light weight, ranging from 175 pounds to 225 pounds. The pigs are growing, therefore, as well as laying on fat during the finishing period, and in order to secure the very best results considerable attention must be given the question of balancing the ration so that sufficient protein and mineral matter will be given to develop muscle and bone. The finishing period need not exceed sixty days unless a rising market warrants longer feeding.

The finishing period should begin when the pig is about 100 pounds in weight regardless of age. As a rule, however, the pig that reaches 100 pounds in weight when about five months old is more economical to feed for market than one that reaches this weight at an earlier or a later age.

PREPARATION OF FEEDS AND METHODS OF FEEDING

A good many tests have been made concerning the various methods of preparing feeds for pigs and methods of feeding. The results are given below. It may be said, in general, that preparation and methods of feeding are less important than many believe, provided the feed is palatable and fed regularly. It must be remembered that no method of treatment can change the composition of the feed. Particularly is it true that no grinding, soaking, or cooking can lessen the percentage of crude fiber. Digestibility and palatability may, however, be changed to a small degree and thus affect the rate of gain and the amount of feed to the 100 pounds gain, as is indicated in the summary of results following.

GRINDING AND SOAKING

Grains. In general all small grains with the exception of corn should be ground, rolled, or soaked before feeding for fattening purposes. Averages of all tests conducted at Corvallis and Union on the value of grinding small grains show a saving of 10 percent over feeding whole grains. According to a compilation of Experiment Station results by G. M. Rommel (Bulletin 47, U. S. Department of Agriculture), the average saving resulting from grinding small grains is 12 percent. This percentage is figured on the amounts of feed necessary to produce 100 pounds gain. The saving effected by grinding corn does not, under normal prices, justify the expense of

grinding. An average of 18 trials at Wisconsin showed a saving of 6 percent in favor of ground corn over shelled, where the corn was hard and dry. Iowa reports a saving of from 4 to 6 percent. So small a saving will not usually pay for the expense of grinding.

Recent experiments at Corvallis involving sixty animals indicate rather conclusively that in respect to rate of gains, economy of gains, and daily consumption, there is practically no difference between the lots fed finely ground, coarse ground, or steamed rolled barley. Any one of these methods of preparation proved equally efficient with either of the remaining two.

While from the standpoint of feeding there seems to be little difference in the efficiency of fine, coarse, and steamed rolled grain there may be, however, a big difference in cost. Where grain is ground very fine, say to the consistency of shorts, big expensive mills are required and these cost several hundred dollars. Such mills are beyond the reach of the average stockman. The farm mills regularly on the market will not do very fine grinding. They will, however, do very satisfactory coarse grinding, whether of the roller or burr type. The plain, smooth roller does very good work and does a great amount of grinding in proportion to the power used. Dry grain, especially barley, breaks up in rolling, and the product resembles that from the burr mills; where the grain is steamed, or dampened, before rolling, the kernel does not break up but mashes out flat like oatmeal. Steaming or dampening requires additional work and equipment as compared with dry rolling or grinding and adds some moisture which may sometimes cause the grain to heat if stored in large quantities. The fact that fresh steamed rolled barley contains quite a little moisture should be given consideration in buying feed. From the standpoint of cheapness, dry rolling is therefore the best method of preparation, with coarse grinding in a burr mill next in order.

Soaking of whole grains is practically as beneficial as grinding according to our experiments thus far, though further data are necessary before conclusions can be drawn. In soaking, care must be taken to prevent feeding too much water as gains will be retarded if the animals are forced to consume too much moisture. The soaking of grains that have been ground is of very little advantage as shown by tests at Corvallis and Union. There was no material difference between soaked and unsoaked ground grain, either as to rate of gain, feed consumed, or feed required to produce 100 pounds gain; consequently the trouble of soaking would be against this practice.

Alfalfa Hay. Alfalfa hay may be fed long, cut into short lengths, or ground into meal. Results at Union indicate clearly that alfalfa hay fed long in racks as a grain supplement induced larger daily consumption with larger and cheaper gains than when fed either as a meal or cut. The cost to the 100 pounds gain in the lot fed long hay was 42¢ less than where alfalfa meal was used, and 53¢ less than where cut alfalfa was used. These figures take into account the rapidity and economy of gains, as well as cost of preparation. Kansas reports no greater gains where alfalfa hay was ground than where fed long. Nebraska reports results of five years experimentation indicating clearly that the best way to feed alfalfa for fattening pigs is to feed it long in racks. The poor showing for chopped or ground alfalfa is due in all probability to the forced con-

sumption of stems of the plant, which contain the major portion of the total crude fiber. In other words, it is only the leaves and finer portion that are of value for pigs.

Roots. Roots should always be chopped before being fed to fattening hogs. When fed in troughs separate from the grain ration, two or three inches square is a desirable size, but results at Corvallis show very clearly that much greater root consumption can be induced where the roots are finely chopped and mixed with the grain ration before feeding.

COOKING

Grains. Extensive experiments have shown conclusively that the cooking of grains is not only of no value but has a decidedly detrimental effect upon the feed. Corvallis experiments give uncooked grains a preference of 9.8 percent over cooked. Numerous experiments elsewhere confirm these results.

Potatoes. Unlike the grains, potatoes must always be cooked before feeding to obtain the best results. On the basis of the amount of potatoes necessary to replace 100 pounds of grain, Corvallis and Union experiments show an improvement of 25 percent as a result of cooking.

The degree of cooking potatoes is very important as this materially affects feed consumption and economy of production. Tests at Corvallis have shown rather definitely that potatoes are more palatable when cooked until they are about to drop to pieces and form a meal. Cooking until potatoes are desirable for table use is not sufficient to make them palatable for fattening hogs.

The moisture content must be guarded, as hogs forced to consume too much water do not make the most economical use of their food.

Roots. Cooking does not improve roots for hog feeding purposes. This is true also of squashes, pumpkins, melons, and practically all feeds except potatoes, as noted above, and possibly beans. Beans, like potatoes, may require cooking for best results, but the question is not yet demonstrated.

Alfalfa Hay. Results secured at Union on the increased value of steamed alfalfa hay are not extensive enough to draw definite conclusions. A slight advantage for steamed alfalfa is indicated, but not sufficient to justify the expense of the steaming process.

METHODS OF FEEDING

Hand Feeding. This method, which is possibly the most universally followed at present, consists in giving the pigs at a feeding whatever amount they will eat between then and the next feeding or within any given time. Under this system feeders usually feed two or three times daily.

Self Feeding. This system, which is gaining very rapidly in popularity, consists in having quantities of feed before the pigs at all times. Results of seven tests conducted at Corvallis and Union show a saving of 38 pounds of grain to the 100 pounds gain in favor of self feeding over hand feeding. The average daily food consumption was greater and consequently the daily gain more rapid. These results are comparable with those obtained

at other stations. The use of a self feeder reduces the feeding labor to some extent though attention must be given to the feeder from time to time to prevent clogging. Under this system some care must be exercised in getting the animals on full feed, otherwise there is danger of digestive disturbances.

Free Choice. This system, often called the "cafeteria method," is followed to some extent in the Northwest and is gaining in favor. Under this plan several self feeders are employed, each containing a different feed, thus allowing the pigs to balance their own ration. Iowa reports excellent results following this system. This plan involves less work than mixing the feed and putting it all in one feeder, but can not be used where it is desired to introduce some less palatable food to lessen the cost.

Hogging Down. Under this plan such crops as peas, horse beans, wheat, corn, and root crops are grown to maturity, and the pigs are then allowed to do the harvesting. Waste of feed from tramping into the ground is offset by the saving in the expense of harvesting. This is often the best method, especially where cost of harvesting is high as is the case with peas or corn or very light crops of wheat or barley.

FEEDING STUFFS

This section of the bulletin discusses the different feeds. Emphasis is placed upon feeds that are generally used in the Northwest for pig-fattening purposes. The results of experiments conducted in Oregon are given to substantiate statements made, and results from other states are cited when of sufficient pertinence.

CONCENTRATES

Barley. Barley is the basis of all pig-feeding operations in the Northwest and thus has the same position in this section that corn holds in the Middle West. The barley fed is of three kinds: common feed barley, bald barley, and hull-less barley. The common feed barley is much more generally used than either of the other varieties.

A great number of experiments have been conducted at Corvallis and Union as to the value of common feed barley, and the results can be taken as conclusive. In the case of bald barley and hull-less barley fewer experiments have been conducted and definite conclusions can not be drawn. An average of twelve tests shows that it requires 438 pounds of common feed barley, ground and without supplement, to produce 100 pounds of gain. This is for barley weighing 41 to 46 pounds to the bushel. It required 404 pounds of bald barley or 475 pounds hull-less barley, both ground, to produce 100 pounds gain.

Wheat. This grain is used extensively in Oregon for fattening pigs and is commonly thought to be superior to barley, but in numerous experiments wheat has not given results quite equal to barley. The difference is very slight, however, and generally they may be considered of equal value. An average of fourteen tests shows that to produce 100 pounds gain requires 463 pounds of wheat if fed alone.

Corn. This feed is not very extensively used as a pig feed in this State. For fattening purposes it is approximately equal pound for pound to barley or wheat. The following table indicates the results obtained at Ohio and Missouri stations:

Station	Feed	Daily gain	Feed to produce 100 pounds gain
			lbs.
Ohio	Ground corn 9, tankage 1	1.59	366
	Ground wheat 9, tankage 1	1.59	383
Missouri	Ground corn 10, tankage 1	1.51	480
	Ground wheat 10, tankage 1	1.60	469

The results at these stations show a slight advantage for corn in Ohio and wheat in Missouri. In general feeding operations the relative prices of corn, wheat, and barley should determine the grain the producer should feed. Their value, ton for ton, is practically equal.

Wheat By-products. These feeds were extensively used during the war for fattening pigs. They contain considerable quantities of phosphorous and protein although rather low in calcium (lime). The protein present is in sufficient quantity but is lacking in certain essential compounds. This deficiency can easily be supplied by the addition of 5 percent tankage. Results at Corvallis show that animals receiving 5 percent tankage in addition to middlings made gains twice as rapidly and required considerably less feed to the 100 pounds gain than those receiving middlings alone.

Middlings and shorts can be used as a partial substitute for barley whenever prices justify. Experiments at Corvallis indicate that a combination of one-third middlings or shorts and two-thirds barley will give just as good returns as barley alone, but middlings or shorts fed alone as a fattening ration have not been satisfactory, gains being very slow and amount of feed necessary to produce 100 pounds gain being excessive. These feeds are not palatable when fed in large quantities and contain too much crude fiber. Bran is too bulky for a satisfactory fattening feed and can seldom be used economically.

Oats. Owing to the bulkiness (high percentage of fiber) of this feed it should not constitute the sole grain for fattening purposes. Experiments at Corvallis in which one-third of the ration consisted of oats and two-thirds of barley gave results approximating very closely those given by barley alone. Results at the Wisconsin Station in which one-third of a corn ration was replaced by ground oats indicate approximately the same relative values.

Ohio reports indicate a slightly smaller feeding value for oats than for corn. The difference is not great, however, and the feeder is fairly safe in making one-third of the ration oats providing the price of oats justifies the substitution. When fed in larger amounts than one-third of the ration, oats has proved very unsatisfactory.

Rye. Rye as a sole feed for fattening purposes is not palatable and does not give returns equal to other grains. Not only does it require more feed to produce 100 pounds gain, but gains are made less rapidly, as it seems impossible to induce the animals to eat sufficient quantities to make production satisfactory. Rye-fed pigs were lacking very much in finish as compared with the other lots.

The following table gives results of rye feeding:

Station	Feed	Daily gain	Feed to produce 100 pounds gain
Oregon	Rye, ground	1.09	lbs. 440
	Wheat, ground	1.6	423
Nebraska	Rye, soaked	.88	546
	Wheat, soaked	1.05	504
Ohio	Rye 9, tankage 1	1.00	441
	Corn 9, tankage 1	1.09	399

Peas. Because of the prevailing high prices for peas they are not generally used for hog-feeding purposes. This feed contains about two times as much crude protein as the cereals and is high in phosphorus and potash. Peas are fed more efficiently when in combination with some carbonaceous feed, such as wheat, barley, corn, etc.

The most general method of feeding peas is the hogging-down system. The peas are allowed to get ripe, and the pigs are then turned into the field to do the harvesting. This system at Union gave an average daily gain of 1.52 pounds with an average production of 397 pounds of pork to the acre. The Idaho Station reports slightly greater returns. The amount of pork produced to the acre is very largely determined by the yield of the peas. The returns are generally satisfactory considering the fact that the peas are essentially a rotation crop and that the pigs under this system do their own harvesting.

The following table indicates the value of threshed peas compared with other grain:

Station	Feed	Daily gain	Feed to produce 100 pounds gain
Oregon (Union)	Peas	1.76	lbs. 353
	Wheat	1.6	423
Oregon	Barley	1.58	434

From the foregoing tables it is clear that peas rank first of the grains in efficiency of pork production. The economy, however, will depend upon the relative prices and supply of these feeds.

SUPPLEMENTAL FEEDS

Supplemental feeds are feeds used as supplements to the grains such as wheat, barley, or corn, so as to make a better balanced or more palatable ration. Most cereals and cereal products are deficient in protein and the protein contained is incomplete, that is, lacking in certain compounds essential to the most rapid gains. Animal proteins, on the other hand, and to a lesser extent leguminous proteins, contain the desired compounds, and relatively small amounts of supplements are necessary to give satisfactory results. Very large amounts of supplements may greatly increase the cost and lower the rapidity of gains, since their high value lies more

largely in their influence upon the utilization of the other feeds used rather than upon their own independent nutritive value.

Skim Milk. This is not only the very best supplement for growing pigs, but is almost of equal value for fattening purposes. This supplement, though very low in dry-matter content, furnishes a complete protein, which fact accounts in a large measure for the excellent returns. Milk renders the ration more palatable, inducing greater consumption and consequently greater daily gains.

The following tables give comparative results of feeding milk as supplement to grain:

BARLEY AND SKIM MILK

Station	Ration	No. of tests	Average daily gain	Feed to produce 100 pounds gain
Oregon	Barley	12	1.54	lbs. Barley 438
Oregon	Barley and Milk	4	1.57	Barley 322 Milk 319

WHEAT AND SKIM MILK

Oregon	Wheat	14	1.12	Wheat 463
Oregon	Wheat and Milk	4	2.06	Wheat 292 Milk 330

We have always obtained slightly better results with milk than have other stations, due in the main to the small amount of milk fed in proportion to the grain; but a very safe rule to follow in determining the value of skim milk as the supplement to a grain ration is to divide the price of barley, wheat, or corn to the 100 pounds by four, the result being the value of 100 pounds of milk if fed in proportion not to exceed 3 pounds of milk to every pound of grain in the ration. In the Oregon tests, where milk and grain were fed in approximately equal weights, only 235 pounds of milk was required to replace 100 pounds of grain. These results, however, seem to be exceptional.

Buttermilk. This supplement free from wash water, is equal in feeding value pound for pound to skim milk. As in the case of skim milk it should be fed at not over 3 pounds of buttermilk to 1 pound grain in order to attain the greatest efficiency. Before paying prices equal to quotations on skim milk the purchaser of buttermilk should be sure that the product is not diluted. It is a very easy matter for unscrupulous dealers to dilute buttermilk with water. This dilution is also very difficult to detect unless a moisture determination is made.

Whey. While whey is a dairy by-product usually thought of in connection with skim milk or buttermilk, it is very low in its protein content and can not be used as a supplemental feed. A ration containing whey must have added to it some supplemental feed if the best results are to be obtained. Whey is therefore discussed further on under the head of miscellaneous feeds.

Tankage. Tankage, often called meat meal, is a by-product of the meat-packing industry. Waste meat, scrap bones, and fat trimmings are subjected to a very high steam pressure and thoroughly cooked. The fat is then drawn off, and the residue dried, finely ground, and placed on the market under the name of Digester Tankage. There are different grades of the product, containing from 40 percent to about 60 percent protein. It is always advisable to use the grade containing the highest percentage of protein, as the value of tankage is mainly in the small consumption necessary to secure the proper amount of protein.

In general there is no advantage in using tankage in combination with skim milk or other protein supplements. Results of tankage added to alfalfa pasture do not justify its extensive use for this purpose.

The following tables give values of tankage as a protein supplement:

BARLEY AND TANKAGE

Station	Ration	No. of tests	Average daily gain	Average amount feed to produce 100 pounds gain
Oregon	Barley	12	1.54	lbs. Barley 438
Oregon	Barley and Tankage	5	1.61	Barley 340 Tankage 36

WHEAT AND TANKAGE

Oregon	Wheat	14	1.21	Wheat 463
Oregon	Wheat and Tankage	2	1.42	Wheat 330 Tankage 41
Ohio	Wheat and Tankage	1	1.59	Wheat 345 Tankage 38

These tables show that 100 pounds of 60 percent tankage replaced nearly 300 pounds of grain.

Besides the above results eight tests conducted at Union show that 100 pounds of 60 percent protein tankage replaced 327 pounds of grain.

These results indicate clearly the value of tankage as a protein supplement to the grains. One pound of tankage fed in amounts of from 5 to 7 percent of the ration will in general replace 3 pounds of grain. Results of two tests at Corvallis show that 7 percent tankage gives just as good results as 17 percent; that is, the gains were as good and the total amount of feed to the 100 pounds gain no higher.

Cocoanut Meal. Cocoanut meal is the product resulting after the oil has been extracted from the meat of the cocoanut, or copra. Even though the oil has been extracted as completely as possible the product still contains a rather high percentage of fat which tends to become rancid easily. If the fat is rancid it may become unpalatable and cause the pigs to scour. Experimental results so far are rather contradictory. Tests at California show that cocoanut meal was equal to barley if not fed in excess of one-fourth of the ration. In one test at Corvallis the pigs refused to eat the meal in sufficient quantities to make a test. In a second test 25 per-

cent of cocoanut meal and 75 percent of barley gave excellent results, better than barley alone and about what would be expected from barley supplemented with tankage. Other rations, one containing 50 percent cocoanut meal and one containing 10 percent, were less palatable and gave smaller gains. In a third test, growing pigs fed 21 percent cocoanut meal in addition to a mixture of mill run and barley in a self feeder picked out the other feed and left the meal. They made but little better than half the gains made by a check lot receiving tankage instead of cocoanut meal. In general cocoanut meal makes a satisfactory supplement wherever the pigs eat it readily, but of course three or four times as much is required as compared to tankage. Why it is sometimes palatable and sometimes unpalatable remains to be answered by further tests. The cocoanut meal used in these tests was the "domestic" meal and not the Oriental meal. By "domestic" meal we mean the meal made in the United States, although of course the copra itself comes from the Orient. Most of the meal on western markets is of this kind. The Oriental meal is that made in the Orient and has a very high fat content. Tests with this product are under way but have not gone far enough to justify definite conclusions.

Linseed Oil Meal. Linseed oil meal is the product remaining after the linseed oil has been extracted from the flax seed. It is very palatable, uniform in quality, keeps well, and is in all cases a very safe feed. It gives results similar to tankage but must be fed in double the amounts, as approximately two pounds of linseed oil meal is required to furnish the same protein as one pound of tankage. Tankage is for this reason usually the more economical at the usual market prices. The term "oil meal" is generally used to mean linseed oil meal, but is sometimes applied to other products resulting from the extraction of various vegetable oils.

Soy Bean Meal. Soy bean meal is the product remaining after the oil is extracted from the soy bean. It is similar to linseed oil meal in feeding value but has about 20 percent more protein and consequently a higher value. In the South the term "soy bean meal" is sometimes used to mean the entire soy bean ground fine and without the oil having been extracted. This product, however, is not on the market in the Northwest. The soy bean meal on the market here is imported from the Orient and has had the oil extracted.

Cotton Seed Meal. Because of the poisonous properties of this supplement it should not be used as a pig feed.

Alfalfa Hay. Alfalfa hay is in a great many respects a desirable supplement. It contains the compounds in which the cereals are lacking, and where grown in abundance has the added advantage of being relatively cheap. It is, however, so bulky that the pigs do not readily consume enough of it to balance the ration without cutting down the amount of feed. Pigs will not consume a full ration containing more than 10 percent alfalfa hay, and this amount of hay does not contain enough protein properly to supplement the grain ration, though it is much better than grain alone. When added to a balanced ration, alfalfa hay is of little or no value. For these reasons alfalfa hay has little value for fattening pigs. (See Alfalfa Pasture.)

SUCCULENTS

These foods have a very beneficial effect upon the digestive system and induce unusually good returns in proportion to nutrients contained, but on account of their large water content they can comprise only a part of the ration.

Potatoes. Cooked potatoes are possibly the best succulent for fattening purposes. Because of the high water content and lack of palatability, hogs can not be made to consume a ration consisting of more than four-fifths by weight of cooked potatoes. Numerous experiments at Corvallis and Union have shown rather conclusively that with a ration consisting of 4 pounds cooked potatoes to 1 pound grain, 238 pounds of barley and 845 pounds of potatoes were necessary to produce 100 pounds gain. In other words, it required 422 pounds of cooked potatoes to replace 100 pounds of barley. Wisconsin reports that 442 pounds of cooked potatoes replaced 100 pounds of corn meal. Denmark reports 400 pounds cooked potatoes saved 100 pounds mixed grains. These results indicate that approximately 400 pounds of cooked potatoes will replace 100 pounds of grain (barley, wheat, corn, or mixed grains), if fed in proportions not to exceed 4 parts cooked potatoes to 1 part grain.

Roots. These succulents, including sugar beets, mangels, carrots, rutabagas, etc., are valuable when fed in limited amounts. It is not advisable to feed a ration consisting of more than three-fourths roots. On the basis of palatability the roots rank as follows: sugar beets, mangels, carrots, rutabagas.

By actual test animals weighing 150 pounds receiving ground barley in a self feeder could be induced to eat in addition to the barley not to exceed 3 pounds of mangels each in a day. In a recent experiment conducted at Corvallis, however, finely chopped mangels mixed with grain in proportion of 1 pound of grain to 4 pounds of mangels were fed in self feeders. The lot consisted of 15 head, having an average initial weight of 183 pounds, average daily gain of 1.64, and daily consumption of 4.66 pounds barley and 20.8 pounds mangels. It required 1,261 pounds of mangels and 283 pounds of barley to produce 100 pounds gain. The heavy daily consumption is due to mixing the grain and finely chopped mangels before feeding.

We are safe in concluding that 600 pounds of mangels will replace 100 pounds of barley if fed in proper proportions. Carrots and turnips are slightly more valuable than mangels, though not so palatable. Results from other stations show that 400 pounds of sugar beets are necessary to replace 100 pounds of grain. The difference in efficiency of the various root crops, with sugar beets as an exception, is so slight that the determining factor should be the comparative yield and cost of producing the crops.

Artichokes. As reported in Bulletin 54 of this station one-eighth acre of artichokes returned 244 pounds of pork, the hogs consuming in addition 756 pounds of mixed grain. Allowing 500 pounds of mixed grain for 100 pounds gain, an acre of artichokes was worth 3,712 pounds of grain.

Missouri Bulletin No. 29 reports artichokes practically equal to potatoes for pig feeding. Henry states the following regarding artichokes: "Although long grown in a small way and often extolled, no extended feeding trials have yet been made with artichokes, nor does their use by feeders seem to increase."

Silage. Corn silage is practically of no value in a fattening ration. Tests at Corvallis show a smaller daily gain and a greater amount of grain requirement to the pound of gain when silage constituted part of the ration than when the same ration was fed without silage. Results at other stations confirm these conclusions.

MISCELLANEOUS FEEDS

Molasses. Cane molasses can be used to good advantage in combination with other feeds. Tests at Corvallis show that a lot of fifteen pigs receiving four parts mill run and one part molasses consumed as much mill run as similar lots receiving mill run alone. The gains were proportionally good, thus making cane molasses equal in efficiency with mill run and at the same time inducing greater consumption.

In another test recently conducted at Corvallis fifteen pigs having an average initial weight of 183 pounds consumed daily 10.7 pounds of a mixture of ground barley 72 percent, tankage 8 percent, and molasses 20 percent. They made a daily gain for 50 days of 2.11 pounds. In this test molasses proved practically equal pound for pound to ground barley.

Molasses is clearly a valuable feed when it does not cost more than barley, wheat, or corn. Molasses is used chiefly, however, by feed manufacturers in the preparation of mixed feeds. These dealers get molasses in tank cars and at a much cheaper rate than farmers who have to buy it in barrels and in small lots. Barrelling adds approximately 50 percent to the cost of the molasses.

Whey. Whey contains a small amount of carbohydrate material and is valuable to this extent, but should be fed in combination with grain feeds and protein supplements. Fed as indicated, whey has a feeding value equal to about one-fourth or one-third that of skim milk. These results are determined from the use of ordinary whole whey which according to Day is worth 25 percent more than separated whey.

Alfalfa Pasture. There is considerable question in the minds of farmers as to the advisability of allowing fattening pigs pasturage in combination with their grain ration. Results at Union show that it is advisable providing the animals are marketed under 200 pounds. Under these conditions alfalfa pasture made a saving of 88.61 pounds barley to the 100 pounds gain. The animals were on test from an average weight of 96.77 pounds until they averaged 193.35 pounds. The animals were thus on test during the growing period.

Following is a table of results obtained at Wichita Union Stock Yards:

Feed.	Daily gain	Feed to produce 100 pounds gain	
		lbs.	
Corn	.77	Corn 560	
Corn and Alfalfa Pasture	1.63	Corn 393	
Corn and Meat Meal	1.47	Corn 409	Meat meal 19
Corn, Meat Meal, and Alfalfa Pasture	1.48	Corn 390	Meat meal 17

This table shows a great advantage for alfalfa pasture and corn as compared to corn alone. The average initial weight of the hogs used was approximately 120 pounds; thus they were growing during the fattening period. These results indicate the inadvisability of using corn alone as a ration for growing pigs. In the corn and meat-meal ration alfalfa pasture effected a saving of 19 pounds of corn and 2 pounds of meat meal to the 100 pounds gain.

In general, light-weight hogs can utilize good pasture to advantage, but results indicate no advantage from using pasture for heavy hogs. Pasture for fattening pigs must be good in all cases and the grain not limited.

IMPORTANT CONSIDERATIONS IN BALANCING RATIONS

Crude Fiber. An important factor, and one that generally receives little or no consideration in balancing rations for fattening pigs is crude fiber. This comprises the woody portion of the feeding stuffs and consists mainly of cellulose, which is much less digestible than other constituents of the feed. Crude fiber is often mentioned as "bulk" of the ration.

The cow, the sheep, and the horse have special digestive arrangements, whereby crude fiber in quantities is digested; it is in fact necessary for the well-being of the animal. The hog, however, is not so constituted, but is especially fitted for consumption of large quantities of concentrates which he converts into edible product much more efficiently than any other meat-producing animal.

If the fiber content of the ration exceeds 5.5 percent, it is impossible to make good gains in fattening hogs. Small quantities of crude fiber in a fattening ration do no harm, but the limit is easily reached and is too often passed. Canadian laws on feed regulations stipulate that hog feeds being placed on the market must not contain to exceed 6 percent crude fiber.

A few examples and experiments will make the above conclusion evident. Experiments have shown that alfalfa hay, though containing a high quality of protein and other digestible nutriment, will barely maintain hogs if fed as a sole feed in a ration. The feed contains 28 percent crude fiber. To make satisfactory gains a 200-pound fattening hog would have to consume daily 15 to 20 pounds of alfalfa hay. This amount of consumption is a physical impossibility.

Such feeds as wheat bran, containing fiber 10.2 percent; wheat shorts, containing fiber 7 percent; barley shorts, containing fiber 10.1 percent;

oats bran, containing fiber 18.3 percent; barley bran, containing fiber 19.3 percent; oat hulls, containing fiber 29.2 percent; oats, containing fiber 10.9 percent, are all too high in crude fiber content when fed as a sole feed in a fattening ration. Numerous experiments have clearly shown that they do not give satisfactory gains unless fed with other feeds, low enough in fiber so that the fiber content of the mixture is less than 5.5 percent.

Experiments at Corvallis have shown that a ration consisting of two-thirds barley, one-third shorts, is equal to barley. This combination gives a crude fiber content of 5.4 percent, just under our limit. Experiments at Corvallis and other places have shown specifically, likewise, that a ration consisting of one-half shorts and the other half barley is not equal to barley alone. This combination gives a fiber content of 5.9 percent, which is above our standard. Similar experiments have shown that two-thirds corn and one-third oats equals corn alone. The fiber content in such a ration equals 5 percent. A ration two-thirds barley and one-third oats is barely equal to barley. The fiber content is approximately 6 percent. Many more experiments are available and could be cited to support the principle that the crude fiber content of the ration should not exceed 5.5 percent.

A great number of commercial hog feeds are advertised with emphasis on their protein and carbohydrate content. These nutrients, though very important, are of little value in the presence of too much fiber. Alfalfa hay, for example, contains a high percentage of protein and a good amount of carbohydrates, but, as stated above, it would be impossible to fatten hogs on alfalfa hay alone. If the purchaser of feeds will pay more attention to fiber content he will realize greater returns.

In selecting feeds the purchaser may be guided by the following principles: Feeds containing 2 percent to 5.5 percent fiber are concentrates ordinarily suitable to pig fattening. Feeds containing 10 percent to 15 percent fiber are bulky concentrates satisfactory for horses and cattle but not for hogs unless mixed with large quantities of more concentrated feeds. Feed containing 20 percent to 30 percent fiber is roughage and must be fed as such, no matter how finely it may be ground. Feeds containing over 30 percent fiber must be classed with the straws and are not ordinarily worth buying.

Protein. The protein question is always important in pig feeding as nearly all the common grains are deficient in protein. Some of the cereal by-products contain enough protein but it is not of the proper quality. It becomes necessary, therefore, to supply this lack with some feed that contains a high percentage of protein and in which the protein is the proper kind. Such feeds are tankage, the oil meals, skim milk, buttermilk, and within certain limits alfalfa. The pig seems to require animal or legume protein. When once the protein requirements of the animal are met, it is of no advantage to add more; in fact, it may be a disadvantage. The high values often obtained from tankage or skim milk are not to be obtained when these feeds are given in larger quantities than enough to furnish the necessary protein. The optimum amount of digestible animal or legume protein for a fattening pig is about one-fourth pound a day.