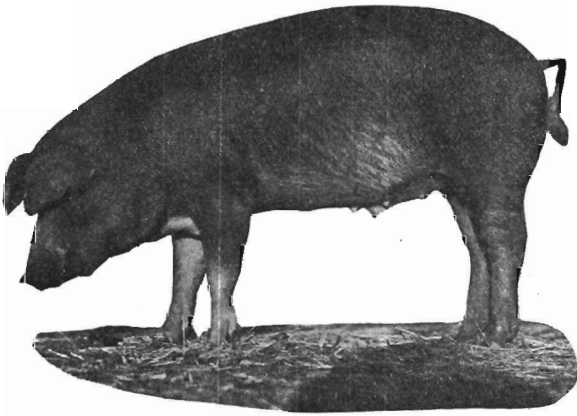


# Fattening Pigs for Market



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CORVALLIS

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## SUMMARY TABLE

Ground barley is the principal hog feed for Oregon, and therefore the other feeds are compared with it. Shorts, for example, is given the value of 90, which means that 100 pounds of shorts has the same feeding value as 90 pounds of barley.

### GRAIN AND MILL FEEDS

Feed	Relative value	How used (the relative values given apply only when feeds are used as indicated).
Barley—ground .....	100	As the chief grain ration.
Barley—whole .....	88	As the chief grain ration.
Wheat—ground .....	100	As the chief grain ration.
Wheat—whole .....	88	As the chief grain ration.
Corn—ground .....	100	As the chief grain ration.
Corn—whole .....	95	As the chief grain ration.
Oats—ground .....	90	Not more than $\frac{1}{3}$ of grain ration.
Oats—whole .....	85	Not more than $\frac{1}{3}$ of grain ration.
Middlings .....	105	For sows and young pigs.
Middlings .....	100	For fattening hogs (not more than $\frac{1}{3}$ of ration).
Shorts .....	95	For sows and young pigs.
Shorts .....	90	For older hogs (not more than $\frac{1}{3}$ of ration).
Mill-run .....	.....	Varies greatly.
Bran .....	75	For maintenance only (contains too much fiber for fattening).
Coconut meal .....	100	Not more than $\frac{1}{3}$ of the ration.

### SUPPLEMENTAL FEEDS

Skim milk or buttermilk.....	33	Not more than 3 pounds of milk with one pound of grain.
Skim milk or buttermilk.....	12	In unlimited amounts (not advisable).
Tankage (60 percent).....	300	5 to 10 percent to balance the ration.
Oil meal .....	150	10 to 20 percent to balance the ration.
Soy-bean meal .....	190	8 to 15 percent to balance the ration.
Cottonseed-meal .....	.....	Dangerous for pigs.

### SUCULENT FEEDS

Potatoes raw .....	17	Not more than 2 pounds to 1 pound grain.
*Potatoes cooked .....	25	Not more than 4 pounds to 1 pound grain.
Mangels or turnips .....	12	Not more than 3 pounds to 1 pound grain.
Rutabagas .....	15	Not more than 3 pounds to 1 pound grain.
Sugar beets .....	20	Not more than 4 pounds to 1 pound grain.
Silage .....	.....	Not suitable to pig feeding.

### ROUGHAGE

†Alfalfa hay, chopped alfalfa, or alfalfa meal .....	75	Not more than 10 percent of ration. Not suitable for pigs. Often used to adulterate prepared pig feeds.
‡Garbage .....	20	For fattening hogs (entire ration).

\*Feed value is on basis of weight before cooking.

†Compared on basis of amount actually eaten; chopping or grinding saves some waste, especially in wet weather.

‡Should not be fed to pigs under 75 pounds weight and in only limited amounts to brood sows.

# Fattening Pigs for Market

By

A. W. OLIVER and E. L. POTTER

This bulletin is prepared with a view to putting before the stockmen of the state the results of experimental work in pig feeding that has been conducted through a series of years by the Oregon Agricultural 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 that are immediately applicable to pig feeding in Oregon. We have made reference to the work of stations outside of Oregon wherever it has bearing on the question under discussion.

All of the data on 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 that have not been thoroughly proved by repeated tests.

As the title indicates, this bulletin deals with fattening pigs for market rather than with growing younger pigs or feeding 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 200 pounds. The pigs are growing, therefore, as well as laying on fat during the finishing period, and in order to obtain 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 90 pounds in weight regardless of age.

A careful study of the most desirable type of market pigs should be made by each producer in order better to meet the demands of the consumers.

## IMPORTANT CONSIDERATIONS IN BALANCING RATIONS

**Crude fiber.** An important factor and one that frequently receives little 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. It is a high content of crude fiber that makes a ration "bulky."

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

fiber to a limited extent only, if at all. Hence large quantities of fiber have a detrimental effect. Some authorities consider any crude fiber detrimental.

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 may do little harm, but the limit is easily reached and is too often passed. Canadian laws on feed regulations stipulate that feeds being placed on the market for pig-feeding purposes must not contain to exceed 6 percent crude fiber.

Experiments have shown that alfalfa hay, though containing a high quality of protein and other digestible nutriments, 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. The consumption of this amount is a physical impossibility.

Such feeds as wheat bran, containing 10.2 percent fiber; wheat shorts, containing 7 percent fiber; barley shorts, containing 10.1 percent fiber; oats bran, containing 18.3 percent fiber; barley bran, containing 19.3 percent fiber; oat hulls, containing 29.2 percent fiber; oats, containing 10.9 percent fiber, are all too high in crude fiber content when fed as a sole feed in a fattening ration. Numerous experiments have clearly shown that these feeds 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 and 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, 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 is 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 fair amount of carbohydrates, but, as stated above, it would be impossible to fatten hogs on alfalfa alone. If the purchaser of feeds will pay more attention to fiber content he will obtain much 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. Feeds containing 20 percent to 30 percent fiber are roughages and must be fed as such, no matter how finely they may be ground. Feeds containing

more than 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 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, but 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.

**Minerals.** Our definite information on the value of minerals for hogs is limited. It is known, however, that the hog should be given some minerals to supplement the grain rations since the grains are deficient, especially in calcium, or lime.

Hogs that are not receiving enough minerals will generally become lame and sometimes paralyzed in the hind quarters. Purdue University in a recent experiment found that a mineral mixture of wood ashes, acid phosphate, and salt increased the daily gains and made the gains more economical with a ration of soy-beans and corn.

The following mineral mixture can be fed either by adding about one-twentieth pound per day per hog to the ration or by keeping it before them at all times in a self-feeder.

	<i>pounds</i>
Limestone, high calcium content .....	50.00
Bone meal .....	27.97
Salt .....	20.00
Iron oxide .....	2.00
Copper sulfate .....	.01
Potassium iodide .....	.02

**Water.** The pig needs good clean water accessible at all times. Water in the feed and water in the trough are the same to the pig provided there is not too much in the feed so that he has to consume too much water in order to get enough feed. While our information on this subject is not as definite as we should like, it seems that the entire ration for a fattening pig should not contain more than 60 percent water and that if it does contain more than 60 percent the pigs will not consume enough feed and will make slower gains and take on less finish.

**Vitamins.** Pigs that are running outside and are on green pasture will get plenty of vitamins, but pigs that are shut inside are very apt to suffer from lack of vitamins. The only vitamins likely to be lacking in a pig's ration are the fat-soluble vitamins A and D. Both these vitamins are very abundant in cod-liver oil. Vitamin A is very abundant in butter-fat. These oils and fats are not economical sources of vitamins for pigs. Alfalfa meal is about the best source of vitamins for pigs in dry lot. A small amount daily of some green crop such as kale can be used to advantage by the pigs in dry lot.

An excellent example of a ration lacking vitamins is white corn and skim milk for pigs shut inside. To correct the deficiencies the best way is to put the pigs on green pasture. In winter, yellow corn to replace white corn will add vitamin A. Direct sunshine is one of the best sources of vitamin D. It is essential that it be direct sunshine and that it shall not pass through window glass as glass does not allow the ultra-violet rays to pass through. The pigs can be allowed to run outside and 4 to 5 pounds of alfalfa meal can be added to 100 pounds of grain to supply vitamin D and also vitamin A.

Plenty of green pasture will provide all of the necessary vitamins. In the absence of green pasture, plenty of direct sunshine and some alfalfa meal will meet the needs.

## PREPARATION OF FEEDS AND METHODS OF FEEDING

Many tests have been made concerning the various methods of preparing and feeding the common feed stuffs. 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-pound gain, as is indicated in the summary of results following.

### GRINDING AND SOAKING

**Grains.** The average of six trials conducted at the Oregon Experiment Station on the preparation of grains showed there is a saving of from 4 to 12 percent in grinding oats. The greater saving is in the finer grinding. The coarse grinding of barley saved about 10 percent while fine grinding saved 13 percent.

Fine grinding of oats and barley has given better results than coarse grinding as the daily gains are more, also less grain is required per pound gain.

The hammer type of mill is better suited to fine grinding than the burr or roller mill as determined by recent tests. The information on types of mills and power required for grinding grain is given in a separate bulletin, which will be published at a later date.

An average of 18 trials at Wisconsin showed a saving of 6 percent in favor of ground over shelled corn, 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 corn, but on the other hand the grinding of small grains is a very profitable operation.

Soaking whole grain did not improve the feeding value. Oats and barley that had been soaked twelve hours had a lower feeding value than



whole dry grain. Wetting ground feed, however, may save waste when fed out of doors in dry, windy weather.

**Alfalfa hay.** Alfalfa hay may be fed long, cut into short lengths, or ground into meal. Results at the Union Station indicate that long alfalfa hay 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 of 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 and in racks. The poor showing for chopped or ground alfalfa is in all probability due to the forced consumption of stems, which contain much crude fiber. In other words, it is only the leaves and finer portion that are of value for pigs, while the coarser portions may be a detriment. The leaves and blossoms are sometimes separated from the stems and fed to pigs while the coarser portions are fed to cattle. This is a desirable practice wherever it can be done without too great expense. It is not practical to feed long hay to pigs in wet weather as too much hay is wasted by tramping it in the mud. Alfalfa meal is the best under such conditions, as it can be mixed with the grain. Care should be taken that alfalfa meal does not compose more than 5 percent of the ration, otherwise the ration will be too bulky. This amount will furnish enough vitamins. Adding this small amount of alfalfa meal to a ration of barley and tannage greatly improves the ration (see supplemental feeds).

**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.

## 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. Cooking seems to lessen the digestibility of protein and mineral matter but may have some slight beneficial effect on the starches.

**Potatoes.** Potatoes being very starchy are an exception and must be cooked before feeding in order to obtain the best results. In an experiment at Union, it took 556 pounds of raw potatoes to replace 100 pounds of barley while it required only 385 pounds of cooked potatoes to accomplish the same results. Experiments elsewhere confirm these results.

The degree to which potatoes are cooked is important. Tests at Corvallis have shown definitely that potatoes are more palatable when cooked until they are about to drop to pieces and form a meal. Cooking potatoes to the state 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 feed. If steamed no water need be added. If boiled the water in which they are boiled must be poured off as this water is unpalatable.

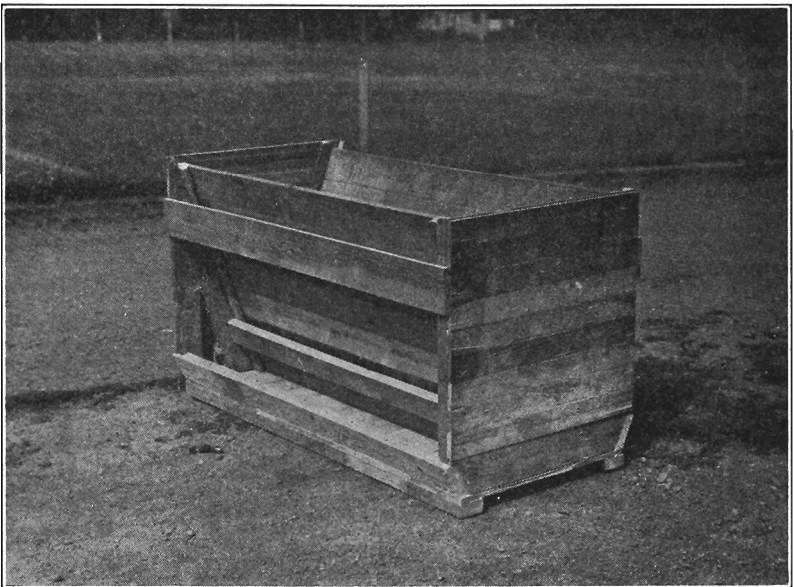
**Roots.** Cooking does not improve roots of squashes, pumpkins, or melons.

**Alfalfa hay.** Results obtained at Union on the increased value of steamed alfalfa hay are not extensive enough to warrant definite conclusions. A slight advantage for steamed alfalfa is indicated, but not sufficient to justify the expense of the steaming process. Steaming alfalfa or clover for hogs at Corvallis has not proved profitable.

## METHODS OF FEEDING

**Hand feeding.** This method consists in giving the pigs at each feeding time the amount of feed they will require to meet their needs until the next feeding time. Under this system feed is given two or three times daily.

**Self-feeding.** This system consists in having a quantity of feed before the pigs at all times and in such form that it will not be trampled under foot and wasted. 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



Self-feeder for the grain mixture.

greater and consequently the daily gain more rapid. Similar results have been 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 once or twice a day to prevent clogging. Some care must be exercised in getting the animals on full feed.

**Free choice.** 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 when corn and tankage are used. The free-choice system is not practical when any of the feeds are slightly unpalatable. The free-choice system is not satisfactory with barley or most of our other Pacific Coast feeds.

**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 with very light crops of wheat or barley. In Oregon the season for hogging down corn is often very short.

## FEEDING STUFFS

In this section of the bulletin are discussed the different 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 such 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.** For fattening purposes corn is approximately equal pound for pound to ground 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
		<i>lb.</i>	<i>lb.</i>
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 since their value, ton for ton, is practically equal.

**Wheat by-products.** 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.

## OATS AND BARLEY

Station	Ration	Daily gains	Daily feed	Feed per 100 pounds gain
		<i>lb.</i>	<i>lb.</i>	<i>lb.</i>
Oregon.....	Finely ground barley 89			
	Tankage 7			
	Alfalfa meal 4	1.40	5.96	426
Oregon.....	Finely ground barley 66.75			
	Finely ground oats 22.25			
	Tankage 7.			
	Alfalfa meal 4.	1.47	6.63	450

Results at the Wisconsin Station in which one-third of the corn ration was replaced by ground oats indicate approximately the same relative values.

Ohio reports indicate with a similar ration 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 provided the price of oats justifies the substitution. When fed in larger amounts than one-third of the ration, however, oats have not proved satisfactory.

It should be noted that oats can be fed in a higher proportion to growing pigs before they reach the fattening stage. The fattening, however, should not be delayed after the pigs weigh 80 to 90 pounds. Oats are a very satisfactory feed for breeding stock.

**Rye.** Rye as a sole feed for fattening purposes is not palatable and does not give as good returns as other grains. Not only does it require more feed to produce 100 pounds gain, but gains are made less rapidly. It seems impossible to induce the animals to eat sufficient quantities of rye to produce satisfactory gains. 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	<i>lb.</i> 1.09	<i>lb.</i> 440
	Wheat, ground	1.60	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

If a small proportion of rye is mixed with a larger proportion of other feed the pigs will eat it satisfactorily and make good gains. Rye contains about the same amount of nutrients as wheat. The lack of palatability is the limiting factor.

**Peas.** Because of the prevailing high prices for peas they are not generally used for hog-feeding purposes. They contain about two times as much crude protein as the cereals and are high in phosphorus and potash. Peas are more efficient when fed 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 amount of pork produced to the acre is very largely determined by the yield of 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.

Station	Feed	Daily gain	Feed to produce 100 pounds gain
Oregon (Union).....	Peas	<i>lb.</i> 1.76	<i>lb.</i> 353
	Wheat	1.60	423
Oregon.....	Barley	1.54	438

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 to supplement 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 these desired compounds. Cereals are also commonly deficient in minerals and in vitamins. Only relatively small amounts of supplement are necessary to give satisfactory results. Very large amounts of supplement may greatly increase the cost and lower the rapidity of gains, since the high value of supplements lies more in their influence on the utilization of the other feeds used than in their own independent nutritive value.

**Skim milk.** This is not only the very best supplement for growing pigs, but is of almost equal value for fattening purposes. Though very low in dry-matter content, milk 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. Also milk is a good source of minerals.

The following table gives comparative results of feeding milk as supplement to grain:

## BARLEY AND SKIM MILK

Station	Ration	Number of tests	Average daily gain	Feed to produce 100 pounds gain
Oregon.....	Barley	12	<i>lb.</i> 1.54	<i>lb.</i> 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

Tests elsewhere indicate that where three or four pounds of milk are fed to each pound of grain it will require 400 pounds of milk to replace 100 pounds of grain. Where milk is fed alone, gains will be quite slow, and it will require 1,000 to 1,500 pounds of milk to replace 100 pounds of grain.

## FEEDING VALUE OF SKIM MILK\*

Pounds of skim milk to grain	Amount of skim milk to replace 100 pounds of grain
3 pounds of skim milk to 1 pound of grain.....	325
5 pounds of skim milk to 1 pound of grain.....	450
7 pounds of skim milk to 1 pound of grain.....	575

\*Feeds and Feeding by Henry and Morrison.

**Buttermilk.** This supplement when 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 more than 3 pounds of buttermilk to 1 pound of

grain in order to attain the greatest efficiency. Before paying a price for buttermilk equal to that of skim milk the purchaser should be sure that the buttermilk is not diluted. It is a very easy matter to dilute buttermilk with water and the dilution is very difficult to detect unless a moisture determination is made. In order to avoid the spreading of tuberculosis, creamery buttermilk should be heated to 180° F. if the cream has not been pasteurized before churning.

**Whey.** While whey is a dairy by-product and usually thought of in connection with skim milk or buttermilk, it is very low in its protein content. The protein present, however, is very efficient and when fed to fattening pigs will balance a ration of barley or wheat. Whey does not contain enough protein to balance a ration for growing pigs. For growing pigs, about 3 to 4 pounds of tankage should be fed to 100 pounds of grain together with all the whey they want.

Whey has a value of about one-half that of skim milk or about one-eighth to one-twelfth the value of grain. Skimmed whey has slightly lower value.

**Tankage.** Tankage, often called meat meal, is a by-product of the meat-packing industry. Waste meat, scraps, blood, 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 its protein content. In general there is no advantage in using tankage in combination with skim milk or other protein supplements of animal origin. Less tankage should be fed with barley to pigs on alfalfa pasture. About five pounds tankage will balance the ration under these conditions.

The following table gives the value of tankage as a protein supplement.

BARLEY AND TANKAGE

Station	Ration	Number of tests	Average daily gain	Feed to produce 100 pounds gain
Oregon.....	Barley	12	1.54	lb. 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

This table shows that 100 pounds or 60 percent tankage replaced nearly 300 pounds of grain.

Besides the foregoing 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. They also indicate the inefficiency of grain alone. 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 a ration containing 7 percent tankage gives just as good results as a ration with 17 percent; that is, the gains were as good and the total amount of feed to the 100 pounds gain no higher, thus showing that 5 to 7 percent was enough to balance the ration.

**Fish-meal.** Fish-meal is a protein supplement prepared from fish scraps and fish unsuited for human food. The fish and scraps are cooked, then pressed to express the oil, after which the residue is dried and ground.

Some fish-meals contain from 2 to 10 percent less protein than does tankage, but they contain more mineral matter, especially more calcium and phosphorus, bone-building compounds, which are important in hog feeding.

The following table gives the results of tests of tankage versus fish-meal.

Station	Number of tests	Ration		Daily feed	Feed to produce 100 pounds gain	
			%	lb.		lb.
Oregon .....	2	Barley	93	1.32	Barley	402
		Fish-meal	7		Fish-meal	30
Oregon .....	2	Barley	93	1.08	Barley	441
		Tankage	7		Tankage	33
United States .....	1	Corn	90	2.16	Corn	354
		Fish-meal	10		Fish-meal	39
United States .....	1	Corn	90	2.00	Corn	416
		Tankage	10		Tankage	46

From the table it will be observed that fish-meal is more efficient than tankage as a protein supplement. The average saving in feeding fish-meal in preference to tankage is 9 percent. The relative price of tankage and fish-meal will determine which feed should be fed. Fish-meal containing less than 45 percent protein can not be expected to be as efficient as the high-grade tankage.

**Coconut meal.** Coconut meal is the product resulting after the oil has been extracted from the copra, or meat of the coconut. There are two kinds of coconut meal, the domestic and Oriental. The domestic meal is made in America from copra imported from the Orient. The Oriental meal is made in the Orient and owing to the crude method of manufacturing still contains 30 to 40 percent fat. Most of the coconut meal on the American market is of domestic manufacture. The use of coconut products is being encouraged by commercial shipping interests of the Northwest to furnish return cargo for ships that have gone to the Orient with flour and lumber.

Some coconut meal tends to become rancid if stored for a long period, especially when it contains much moisture. Coconut meal varies as to palatability. Occasionally there will be a quantity that the pigs will not eat readily, probably because the fat has become rancid, although we can not be quite sure on this point.



In one test at Corvallis, growing pigs refused to eat coconut meal when fed as 21 percent of the ration, but in other tests they have readily eaten up to 50 percent coconut meal. In two tests coconut meal containing 43 percent fat was fed in the proportions of 25 percent and 50 percent of the total ration. In both cases the 25-percent ration proved to be the more satisfactory. The 50-percent ration had a laxative effect causing the pigs to scour. The standard domestic coconut meal was fed in two other tests, and each time a ration containing 25 percent coconut meal and 75 percent barley or wheat was the most satisfactory. In a ration of 25 percent coconut meal, the remainder being barley, wheat or corn, coconut meal is equal to any of the common grains.

**Linseed-oil meal.** Linseed-oil meal is the product remaining after the linseed-oil has been expressed from the flaxseed. It is very palatable, uniform in quality, keeps well, and is in all cases a safe feed. 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.

Linseed-oil meal is a satisfactory supplement to barley at the rate of 10 pounds of linseed-oil meal to 90 pounds of barley when the pigs are on pasture. Tankage and alfalfa should be added when the pigs are not on pasture.

**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 used to indicate the entire soy-bean ground fine, 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. Soy-bean oil meal can be used to replace linseed-oil meal when the prices are favorable.

**Cottonseed-meal.** Because of certain poisonous properties cottonseed-meal should not be used as a pig feed although it is very desirable for cattle and sheep.

**Alfalfa hay.** Alfalfa hay is a desirable supplement within certain limits. It contains the compounds which are lacking in the cereals, and where grown in abundance has the 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 total amount of feed consumed. Pigs will not consume a normal amount of any 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 a little better than grain alone. A few pounds of alfalfa meal in 100 pounds of grain mixture is a good thing in a ration for fattening pigs but under no conditions should more than 5 pounds be added to 100 pounds of grain. This amount is sufficient to add the necessary vitamins. With this small amount of alfalfa some additional feed such as tankage should be used.

**Protein mixtures.** A mixture of protein feeds is superior to a single protein feed especially if the single protein is a vegetable protein. A mixture of alfalfa meal and tankage is a better supplement to barley than either alfalfa meal or tankage alone.

A mixture of 2 parts tankage, 1 part linseed-oil meal and 1 part of alfalfa meal has been used with very satisfactory results by several of the Middle West stations. This mixture is fed at the rate of 12 pounds to 88 pounds of grain. Fish-meal can be used in this mixture in place of the tankage.

### SUCCULENTS

Succulent feeds have a very beneficial effect on the digestive system and produce unusually good returns in proportion to nutrients contained, but on account of their large water and fiber content they can supply only a small part of the total nutrients required. Their use, therefore, does not lessen to any large extent the amount of grain needed. When cheap, feeders are often tempted to feed succulents to excess with the result that the pigs make poor gains and do not get fat.

**Potatoes.** Cooked potatoes are possibly the best succulents for fattening purposes, but because of their high water content pigs will not consume a full ration if the proportion of potatoes is greater than 4 pounds of potatoes to 1 of grain. If a larger proportion of potatoes is used the pigs will gain more slowly and will put on but little finish. On potatoes alone pigs will make a very small gain in weight but will not fatten.

In several tests at Corvallis and Union with a ration consisting of four parts by weight of cooked potatoes to one part of grain, an average of 238 pounds of barley and 845 pounds of potatoes was necessary to produce 100 pounds gain. On this basis 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 that 400 pounds cooked potatoes saved 100 pounds of mixed grain. These results indicate that 400 to 425 pounds of cooked potatoes will replace 100 pounds of grain (barley, wheat, corn, or mixed grains), if fed in proportions not to exceed four parts cooked potatoes to one part grain.

**Roots.** Roots, 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 to one-fourth grain. 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 three pounds of mangels each in a day. In a recent experiment conducted at Corvallis, however, finely chopped mangels were fed successfully in self-feeders. The lot consisted of fifteen head, having an average initial weight of 183 pounds. The average daily gain was 1.64, and the daily feed consumption was 4.66 pounds of barley and 20.8 pounds of mangels. It required 1,261 pounds of mangels and 283 pounds of barley to produce 100 pounds gain. The heavy consumption of mangels is due to mixing the grain and finely chopped mangels before the 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 as 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, except sugar-beets, is so slight that the determining factor should be the comparative yield and cost of producing the crops. Such differences as there are seem to depend upon the dry-matter content.

**Artichokes.** As reported in Station Bulletin 54 one-eighth acre of artichokes supplemented with 736 pounds of mixed grain produced 244 pounds of pork. Allowing 450 pounds of mixed grain for 100 pounds gain, an acre of artichokes was worth 2,896 pounds of grain. Missouri Bulletin 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." Artichokes are grown to some extent on the richer bottom soils of the Coast counties of Oregon but are almost unknown in the other parts of the state.

**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 the other stations confirm these conclusions. This is probably due to the large amount of fiber contained in the silage.

Silage made from the ear corn without the stalks is a very satisfactory pig feed, but the pigs leave the cobs and husks and eat only the kernels. There seems to be no advantage in putting ear corn in the silo instead of putting it in the crib.

### MISCELLANEOUS FEEDS

**Molasses.** Cane molasses can be used to advantage in combination with other feeds. Tests at Corvallis show that one 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 proportionately better, thus making cane molasses more efficient than mill-run and at the same time inducing greater consumption and greater gains.

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.

In a test at Corvallis, one lot of pigs was fed as high a proportion of molasses as was possible in order to determine how much they could consume without any detrimental effects. The pigs were started on a 30-percent ration, which was gradually increased until 43 percent of the ration was molasses. A ration containing more than 30 percent molasses will cause the pigs to scour.

Molasses is especially good to mix with other feeds of an unpalatable nature. It is 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. Barreling adds approximately 50 percent to the cost of molasses. Farmers usually dislike molasses because it is unpleasant to handle.

**Garbage.** Garbage can be utilized as a hog feed without any detrimental effects on the pork produced although popular opinion is to the contrary. The only effect garbage has on the hogs is that it makes them rather paunchy and in that way lowers their dressing percentage.

In several tests at Corvallis, with garbage from the dormitories, it required from 1,500 pounds to 2,000 pounds to produce 100 pounds of gain. Gains as high as 1.5 pounds per day have been made by pigs fed on garbage alone. Restaurant and hotel garbage has a higher feed value than family garbage. It is not necessary to cook garbage; in fact cooking means an additional expense and does not increase the feed value unless the garbage is nearly all potato peelings. Cooking does not control the spread of disease and it is always necessary to vaccinate the hogs in case cholera is prevalent. Some feeders cook garbage in order to remove the grease, which they sell as soap grease, but the grease ordinarily does not pay the expense of cooking. In order to skim the grease off it is necessary to add enough water to cover the garbage, which increases the bulk and reduces the feed value. In addition, the grease has a feed value to the pigs of about two times the value of grain.

The laws of Oregon at one time required that garbage be cooked before feeding it to hogs, but this law has been repealed as a result of information obtained at the Oregon Experiment Station.

Since the supply of garbage always varies from day to day, it is a good plan to have pigs enough to eat up all the garbage at all times and then when there is not enough garbage, make up the deficiency with grain. Garbage should always be fed fresh as there is no very satisfactory way of storing it.

Hogs that are fed garbage from a city should be vaccinated for hog cholera.

When grain is fed to reduce the pig's "paunchiness" only grains that have a small amount of crude fiber such as barley, wheat or corn should be fed. Such feeds as mill-run or oats are too bulky and cause the same "paunchy" condition as garbage.

In tests at Corvallis, it was proved that garbage does not need a protein supplement such as tankage or fish-meal, as there seems to be sufficient protein in the garbage to balance the ration.

**Beans.** According to the Michigan Station, cooked cull beans fed with equal parts of corn made 1.5 pounds gain per day and required 406 pounds of feed to produce 100 pounds gain. When a straight ration of cooked beans was fed, the daily gains were not as much and it required more feed per 100 pounds gain. A ration containing more than one-half of cooked beans causes soft pork.

## PASTURE CROPS

**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 provided the animals are marketed under 200 pounds. Under these condi-

tions alfalfa pasture made a saving of 88.61 pounds barley to the 100 pounds gain.

Following is a table from *Feeds and Feeding* by Henry and Morrison.

Feed	Daily gain	Feed to produce 100 pounds gain
Corn and tannage .....	1.13	450
Corn, tannage, and alfalfa pasture.....	1.31	394

This table shows a great advantage for alfalfa pasture. The average initial weight of the hogs used was approximately 52 pounds; thus they were growing during the fattening period.

In general, light-weight hogs can utilize pasture to the best advantage. Pasture for fattening pigs must be good in all cases and the grain not limited.

**Clover pasture.** Clover pasture and rape pasture are of about equal value for hogs. They will not yield as much as alfalfa but will grow in localities where alfalfa will not grow and are especially suited to the Willamette Valley. Clover will furnish pasture earlier in the season than rape, while rape is at its best during the summer when clover is getting woody. Clipping clover when it is getting stemmy or woody will induce a new growth and greatly improve the pasture. Red clover is the most satisfactory variety for hog pastures. It is seeded at the rate of 8 to 10 pounds per acre.

**Rape pasture.** Rape can be sown either in rows or broadcast. Sowing in rows so it can be cultivated is generally more satisfactory for pasture in dry weather. It may be sown with a grain drill leaving the first hole open and plugging the next three holes, then leave one hole open, and so on across the drill. Rape should not be sown until the weather and the ground are warm, and it should be cultivated after each rain to keep down weeds and conserve moisture.

Rape should not be pastured until it is about ten or twelve inches high. After rape has been grazed down to four or five leaves to the plant, the hogs should be changed to another pasture and the rape cultivated. Then after a short time it can be pastured again.

Seed rape at about 3 pounds per acre in rows and about 5 pounds when broadcast. It is probably the best pasture in Western Oregon.

Rape is primarily a pasture crop to be utilized in July, August, and September or the dry season. Rape pasture has replaced, on the average for five years, 725 pounds of grain per acre of rape for fattening pigs. The returns from rape pasture have not been large as its growth is limited since moisture is lacking in the soil during the months that rape is expected to make its growth.

**Winter wheat.** Winter wheat planted in the spring makes a good hog pasture for Western Oregon. It yields only about two-thirds as much as rape or clover but it is better suited to poor undrained soil. It is necessary to keep the wheat grazed to about three or four inches in height or the

wheat will head and stop growing. Winter wheat may often be grazed the second season. Seed about two bushels per acre.

**Vetch and oats.** Vetch and oats are not as satisfactory as the foregoing crops. They do not stand the grazing as well and do not grow well after once having been eaten off.