Inedible Offal as a Hog Feed

Processing and Feeding by Small Slaughterers

by Bert D. Miner

FARMER COOPERATIVE SERVICE
U. S. DEPARTMENT OF AGRICULTURE
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Joseph G. Knapp, Administrator

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, financing, merchandising, product quality, costs, efficiency and membership.

The Service publishes the results of such studies; confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

This study was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

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Manufacturers and distributors of garbage and offal cookers supplied photographs of their equipment.

Contents

Summary and conclusions

Commercial rendering companies have been and still are major outlets for offal from small slaughter plants. Some small plants, however, are cooking it for hog feed. In 1955, approximately 200 out of about 3,400 small slaughter plants operating in conjunction with frozen food locker plants were cooking their offal for swine feed.

The Frozen Food Locker Branch of Farmer Cooperative Service sent a mail questionnaire to each of these 200 plants -- some of them cooperatives. From those plants returning the questionnaire, it selected 16 for detailed study. The plants varied widely in equipment and methods of operation. One plant operated a dry-rendering system; four plants wet-rendered offal; and 11 operated different kinds of offal cookers.

Volume. -- The replies showed that slaughter plants with only a small volume of offal could advantageously get into the cooking and feeding business.

A plant operator has to answer the following questions before he can determine the volume of offal available for processing: Is the hog offal as well as the cattle offal going to be cooked? Is the blood going to be cooked? Are the bones going to be cooked? And is the content of cattle paunches going to be cooked?

Suppose the answers to all these questions are yes and that the locker plant slaughters 3 times a week and averages 3 head of cattle and 7 head of hogs per slaughter day. The 3 cattle and 7 hogs would produce an average of about 900 pounds of raw material for cooking. This would be equivalent to approximately two 50-gallon barrels of offal. Some water would have to be added if the material is to be cooked in a direct-fire-heated cooker.

The resultant cooked offal would feed approximately 30 hogs for two days if fed at the rate of 12 pounds of cooked offal and $1\frac{1}{2}$ pounds of dry feed per hog per day. One could expect average gains of about $1\frac{1}{2}$ pounds per day.

Among the plants studied, volume of offal available for cooking influenced greatly the type and capacity of cooking equipment used and number of hogs fed.

One small operator ran a steam hose into two 50-gallon steel barrels that each had one end cut out. They were his offal cookers and they worked effectively. From the small amounts of offal he cooked, he fed 15 to 20 hogs.

Nine used gas-fire-heated, commercially made, mobile offal cookers with a capacity of between 225 and 275 gallons.

The largest operation was a dry-rendering plant. The dried and ground cracklings were bagged and sold to farmers for hog feed.

Legal Factors. -- Forty-seven States prohibit the feeding of raw offal. Connecticut is the only exception. The laws prohibiting the feeding of raw offal resulted primarily from the national outbreak in 1952 of a disease among swine known as vesicular exanthema.

The general requirement is that offal be cooked at 212^{O} F. or boiling temperature for not less than 30 minutes. Anyone wanting to cook offal for hog feed must also register with and obtain a permit from the designated State agency prior to beginning cooking operations. The State Veterinarian's office should be consulted for information.

Commercial Offal Cookers. -- As indicated previously nine of the 16 plants used commercially-made, mobile gas-fire-heated offal cookers with a capacity between 225 and 275 gallons. These cookers ranged in price from $600 to $800 depending on make and whether it came equipped with tires, fenders, or a recording thermometer. Some complaints against these cookers were the small size of the discharge door and the difficulty

of getting and maintaining the proper cooking temperature.

Homemade Offal Cookers. -- These cookers ranged in capacity from 50 to 500 gallons. They were steam heated and cost from $50 to $300 to make.

Feeding Arrangements. -- In 11 locker plants the operator and his employees handled the entire operation. In one plant one employee was hired especially to handle the cooking and feeding operation. One plant joined with a neighboring farmer to set up a separate company on essentially a 50-50 basis. Two plants set up informal partnerships with one or two farmers. The expenses and profits were shared equally. Three plants rendered the offal and sold the processed product.

Layout of Feeding Operation. -- The area should be well drained and fenced. Inexpensive shelters help protect the hogs in cold weather. The hogs can either be fed on a concrete feeding floor or in troughs of wood, metal, or concrete.

Sanitation. -- Sanitation is one of the key words to a successful hog feeding operation. Cooking the offal is no substitute for sanitation.

Starting Weight. -- Starting weight ranged from 40 to 160 pounds with no agreement on the most satisfactory starting weight. Eleven operators were convinced that pigs weighing 80 pounds or more did better than lighter ones. Some operators, however, obtained excellent results on hogs started at 40 to 45 pounds.

Some operators obtained excellent results feeding 2- or 3-year-old, thin sows.

Mortality Rate. -- Mortality rate ranged from 1 to 8 percent, according to the experience of 14 operators. Half the operators had a mortality rate of 3 percent or less.

Rate of Gain. -- Daily gains ranged between 1 and 2 pounds. Majority of operators said they got 1½ pounds of daily gain. This was influenced by ration, weight, and breed of pigs, among other things.

Problems. -- Raw offal is highly perishable and should, therefore, be processed quickly. The cooked offal is less perishable but must still be handled with dispatch. How fast it spoils will depend to a great extent on temperature and other weather conditions.

Usually the cooked offal has a high water content which makes it subject to freezing in cold weather. It should, therefore, be fed in quantities that can be consumed while still warm.

Economic Potential. -- A hypothetical example of the annual economic potential of cooking and feeding offal to swine -- based on information obtained from operators, manufacturers, and suppliers of offal cooking equipment, and other available data -- follows:

1. 270 pigs @ 120 lbs. (purchase weight) ..... 32,400 lbs.
2. 262 hogs @ 220 lbs. (market weight) ..... 57,640 lbs.
3. It would require about 25,200 pounds of dry feed and 202,000 pounds of cooked offal to bring these lots of hogs up to market weight.
4. Cost of fuel and cooking labor (100 loads @ $1.50)..... $150
5. Cost of dry feed (252 cwt. @ $2.43)..... 610
6. Cost of feeder pigs (324 cwt. @ $18)..... 5,830
7. Income from sale of hogs (576 cwt. @ $18)..... 10,370
8. Margin on sale of hogs ($10,370-$5,830)..... 4,540
9. Margin less feed, fuel, and cooking labor ($4,540-$760)..... 3,780
10. Average margin per hog ($3,780÷270 hogs)..... 14

From the $3,780 margin one must deduct annual operating expenses (other than items 4 and 5 which amounted to $760) to arrive at a profit figure. The same volume of offal would return approximately $1,000 if it were sold raw to a rendering company for ½ cent a pound.

To get into the business of cooking and feeding offal to hogs, the starting place is to find the volume of offal available for cooking. When this volume has been determined, one can more logically select equipment of a type and capacity that will best adapt to the particular operation. Volume and equipment, however, cannot make the operation successful by themselves. Good management is also essential.

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by Bert D. Miner

Frozen Food Locker Branch
Purchasing Division

During the past 20 years the meatpacking industry has been decentralizing. One aspect of this has been the rapid growth and development of small slaughter plants operated by frozen food locker plants -- cooperatives and others. These trends have created new problems in efficient utilization of animal byproducts.

Processing inedible offal[1] into animal feed has been a regular part of the operations of large-scale packers. Until recently, however, few small-scale slaughterers had been able to salvage this product profitably in this manner. With new methods these plants can now profitably cook it for swine feed.

Commercial rendering companies have been and still are the major outlet for inedible offal from small-scale slaughter plants. Prices received have been extremely low in recent years with some plants receiving little or nothing for this product. Still others with no reliable "pick-up" service are forced, at considerable expense, to dispose of it by burning or burying. This has placed many small slaughterers at a competitive disadvantage with large-scale packers.

In 1955, it was estimated that approximately 3,400 small slaughter plants operated in conjunction with frozen food locker plants in addition to several thousand other small slaughter and packing plants in the United States.

The frozen food locker plants alone slaughtered an estimated 2.8 million head of livestock in 1954. The total volume of inedible offal from these 2.8 million animals amounted to approximately 350 million pounds.

A practical and economical method of processing this offal into animal feed would not only improve the operating efficiency and sanitary handling of this product in small-scale slaughter plants but would also benefit farmers from the standpoint of improved market outlets for livestock and as a source of a low-cost feed supplement.

The Farmer Cooperative Service has received requests for research to help small-scale slaughter plants improve their utilization and disposal of inedible offal from individual locker operators, State frozen food locker associations, the National Institute of Locker and Freezer Provisioners and several colleges and universities.

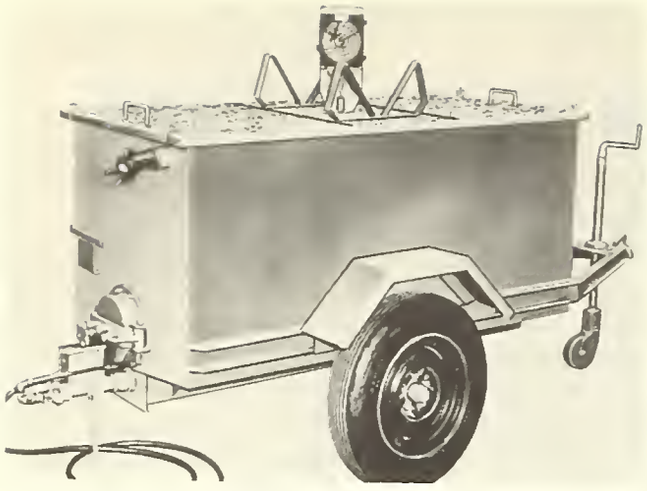
In response to these requests the Frozen Food Locker Branch in 1954 proposed research to determine practical and economical methods by which small-scale slaughter plants could process inedible offal. It submitted this proposal to the Refrigerated and Frozen Products Research Advisory Committee which approved it in both 1956 and 1957.

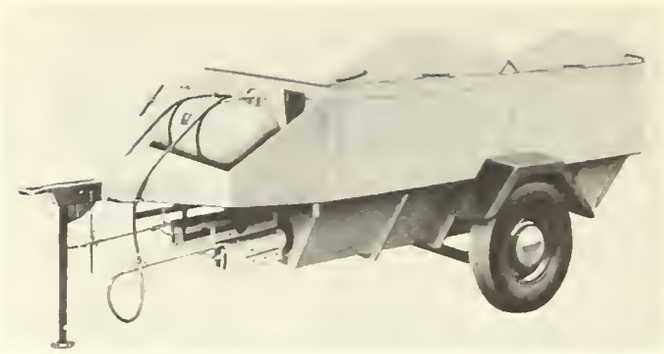
The objectives of this study were: (1) To ascertain the scope and importance of the problem, and (2) to obtain information on present methods being used by a representative group of slaughter plants that are processing inedible offal.

From a nationwide survey of the frozen food locker industry in 1955, it was estimated approximately 200 plants were processing the offal from their slaughter operation. A questionnaire went to each of these 200 plants to obtain information on their slaughter volume, equipment, methods of processing, and disposal of the processed product.

The information obtained from these questionnaires was the basis for studying

[1] Inedible offal - products not intended for human consumption such as viscera, blood and bones but which can be processed into animal feed.





These are commercially made gas-fire-heated mobile cookers used for cooking animal offal or garbage. In each case the discharge door is located in the lower section of the rear panel.

16 plants selected so as to obtain information that reflected variations in volume processed, methods, equipment, costs, mortality rate, daily gains, and other points.

Priority points to consider

Before deciding to begin processing operations, volume requirements and State and local legal requirements must be considered.

Volume

The major factor in determining volume of raw material available for cooking was slaughter volume. Some locker plants which slaughtered as few as 300 cattle and 300 hogs a year were heat-treating the offal for hog feed. The average slaughter volume for plants heat-treating offal was about 650 cattle and 800 hogs. The slaughter volume was greater for plants that rendered the offal.

How Much of the Inedible Offal Should Be Cooked?

Two operators did not cook swine offal because they feared that the hog offal might carry some swine diseases that might infect the herd. Proper heat-treatment, however, destroys such diseases and prevents their being passed on to the feeder stock. In fact, this was the purpose of enacting garbage cooking laws.

Should the Blood Be Cooked?

Thirteen of the 16 locker plants studied cooked the blood. It is high in protein. The primary problem seemed to be a matter of providing some way to catch the blood. Catching and cooking the blood also helped simplify sewage disposal.

Should the Bones Be Cooked?

Eleven of the 16 locker plants cooked the bones. With a wet- or dry- rendering system the bones presented no problem because they were softened and became palatable in the cooking process.

In the case of cooking or heat-treatment, however, the bones were not softened. The meat on the bones was cooked and when the hogs got through gnawing on them, the bones were clean and white. Then they were gathered up and thrown into a pile or wooden rack. In this condition they did not give off offensive odors. When several tons of bones had accumulated they were sold to a rendering company.

The other five locker plants disposed of the green bones either to a rendering company or to dog owners. The green bones had to be disposed of quickly or held under refrigeration; otherwise meat particles began to putrify and gave off offensive odors.

Should the Content of Cattle Paunches Be Cooked?

Seven of the 16 locker plants studied believed that the content of the paunch had considerable feed value and, therefore, cooked it. In addition they argued that to empty the paunch before cooking would only create another problem of disposing of the contents.

Other operators believed that the paunch content did not have sufficient feed value to warrant cooking and feeding it. Individuals using wet- or dry-rendering systems did not like to cook the paunch content because it resulted in a darker, lower grade grease or tallow, which sold at a reduced price.

Those plants that emptied the paunch before cooking disposed of the content to the city dump or used it for land-fill or fertilizer.

Once it has been determined what products are to be included in the offal to be cooked, an estimate can be made of the available volume of raw offal. If additional raw material is needed or wanted, it can be picked up from other slaughter plants and poultry dressing plants, or garbage from hotels, restaurants, cafes, schools, hospitals, grocery stores, produce houses, and other such places. Five of the 16 locker plants augmented their slaughter volume with raw material from these sources.

A few examples will help clarify the method of calculating available volume of raw material for cooking. The average per head weight of raw material used in these samples is based on information furnished by Ohio State University.

	Cattle	Hogs
	Pounds	
Viscera (including unemptied paunch)	145	22
Bones	42	8
Blood	30	6
Total	217	36
Contents of cattle paunch only	55	

Example A

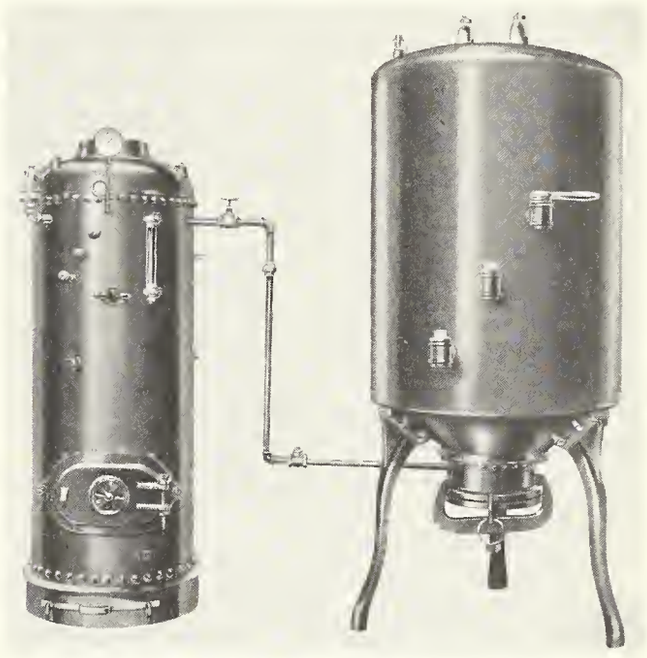
Suppose a locker plant slaughters 3 times a week and averages 3 head of cattle and 7 head of hogs per slaughter day. In this example the decision is made to cook the hog offal as well as beef offal and to cook the blood, bones, and paunch content. Then 3 cattle and 7 hogs would produce about 900 pounds of raw material for cooking.

The 900 pounds of raw material would be equivalent to approximately two 50-gallon barrels of offal.[2]

This, however, would be only about half a load for any of the known direct-fire-heated, mobile, commercially made garbage cookers.

How Many Hogs Will This Volume of Offal Feed?[3]

Some water would be added to the raw material to assure even cooking and prevent scorching. According to one manufacturer of offal cookers, this should amount to about 5 gallons of water to each 50 gallons of raw material.



The wet-rendering tank (right) allows live steam to enter directly into the mass of raw material at the lowest point in the tank. The boiler (left) provides the live steam.

[2] A supplier of slaughter equipment estimates that the range of weight for a gallon of offal can vary from a low of 7 to a high of 10 pounds.

[3] These calculations refer only to the volume of raw material available from the slaughter of 3 cattle and 7 hogs, assuming both cattle and hog offal -- including blood, bones, and paunch content -- are cooked. They do not include volume available from any other source.

On this basis, Example A would require about 10 gallons of water, making a total volume of raw material and water of approximately 110 gallons or 1,000 pounds.

This volume would yield only about 750 pounds of cooked offal for feeding, the difference being the weight of bones that could not be eaten and about 7 gallons of water lost during cooking.

Since the assumption was that this plant slaughtered only three times a week, the volume of offal obtained in 1 slaughter day should supply the hogs with feed for 2 days. Then the 3 slaughter days would yield a sufficient amount to feed the hogs 6 days a week. Grain or some other feed should be fed the seventh day.

The 750 pounds of cooked offal supplemented with about 90 pounds of grain would feed approximately 30 hogs for 2 days.[4]

Example B

It was pointed out previously that some of the locker plants did not cook the hog offal, blood, bones, or paunch content. In any event the amount not cooked would have to be excluded from the volume of raw material available for cooking. For instance, the volume of raw material available for cooking from three cattle and seven hogs, excluding bones and paunch content, would be approximately 556 pounds. Of course, if the hog offal and blood were excluded also, the volume of raw material available for cooking would be even less.

There is some question as to the feed value of the paunch content. This feed value would influence to some extent the number of hogs that could be fed on a given volume of cooked offal and the gains to be expected.

Example C

Suppose the problem of volume is approached from a different angle. In this case the locker plant already has a direct-fire-heated, mobile, commercially made garbage cooker of about 250-gallon capacity. How much slaughter volume would be needed to fill the cooker?

In this example it would require the offal, including blood, bones, and paunch content, from about nine cattle in addition to the recommended amount of water (about 5 gallons of water to each 50 gallons of offal) to fill the cooker. This was calculated as follows: 217 pounds of offal per animal divided by 8.5 pounds per gallon equal 25.5 gallons per animal; 250 gallons of capacity minus 25 gallons for water equal 225 gallons of capacity; 225 gallons of capacity divided by 25.5 gallons per animal equals about nine cattle whose offal would be required to fill the cooker.

Similarly it would require the offal from approximately 54 hogs in addition to the recommended amount of water to fill the cooker.

If, however, the blood, bones, or paunch content were excluded, it would require the offal from more animals to fill the cooker.

The various ratios of cattle offal to hog offal required to fill the cooker could also be calculated since the offal from one beef animal requires about the same amount of cooker space as the offal from six hogs.

Since so many factors influence the ultimate volume of raw material available for cooking, each plant operator must make his estimates based upon his particular situation.

Legal factors

Feeding inedible offal to hogs has been practiced by some small-scale slaughterers in the past. In most cases this offal was uncooked. This practice is now unlawful in most States. The laws prohibiting the feeding of raw garbage resulted primarily from the national outbreak in 1952 of a disease among swine known as vesicular exanthema.

The disease - commonly called V.E. - causes weight losses in mature hogs, slower gains in feeders, and sometimes death to sucklings.

V.E. is characterized by lesions or blisters on the feet and snout similar to those in foot-and-mouth disease. Control

[4] These calculations are based on a ration composed of 12 pounds of cooked offal and 1½ pounds of dry feed (mostly grain) per hog per day. Hogs on this ration should average gains of 1½ pounds per day.

and eradication of this disease are based on seven major points: Quarantine, prompt disposal of infected and exposed swine, cleaning and disinfection, inspection, prohibition of feeding raw garbage, control of marketing of garbage-fed swine, and dissemination of helpful information.

As of 1957, Connecticut was the only State that did not prohibit feeding raw garbage to swine. Raw garbage is defined to include raw animal offal.

The general requirement is that garbage be cooked at 212° F. or boiling temperature for not less than 30 minutes. Also, anyone wanting to cook garbage for hog feed must register with and obtain a permit from the designated State agency prior to beginning cooking operations.

More detailed information on the requirements for cooking garbage can be obtained from the State Veterinarian's office. Anyone interested in cooking garbage or offal for hog feed should consult the State Veterinarian's office and examine all applicable regulations.

Processing methods and equipment used

The type and capacity of cooking equipment used depended to a considerable extent upon the volume of raw material processed.

One of the locker plants operated a dry-rendering system. Four plants operated wet-rendering systems. The other 12 plants operated a variety of heat-treatment or cooking equipment.

Dry-rendering

Dry-rendering is a process in which fats are liberated or made available for recovery from fatty tissue. This is accomplished by heat and pressure in a horizontal, cylindrical, steam-jacketed tank. Steam admitted to the jacketed space heats the fatty tissue and causes the fat cells to rupture. It also evaporates most of the moisture contained in the fatty tissue.

After proper cooking the material is discharged from the cooker into a percolator where the free grease drains off. Then the residue or cracklings are pressed to extract more grease. After this, the round cakes of cracklings are usually ground and sacked for sale. The grease also is sold.

The smallest dry-rendering tanks have a capacity of approximately 4,000 pounds. Since few locker plants have sufficient slaughter volume to warrant the use of a dry-rendering system, it will not be discussed further.

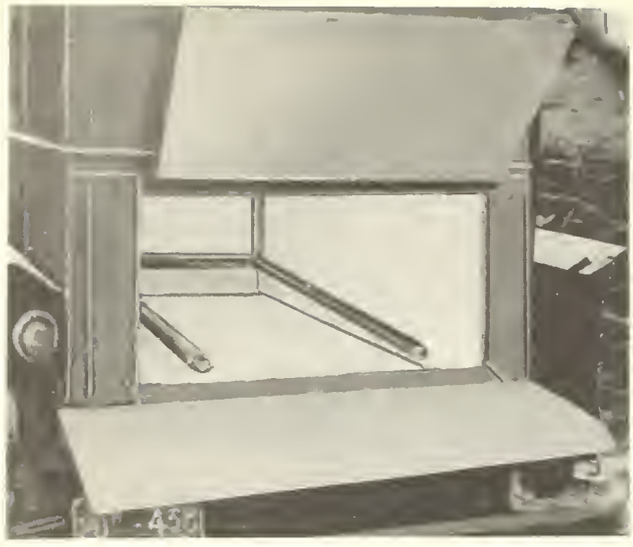
Wet-rendering

Wet-rendering also is a process in which fats are liberated or made available for recovery from fatty tissue. This is accomplished by heat and pressure in a vertical, cylindrical tank. In wet-rendering, however, the live steam is permitted to enter directly into the mass of raw material at the lowest point in the tank.

Usually after 6 to 8 hours the rendering is completed. Then the tank is allowed to settle for a couple of hours to permit separation of grease, water, and slush. After the grease is drawn off, the tank water is drained and the slush is dropped through the gate valve.

One of the locker operators emptied the tank water and slush into a large, horizontal, cylindrical tank on wheels. This trailer affair was then towed out to the feeding area and emptied. Another operator emptied this material into a chute which extended outside the building onto the feeding floor. The other two operators discharged it into drums which were then hauled to the feeding area. The average slaughter volume in 1955 for the four locker plants using wet-rendering systems was 960 cattle and 1,935 hogs. Two plants used 300-gallon rendering tanks and two used 500-gallon tanks.

In addition to the tank water (stick) and slush (wet tankage) used for hog feed, two plants indicated they received about $20 a barrel, or approximately $2,000 a year, from the sale of grease.



Rear view of a homemade, steam-heated, 500-gallon, offal cooker mounted on a truck. The steam pipes can be seen through the open discharge door. The wide metal lip beneath the discharge door directs the flow of cooked offal over the rear bumper.

Plants interested in wet-rendering should obtain a high pressure boiler of adequate capacity.

A five-horsepower boiler will provide adequate steam for wet-rendering tanks ranging in size from 150- to 300-gallon capacity. Additional information on rendering can be obtained from the manufacturers or distributors of rendering equipment.

Commercial offal cookers

Nine of the 16 locker plants used commercially made garbage and offal cookers. These cookers were mobile and gas-fire-heated and had a capacity of between 225 and 275 gallons.

Prices paid for these cookers ranged between $600 and $800, depending on the make and whether or not they came equipped with tires, fenders, or a recording thermometer.

In this type cooker the mass of raw material is heated by applying a direct flame to the bottom of the cooker. The heat is distributed upward through the mass. Water in the amount of about 5 gallons to each 50 gallons of raw material is added to provide a more uniform cook and prevent scorching. Even so the mass should be stirred occasionally during the cooking period to prevent "cold spots" and scorching.

This type of cooking is much different from rendering. The material is cooked for a relatively short period of time and without the use of pressure. Although some fat cells will rupture, the separation is far from complete.

In the plants studied, the length of time required to cook a load varied with the temperature and other weather conditions. A cold wind blowing on one side of the cooker forced the flames around the other side. In such cases it was extremely difficult to obtain an adequate cooking temperature throughout the load. The variable weather conditions caused some operators to build an inexpensive shed or provide another suitable undercover area for cooking.

After the material had cooked at 212° F., or boiling temperature, for not less than 30 minutes, it was allowed to cool. It was cooled in the cooker or was discharged through a door in the lower rear section of the cooker onto a feeding floor or into troughs to cool. Here again weather conditions influenced the method used. In cold weather it was desirable to hold the heat so the load was cooled in the cooker. In hot weather it was necessary to discharge the material onto a feeding floor or into troughs to prevent an unduly long cooling time.

One operator used a different type of commercially manufactured garbage and offal cooker. This cooker was oil-fire-heated, was on skids, and had a capacity of approximately 500 gallons. The distinguishing feature of the cooker was the method of discharging the cooked material. Unlike the aforementioned commercially made cookers, this one did not have a discharge door. Instead, the cooker, supported at either end on pivot points, tipped to the side dumping the contents out the top. A crank was turned to determine the degree and speed of tipping. It worked on the same principle as the old cement mixer.

This cooker sold new for about $700 excluding freight.

Homemade offal cookers

Two operators fashioned their own cookers. Both types were steam heated.

One cooker was a 500-gallon metal tank, 8 feet long, 4 feet wide, and 4 feet deep mounted on a 3/4-ton truck. About 4 inches off the bottom of the tank was a network of 3/4-inch pipes. These pipes were drilled with a number of 1/16-inch holes to allow the steam to escape and in this way cook the load of offal. A length of steam hose was used to connect the cooker to the boiler.

A large discharge door about $3\frac{1}{2}$ feet wide and 2 feet high was located low in one end of the tank. The metal door was hinged on top for ease of operation. During the cooking process the door was clamped down tight on a gasket to prevent leaking. Beneath the discharge door and projecting about 10 inches to the rear was a metal chute which directed the flow of cooked offal when the cooker was emptied.

There was also a tight fitting metal lid on the cooker which helped contain the heat and, hence, reduced the time and cost of cooking and prevented "cold spots."

It cost approximately $300 to construct this cooker. The used 3/4-ton truck, on which the cooker was mounted, was valued at $500.

The other cooker was a 50-gallon steel barrel with one end cut out. The barrel stood upright during the cooking process and was tipped on its side to empty. A piece of 3/4-inch pipe, predrilled with a number of 1/16-inch holes, fit across the bottom of the barrel. The pipe protruded about 4 inches out through the side of the barrel and was attached to a steam hose. Where the pipe went through the side of the barrel, there was a leak-proof weld.

A hand valve controlled the flow of steam from the boiler to the cooker. The lid consisted merely of an old number 10 wash tub placed upside down over the top of the cooker. To assist in emptying the cooker, a metal bracket was welded to the outside of the barrel about half way up the side. An overhead hoist lifted and held the cooker while it was tipped on its side for emptying.

It cost approximately $50 to construct this cooker. Depending on the volume of raw material available for cooking, one or more of these cookers could be used.

The major problem in using this type of cooker was transferring the cooked offal from the cooker to the feeding floor or troughs.

Most manufacturers of garbage and offal cookers are continually trying to improve their product. One of the latest models is shown in the picture on page 11. This model is scheduled to replace a discharge-door-type cooker and will sell for approximately $800 excluding freight.

Feeding arrangements and methods

In 11 locker plants the locker operator and his employees handled the entire operation of cooking and feeding offal. In these cases the locker plant operator furnished the capital, equipment, offal, hogs and anything else used in the operation. Since he paid the expenses and stood all the risk, he received all the profit, if there was any.

In only one of these locker plants was an employee hired especially to supply the labor for the cooking and feeding operation. This employee was responsible for keeping the abattoir clean, picking up some additional garbage around town, cooking and feeding, cleaning the feeding floor, and hauling and taking care of the hogs plus any other tasks that the locker plant operator assigned.

Three locker plants had made some kind of arrangements with a farmer. One of these plants had joined with a neighboring farmer to set up a separate company. The company paid all expenses, including gas for the cooker and boiler, any extra help, straw for bedding, barrels for offal, and so on.

The arrangement was intended to work on essentially a 50-50 basis. The locker plant furnished the offal, cooker, and boiler and did the bookkeeping. It furnished the offal without cost to the company even though the locker plant had to pay one-half cent a pound for some of the offal it picked up from the other locker plants.

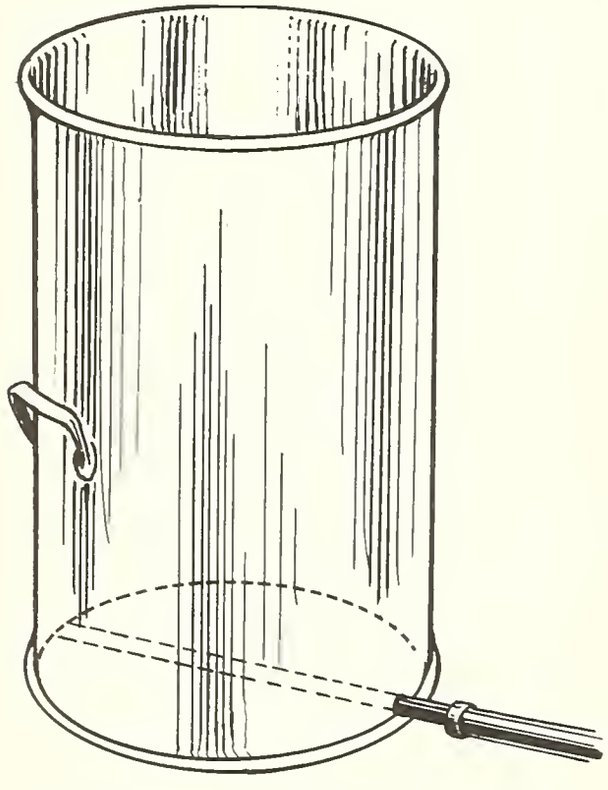
The farmer furnished the land, feeding floor, and water, attended to the

cooking and feeding, and trucked the feeder pigs bought in the community.

The other two locker plant-farmer arrangements were much like the one just mentioned except that they had no formal company set up. In each of these cases, it was merely an informal partnership arrangement. Therefore, the expenses as well as the other tasks were shared equally.

One plant, which dry-rendered its inedible offal, sacked the dried product into 100-pound bags for sale as animal feed.

Another locker plant wet-rendered its inedible offal. It sold the stick and wet tankage to a farmer for $400 a year on a 2-year contract. The farmer fed it to hogs. Based on the average quantity cooked per load, less the rendered grease, and the average number of loads cooked per week, this plant over the course of a year received approximately one-tenth cent a pound for the stick and wet tankage. It received about 5 cents a pound for the grease.



This is a homemade, steam-heated offal cooker constructed from a used 50-gallon, steel barrel. Steam enters the raw material from the pipe fitted across the bottom of the barrel. The handle on the outside of the barrel is used to lift the barrel while the contents are poured out.

Layout of feeding operation

The amount of land used in the feeding operation varied considerably from one location to another. The acreage used to feed 50 head of hogs ranged from one-half acre up to 25 acres. Those feeding 100 or more hogs used between 2 and 8 acres. Since the use of the land was one of the costs of a hog feeding operation, it was wise to make the most economical use of it.

Good drainage was very important in choosing the land for the feeding area. An all-weather road from abattoir to feeding platform was an important item. A tractor or truck and loaded cooker cut up a field rather quickly in wet weather. Some operators had to build and maintain a gravel road on their property so they could get to the feeding platform in wet weather.

Some operators found it to their advantage to construct relatively inexpensive shelters in the feeding area to protect the hogs in cold weather. Also, some operators in high rainfall areas were considering constructing some kind of roof over the feeding platform to prevent accumulation of water on the feeding floor.

The feeding area had to be well fenced. Most operators used a hog-wire mesh fence. Many operators used this same type of fence around the feeding platform, even for the gates. The two gates provided for control of the hogs, and supplied openings through which the cooker was moved onto the feeding floor, emptied, and moved off.

Feeding Platform

The feeding platform is usually constructed of concrete. It is important that high-quality concrete be used for the feeding platform because of the acid nature of cooked garbage and offal plus the abrasive action of cleaning and hard usage. If ready-mixed concrete is used, a mix containing 5 gallons total water for each sack of cement and at least eight sacks of cement for each cubic yard of concrete is needed.

Concrete properly cured adds strength and durability. Seven days of proper

curing can increase the strength by more than 40 percent. There are several satisfactory ways of curing it. Any covering that prevents evaporation of moisture from the concrete is suitable. It can be moist sacks or straw, impermeable paper, curing compound, or ponded water on the feeding platform.

A 4-inch thickness of concrete on a base of 4 to 6 inches of granular fill should be sufficient unless a tractor or truck is to be driven on it, in which case the concrete ought to be reinforced and increased to 6 inches. There ought to be a border of concrete 6 inches wide and 3 inches above the floor level around the outer edge of the feeding floor. About a 6-inch drain should be installed to facilitate cleaning the floor. Of course, the semi-solid material should be scooped up before washing the floor.

The size of the feeding platform will depend upon the number of hogs to be fed. A minimum of 5 square feet of floor space should be provided for each hog. On this basis it would require approximately 250 square feet of floor space to feed 50 hogs. Some operators said it wasn't good practice to feed more than 50 hogs on any one feeding floor. The larger hogs pushed the smaller ones off the floor.

The cost of a concrete feeding floor will depend upon its size, geographical location, and how much of the work is done by the operator, among other things. For instance, one feeding floor in Virginia cost approximately $305 in 1954. This included about $135 for concrete, $25 for lumber, $105 for fencing, and $40 for finishing stone. The floor was about 24 feet square and 6 inches thick.

Feeding Troughs

Many of the States do not require a feeding platform. In those States some operators preferred to use movable troughs.

One commercially manufactured trough measures 32 inches wide, 96 inches long, and $7\frac{1}{2}$ inches deep. One such trough will hold about 90 gallons of cooked offal. Three troughs will hold the contents of a 275-gallon cooker. Some operators made their own troughs out of either wood or metal. A pig requires about 15 inches of trough side to eat.

One advantage of using troughs was that they could be moved from one place to another. This was especially helpful where hogs were rotated from one field to another. Where the hogs had been rotated, it helped to build up the soil fertility.

There were other advantages. It cost less to buy or build a few troughs than it did to construct a feeding floor. If a locker operator decided to quit feeding hogs, the troughs could be moved off the land quickly whereas a feeding floor, a relatively permanent construction, became a nuisance.

Sanitation

Sanitation is one of the key words to a successful hog feeding operation. Cooking the offal and garbage is no substitute for sanitation.

Cooking offal soon after slaughtering is completed helps prevent unpleasant odors during cooking. Also, some chemical compounds on the market, when added to the cooking offal, help prevent unpleasant odors without harmful effect on the offal as hog feed.

The cooker should be kept clean. Material stuck to the cooker causes (1) scorching, (2) warping of the cooker bottom, (3) holes in the cooker bottom, (4) longer cooking time, (5) lower cooking temperature, and (6) unpleasant odors from the decomposing material.

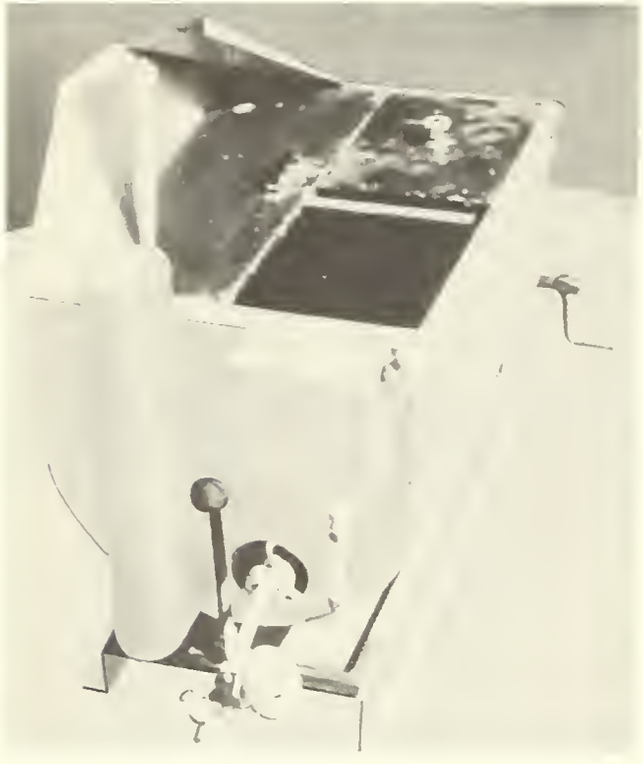
The feeding floor or troughs should be cleaned regularly and the waste disposed of. A clean feeding area helps prevent disease. Plowing or discing and then planting pasture grasses helps keep the feeding area disease free. Rotating feeding areas, where possible, also helps in this regard.

Clean, healthy pigs should be obtained to start with and the operator should make sure they have been inoculated for hog cholera and isolated from other pigs before putting them in his feed lot. A little money spent here may save considerably more in the long run. One operator did not bother to inoculate his feeder pigs until he lost 45 of them from

cholera. He inoculates all his feeder pigs now.

Records

An operator ought to know the number, weight, and price of any group of pigs bought or sold, number of hogs on feed each month, amount and estimated cost of cooked offal fed, amount and cost of any other feeds used. With this information at the end of a year, he can soon determine number of pigs bought, number sold, number still on feed, mortality rate, average starting weight, average sale weight, average daily gain, average purchase price, average sales price, total cost of feeder pigs, gross income from sale of hogs, total amount and cost of feed, average amount of feed required per pound of gain, and average cost per pound of weight gained.



This is a commercially made, oil-fire-heated offal and garbage cooker mounted on skids. The tank is tipped to the left to discharge contents. Note the hand crank at the right rear and the pouring spout at the upper left. The smoke stack (left front) must be removed before the tank is tipped.

Starting weight

The feeding of cooked offal presents a problem which so far does not have a satisfactory answer. It is: What is the optimum weight for starting hogs on cooked offal? Operators with from 2 to 8 years experience in feeding cooked offal did not agree on an optimum starting weight. Eleven operators were convinced that pigs weighing 80 pounds or more did better than lighter ones. Other operators started their pigs on cooked offal at 40 to 45 pounds and appeared to have good results.

Half a dozen operators said they got excellent results by feeding 2- or 3-year old, thin sows. One operator bought pregnant sows and fed them cooked offal. The young pigs began eating the cooked offal at about weaning age. After the pigs were weaned, the sows and pigs were fattened and butchered.

Sometimes the lighter weight hogs "scoured," if the transition to cooked offal was made too quickly. Most of the operators fed some grain in addition to the cooked offal to prevent scouring and to provide what they considered a more adequate diet.

Mortality rate

Experience of the 14 operators feeding cooked offal to hogs indicated a mortality rate ranging from 1 to 8 percent. Half the operators had a mortality rate of 3 percent or less. Some of the higher rates could be partially explained by disease or unforeseen circumstances. One operator lost 21 head from necro or salmonellosis. Another lost 36 from pneumonia. Another lost 45 from cholera. These diseases are not confined to garbage or offal fed hogs. Lightning killed 30 head at another place.

Rate of gain

Daily gains averaged between 1 and 2 pounds, according to the experience of cooked-offal feeders. The majority of feeders estimated they got about $1\frac{1}{2}$ pounds of daily gain. The rate of gain was influenced by the ration fed and the weight and breed of pigs, among other things. In turn, the rate of gain, coupled with the starting and marketing weight, influenced the length of feeding. Because of the variables, the length of feeding

ranged from 3 or 4 weeks to several months.

Problems

Many of the problems that arose in cooking and feeding offal to hogs have been treated elsewhere in this report. A few other problems, however, should be brought to the reader's attention.

Two characteristics of cooked offal created problems. These characteristics were perishability and high water content.

Because of its perishability cooked offal putrified. How fast it spoiled depended to a great extent on the temperature. It therefore kept longer during cool weather than during hot weather.

On the other hand, the high water content presented a problem during cold weather because if the offal was not eaten while warm it froze. Of course, the hogs could not eat a frozen product.

Some operators expressed difficulty in obtaining as many feeder pigs as they needed. In part this was caused by the very nature of hog farrowing. On the two-litter system the supply of feeder pigs became relatively plentiful only twice a year. Even then, a great many farmers fed out their own pigs rather than selling them for feeders.

Because of this difficulty in obtaining the desired number of feeder pigs from outside sources, some of the locker operators, or their partners in the cooking and feeding operation, farrowed and raised their own. Some operators balanced their herd by feeding thin sows or older hogs.

This is one of the latest models in commercially made, gas-fire-heated mobile offal and garbage cookers. The tank is in dump position. See open discharge door lower right. The tank is so positioned on the support frame that it can be tipped either mechanically or manually. This picture shows the mechanical tipping lever - upper center of tank to lower left on frame.

Some economic potentials

The lack of adequate data greatly hindered an accurate evaluation of the economic potentials in feeding cooked offal to swine. Therefore, the economic potentials given here are only an approximation. This section, however, has value in showing a procedure for calculating the economic potential of feeding cooked offal to swine.

The assumptions used in this section are based on information obtained from 14 frozen food locker plant operators who feed cooked offal to swine and from available information on cooking garbage for swine.

Operators can analyze their own operation by inserting their figures in place of those used in the following example D:

Assumptions[5]

1. "Starting" weight of feeder pigs..... 120 pounds
2. Rate of daily gain..... $1\frac{1}{2}$ pounds
3. Marketable weight..... 220 pounds
4. Mortality rate..... 3 percent

[5]Appendix A includes a discussion of each of the assumptions.

5. Days hogs fed to reach average of 220 pounds..... 67 days
6. Average number of hogs fed at a time..... 50 hogs
7. Herd "turnover" average per year..... 5.4 times
8. Pounds of cooked offal combined with 1 pound of dry fed to produce a pound of pork..... 8 pounds
9. Estimated cost of fuel and labor to cook a load of offal (250 gal.)..... $1.50
10. Purchase price of feeder pigs (per 100 pounds)..... 18.00
11. Sale price of marketable hogs (per 100 pounds)..... 18.00
12. Cost of dry feed (per 100 pounds)..... 2.43
13. Cost of raw offal..... 0

Calculations

1. 270 pigs @ 120 lbs.....32,400 lbs.
2. 262 hogs @ 220 lbs..... 57,640 lbs.
3. It would require about 25,200 pounds of dry feed and 202,000 pounds of cooked offal to bring these lots of hogs up to market weight.
4. Cost of fuel and cooking labor (100 loads @ $1.50)..... $150
5. Cost of dry feed (252 cwt. @ $2.43)..... 610
6. Cost of feeder pigs (324 cwt. @ $18)..... 5,830
7. Income from sale of hogs (576 cwt. @ $18)..... 10,370
8. Margin on feed of hogs ($10,370 - $5,830)..... 4,540
9. Margin less fuel, and cooking labor ($4,540 - $760)..... 3,780
10. Average margin per hog ($3,780 ÷ 270 hogs)..... 14

Annual operating expenses

From the $3,780 margin one must deduct annual operating expenses (other than items 4 and 5 which amounted to $760) to arrive at a profit figure. It is possible only to give an approximation in this report as to what these expenses may include.

Depreciation on the Cooker. -- Using an average purchase price of $700 and an average depreciation base of 5 years, the annual depreciation would be $140.

Depreciation on the Feeding Floor. -- Using an estimated cost of $300 and a depreciation base of 20 years, the annual depreciation would be $15. The floor, however, should be resurfaced every 3 or 4 years because of the acid nature of cooked offal, and the rough wear from hogs and cleaning.

Depreciation should also be figured on any other equipment or facilities used in the hog feeding operation, including sheds, self-feeders, hog waterers, tractor, truck, and so on. If some of the equipment is used in other parts of the business, the depreciation on that equipment should be allocated accordingly.

Use of Land. -- A reasonable charge should be made against the offal cooking and feeding operation for the land used for this operation. This can be estimated from the going rental rate for similar land in the area.

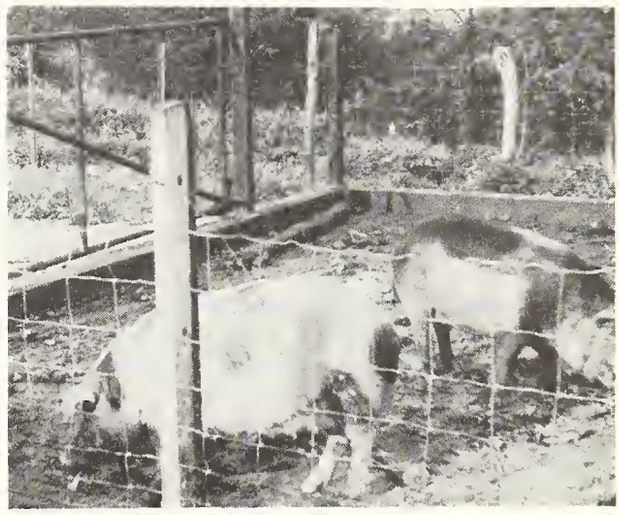
License Fee. -- This varies by States and even within the same State. Some have no charge for a garbage cooking permit. Some charge as much as $100 a year. Most States use a fixed charge regardless of the number of hogs fed. Three have a sliding scale of charges dependent upon the number of hogs fed.

Labor. -- The amount of labor expense chargeable to the cooking and feeding operation will vary. No reliable estimates were available for this item. It could include, but not be limited to, labor for such things as buying, inoculating, feeding, and selling hogs; buying and grinding grain; and cleaning feeding floor or troughs.

Other Expenses. -- These might include interest on investment, transportation, repairs and maintenance, insurance, veterinarian fees, water, insecticides, and other such items.

It is obvious from example D starting on page 11 the profit potential is influenced

Two views of a typical concrete feeding floor enclosed with mesh-wire fencing. Note the wide gate opening onto the feeding floor. There is a similar gate at the other end of the floor.



by such factors as mortality rate, rate of gain, starting weight of hogs, annual operating expense, purchase and sale price of hogs, price of grain, cost of cooking offal, cost of raw offal, and composition of the ration.

Example D provides a basic understanding and a framework for measuring any particular operation by inserting the proper figures.

Additional research needed

This report should prove especially useful to those small-scale slaughterers who are examining the possibilities of cooking the offal from their plants for hog feed.

More precise data are needed to verify several points. A few questions will indicate areas that need covering:

How much cooked offal is required to feed a hog per day?

How much cooked offal is required to produce a pound of gain?

Should cooked offal be supplemented with other feeds to produce the most economical gains?

Should the paunch content of cattle be cooked?

Should the grease be skimmed off before feeding?

Should the bones be cooked?

What is the most economical weight to start pigs on cooked offal?

How can present offal cooking equipment be improved?

What is the value of cooked offal as a feed in terms of other feeds?

Answers to these and related questions are needed to help small plants make the most profitable use of their inedible offal. Research to provide more accurate answers will call for studies of operations under controlled conditions which were not possible in this exploratory report.

Appendix

Here a discussion is presented of each of the assumptions used in example D starting on page 11.

1. Starting weight of feeder pigs. -- Wide variations existed in the starting weight. Since many operators stated they preferred to start heavier hogs, it was decided to use 120 pounds starting weight. This does not mean to imply that pigs cannot be started at lighter weights with satisfactory results. As a matter of fact some feeders were getting excellent results with pigs started on cooked offal at 45 to 50 pounds.

2. Rate of daily gain. -- All feeders estimated they were getting between 1 and 2 pounds of daily gain. Most of them estimated the gain to be about $1\frac{1}{2}$ pounds.

3. Marketable weight. -- The marketable weight of 220 pounds does not mean that all feeders market their hogs at that weight. Some hogs were marketed at lighter weights and some heavier.

4. Mortality rate. -- The 3 percent mortality rate was based on the experience of some 14 feeders. Among these feeders the rate varied from about 1 to 8 percent with an average of 3 percent.

5. Hogs fed an average of 67 days to reach 220 pounds. -- This was a calculated figure. The hogs must gain approximately 100 pounds each. At the rate of $1\frac{1}{2}$ pounds a day, it would take 67 days.

6. Feed an average of 50 hogs at a time. -- Since many operators stated they were feeding approximately 50 hogs, it was decided to use this figure in example D. The number of hogs fed generally varied with the volume of cooked offal.

7. Herd turnover averaged 5.4 times a year. -- This was a calculated figure. Since it would take about 67 days to feed one lot, approximately 5.4 lots could be fed in a year (365 ÷ 67 = 5.4).

8. The ration. -- The assumption was that approximately 1 pound of dry feed and 8 pounds of cooked offal would produce a pound of gain. This assumption was based on a garbage feeding study conducted at Virginia Polytechnic Institute (VPI), Blacksburg, Va. The results of this study will be published shortly.

This study showed that one group of hogs started at 118 pounds and marketed at 224 pounds consumed an average of 2.4 pounds of dry feed and 20.3 pounds of cooked garbage a day and averaged 2.54 pounds in daily gains. Further, the study showed that all groups of hogs 118 pounds or heavier gained more than 1 3/4 pounds a day regardless of the composition of their ration. Some averaged gains as high as 2.6 pounds a day.

For the ration assumption in example D, the 2.4 pounds of dry feed and 20.3 pounds of cooked garbage were broken down to give the feed requirements per pound of gain. To do this, 2.4 and 20.3 were each divided by 2.5; hence, 1 pound of dry feed and 8 pounds of cooked garbage per pound of gain.

In the assumption, however, cooked offal was substituted for cooked garbage. It is believed that cooked offal will produce equal or better results than cooked garbage. Nevertheless, the conservative figure of $1\frac{1}{2}$ pounds of daily gains was used.

The dry feed portion of the ration used in the VPI garbage feeding study consisted mostly of corn with some soybean oil meal and some alfalfa meal. When feeding cooked offal instead of cooked garbage, the soybean oil meal could probably be eliminated. This would reduce slightly the cost of the dry feed. The dry feed used in the VPI garbage feeding study cost approximately $2.43 per 100 pounds.

9. Estimated cost of fuel and labor to cook a load of offal (250 gal.). -- This cost was based on information obtained from feeders who were using gas-fire-heated, commercially manufactured, mobile garbage cookers. It included the estimated cost of gas and labor (only the labor needed to load the cooker and attend it during cooking) required to cook a load of offal.

10. Purchase price of feeder pigs (per 100 pounds). -- This price was based on market prices reported from Chicago in March 1957.

11. Sale price of marketable hogs (per 100 pounds). -- This price was based

on market prices reported from Chicago in March 1957.

12. Cost of dry feed (per 100 pounds). This cost was based on the ration used in the garbage feeding study made at Virginia Polytechnic Institute.

13. Cost of raw offal. This cost was based on the fact that some locker plants received nothing for their inedible offal.

If, however, a locker plant receives some income from the sale of its inedible offal, this fact should be considered when deciding whether or not to cook the offal for hog feed. For instance, example D required 202,000 pounds of offal. If the locker plant could get one-half cent a pound for the sale of it, the return would amount to about $1,000.

Of course, a plant might incur an expense in disposing of its offal, but if the offal were cooked for hog feed the disposition expense would result in a saving. In one locker plant these savings amounted to an estimated $30 a month.

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