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To the Graduate Council:

I am submitting herewith a thesis written by Jerry C. McMaster entitled "Comparison of Confinement and Pasture Systems for Growing and Finishing Swine from Birth to Market." I recommend that it be accepted for nine hours of credit in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Husbandry.

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COMPARISON OF CONFINEMENT AND PASTURE SYSTEMS FOR GROWING
AND FINISHING SWINE FROM BIRTH TO MARKET

A Thesis
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
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CHAPTER I

INTRODUCTION

The growing and finishing of pigs in confinement on concrete feeding floors, called "pig parlors" by many producers, has received increasingly more attention as a system of producing market hogs in recent years. This system of growing and finishing hogs has been made possible by recent advances in swine nutrition. Formerly, pasture was relied upon to correct some nutritional deficiencies in swine rations and to replace a limited part of the protein and energy requirements.

Because of the increased knowledge of the nutritional requirements of the pig, together with the availability of vitamin supplements and other feed additives, rations for confinement or drylot feeding can now be formulated so that the gains and efficiency of pigs fed in confinement are comparable to or greater than, in many cases, those obtained on pasture.

This and other factors has made confinement systems of producing market hogs attractive to some producers and has led many to question the economic value of including pasture in a production program. However, only a limited amount of work has been done to compare the performance, feed requirements and production costs under confinement and pasture systems. This is particularly true for systems which include the period from birth of the pigs to weaning time.

This experiment was conducted at the University of Tennessee

Field Station at Ames Plantation to obtain comparative data relative to the performance, feed requirements and costs of production of pigs produced from birth to marketing in confinement and pasture management systems.



CHAPTER II

REVIEW OF LITERATURE

There has been a considerable amount of work in recent years at many universities involving the use of pasture and confinement systems for growing, finishing and marketing swine.

Hanson (1958) had the following to say about pasture: "Fifty years ago pasture was indispensable for economical swine production. The pasture, if of good quality, supplied many vitamins, some protein and calcium. As rations have improved, the nutritional advantages of pasture over drylot feeding, for market pigs, have diminished." Hanson (1955) compared pasture and drylot data obtained at the Minnesota Station and raised the question whether the use of land for hog pasture was the best use of that land.

Conrad and Beeson (1957) reported three experiments in which drylot and pasture feeding of self-fed pigs was compared. The pasture was either alfalfa-Ladino clover or Ladino clover of excellent quality. The rates of gain were about the same under both systems of feeding. The pigs fed on pasture required an average of 4.9 per cent less feed per unit of gain. This was equal, at prevailing feed prices, to 66 cents per 100 pounds of gain or \$23.76 per acre of pasture (20 pigs per acre x 180 pounds of gain per pig x 66 cents per 100 pounds gain).

The commercial development of low cost vitamin supplements during the past 10 years has made it unnecessary for the feeder to depend on

natural feedstuffs as a source of vitamins. For example, if the feeder wished to feed in a closed building, without sunlight and with no vitamin A, D, riboflavin, niacin, pantothenic acid or vitamin B₁₂ supplied in the basal ration, at prevailing prices he could add these vitamins in ample quantities for 75 to 80 cents per ton of complete feed.

In some cases confinement feeding is referred to as "pig parlor" feeding, whereas others consider it growing pigs out on concrete or even in dirt lots. Confinement feeding is on the increase in many areas of the country because land values have increased to the point where it does not pay to finish pigs on pasture. The land will give greater returns when used to grow corn or other crops. Moreover, the newer knowledge of swine nutrition has made it possible to compound rations which give as good, or even better results, than finishing pigs on pasture. In the early experiments comparing pasture and drylot feeding, the pasture was covering up many nutritional inadequacies of the drylot rations used then. With present rations which are adequate in amino acids, vitamins and minerals, the special nutritional value which pasture used to have is no longer apparent in most cases for the growing-finishing pig. However, it is still recommended, on the basis of present knowledge, that breeding animals or those being grown out for herd replacement be kept on high quality pasture as much as possible.

USDA Farmers Bulletin 2166 (1961) contains the following statements: "Good pastures can supply a large part of the protein, calcium, and vitamins needed by swine but with advances in swine nutrition, we

are less dependent on pasture for growing-finishing hogs. However, pigs intended for feeding out on concrete or in a drylot, will do better if they have had access to abundant green grazing during their suckling period. Proper pasture use benefits both pasture and animals. Grazing too closely harms plants. Under-grazing allows plants to mature too much and lowers their digestibility and palatability. Pastures differ widely in carrying capacity, the amount depending on the crop, soil fertility and climate. A fair to good pasture may carry five to fifteen 100 pound hogs per acre. Hogs on pasture distribute manure uniformly. This saves the expense of removing and distributing manure---a considerable cost in platform feeding. Pastures are more valuable for the breeding herd than for other classes of swine. The feed requirements of pregnant sows can be nearly filled by pasture under ideal conditions. Normally, grazing can replace one-third to two-thirds of a gestation diet."

Feed cost is very important when figuring cost of producing swine. Hale (1962) reported that the feed cost from weaning to a 200 pound market weight represents from 80 to 85 per cent of the total cost. About 565 pounds of feed is required to feed a 35 pound pig to 200 pound market weight. If the total cost is expressed in terms of pounds of feed, 701 to 665 pounds of feed represents the feed cost plus overhead cost such as labor, taxes, interest, depreciation and veterinary cost.

Luscombe (1961) made the following observations. Labor cost of producing 200 pound pigs represents 10 per cent of total costs. The

producer must plan for minimum manual labor, amenable working conditions, and maximum opportunity to observe the stock. In confinement feeding, the removal of dung and urine from the concrete can become a problem. Luscombe (1961) gives these figures for 100 pigs at 100 pounds live weight. They will need approximately 400 pounds of feed and 1,000 pounds of water every day, and will excrete at least 1,200 pounds of dung and urine.

Tanksley (1960) made the following remarks about the value of pasture. In the past, pasture has made a valuable contribution toward making deficient rations adequate and therefore, pasture has "covered-up" for many nutritional deficiencies. Work at several stations ten years ago indicated that good pasture saved about 10 per cent of the grain and 30 to 40 per cent of the protein supplement required per 100 pounds of gain. These results were obtained, in some cases, with rations that are deficient by today's recommendations.

Recent work at Purdue, quoted by Tanksley (1960), shows that good alfalfa-Ladino clover pasture saved 2 to 5 per cent of the grain and 10 to 20 per cent of the protein supplement. If good pasture reduced grain needed by 3 per cent and protein supplement by 15 per cent, pasture would reduce the feed cost per hundred pounds of gain by \$0.58 (9 pounds grain saved at \$2.50 cwt., 7 pounds supplement saved at \$5.00 cwt.). If 15 hogs were fed per acre and each gained 180 pounds, the pasture would have a feed replacement value of \$15.66 per acre ($180 \times 15 = 2,700$ pounds pork $\times$ \$0.58). Pastures result in greater savings if rations deficient in protein, vitamins or minerals are used.

The Purdue work further indicated that a less complex ration can be fed to pigs on good pasture as compared to drylot with similar results in terms of rate of gain and feed efficiency. Also, feed preparation costs (grinding-mixing-formulating) are usually less with the more simple ration fed on pasture.

The following summary compiled by Geurin (1958) of the Florida Agricultural Experiment Station and cited by Cunha (1959) is typical of present day information on drylot versus pasture feeding:

	<u>Drylot</u>	<u>Pasture</u>
No. test comparisons.....	69	69
No. of hogs.....	633	640
Average daily gain, pounds.....	1.48	1.40
Feed per 100 pounds gain, pounds....	324	315
Feed saved per pig from weaning to market by pasture, pounds.....	-	16
Feed saved per 100 pounds gain by pasture, pounds.....	-	9

The 16 pounds of feed saved per pig by pasture would be worth from 48 to 64 cents if feed costs were 3 or 4 cents per pound, respectively. Assuming that 20 pigs were run on each acre, this would be a return of \$9.60 to \$12.80 per acre of pasture. It must also be considered that the pigs gained a little slower on pasture. These relatively low returns for pasture are one of the reasons why more swine producers are going to confinement feeding.

A recent Florida experiment reported by Wallace and Combs (1958) is in agreement with Geurin's (1958) summary. They found excellent quality legume pasture saved only 18.1 pounds of feed per weanling pig being finished on pasture as compared to drylot. The value of the

feed replaced per acre of pasture was \$12.67. Pigs restricted to 80 per cent of a full ration on pasture, required 29.7 pounds less feed per pig than those in drylot. However, the value of feed replaced per acre of pasture was only \$11.78, since the carrying capacity was less and the pigs gained at a slower rate than those full-fed on pasture.

Swine experiments at Ohio reported by Robinson (1955) give the following value to pasture. Based on the gains produced per unit of feed consumed, mixed pasture, Ladino clover, red clover, alfalfa and bluegrass ranked in the order named as pastures for pigs in a 1954 experiment. The mixture contained Ladino clover, red clover, and timothy but was predominantly alfalfa. It was believed to be in a more favorable location for moisture than were the pastures on the other plots. There were no marked differences in either the rate or the efficiency of gains of the pigs. The stand of red clover was poor. Red clover and bluegrass carried fewer pigs per acre. Based on the gain per acre, the feed prices used, and the amounts of the various feeds required per unit of gain by the pigs in drylot and by those on pasture, the mixture, Ladino clover, alfalfa, red clover and bluegrass pastures were worth \$37.62, \$37.13, \$31.25, \$27.66 and \$24.87 per acre, respectively, as pastures for pigs. A first cutting was removed from the plots.

Carlisle et al. (1963) gives the following advantages and disadvantages of all-concrete confinement systems of swine production.

Advantages of all-concrete systems are:

1. A possible saving in labor in providing feed and water.

2. Better control of environment. The hogs can be kept warmer and dryer in the winter and spring and cooler in the summer than under most field systems.

3. Better control of internal parasites.

4. On all tillable farms, the possibility that former pasture land can be put to a use that will return more per acre than when used for finishing pigs.

If extremely careful management practices are followed, the confinement system can be successful. However, to make it successful, attention must be given to many details that are not so much of a problem in a pasture system.

Some of the disadvantages are:

1. The system involves a large investment in buildings and concrete lots. To pay for this cash outlay, lots and buildings must be used the year round. Careful planning of breeding, feeding and marketing programs is necessary to keep the production line going.

2. Infectious diseases may be more of a problem when hogs are concentrated in a small area than when they are on pasture. Programs should be planned so that all lots, buildings, and equipment can be completely cleaned and will be free of all hogs for at least a week between hog crops. Extreme care must be taken to keep pens and buildings clean if disease outbreaks are to be prevented. Disease control can be a big problem.

3. More care must be given to feeding adequate rations under this system. Good pasture takes care of many mistakes in feeding,

but with hogs in drylot adequate amounts of minerals, vitamins, and properly balanced protein must be supplied at all times.

4. Manure disposal, tail-biting, cannibalism, flies, odors, and feet and leg troubles cause problems in some confinement systems.

Hutchinson et al. (1957) reported two experiments involving pasture and drylot comparisons where complete and free-choice feeding were used. The effects of drylot vs. pasture management, and of complete rations vs. free-choice feeding on rate of gain, feed efficiency, and carcass quality were studied using crossbreds, Durocs, Hampshires, and Yorkshires. Under the conditions of these tests, the shelled corn and supplement fed free-choice, rather than a complete ration on pasture, resulted in significantly poorer growth and performance. Pasture feeding resulted in a saving of about 45 per cent of supplement per pound of gain when compared with drylot. The poorest growth performance, but the most efficient gains and best carcass characteristics, were exhibited by the Yorkshire breed. In Experiment I, the pigs fed free-choice in drylot had a higher yield of the four lean cuts than pigs on the other three treatments which included complete and free-choice feeding on pasture. In Experiment II, both pigs fed free-choice in drylot and on pasture had a higher yield of the four lean cuts than pigs fed a complete ration either on pasture or in drylot ($P < 0.01$).

Becker et al. (1958) compared complete and free-choice rations fed to pigs on pasture and in drylot. The free-choice ration consisted of supplement and shelled corn. The complete ration was the same except that the corn was ground and mixed with the protein supplement. Becker

stated that pigs fed complete rations on pasture gained considerably faster than pigs fed free-choice rations on pasture. Apparently most of this difference resulted from a difference in feed intake since there was only slight variation in the feed efficiency. The most economical gains were made by pigs fed a free-choice ration on pasture. This lower cost was due to greater feed efficiency and elimination of grinding and mixing costs. Feeding free-choice rations on pasture appears to stimulate greater forage consumption, which decreases the amount of grain and supplement required per pound of gain. But, as previously mentioned, it also decreases rate of gain.

Costs in this experiment were \$9.14 for the complete ration versus \$8.29 for the free-choice ration per hundred weight of gain on pasture. No charge was made for pasture. Costs for drylot were \$9.48 for the complete ration and \$9.77 for the free-choice ration. The rates of daily gains of pigs were higher with complete rations, 1.42 pounds in drylot and 1.40 pounds on pasture. Pigs fed free-choice rations had daily gains of 1.35 pounds in drylot and 1.11 pounds on pasture.

Terrill (1958) at the Illinois Swine Growers' Day reported a summary of four experiments. Feed costs per 100 pounds of gain averaged \$9.06 for pigs in drylot and \$8.89 for pigs on pasture. Feed per pound of gain was 3.04 pounds for drylot and 2.99 pounds for pasture. Pigs on pasture consumed 0.29 pound (7 per cent) less feed per pig daily than pigs in drylot. Pasture pigs required about the same amount of feed per pound of gain as drylot pigs. If the difference of 0.05 pound

feed (3.04 minus 2.99) per pound of gain applied to all drylot-pasture comparisons, the feed savings value of an acre of pasture could be calculated as follows: 20 pigs per acre each gaining 180 pounds = 3,600 pounds pork; 3,600 pounds pork x 0.05 = 180 pounds feed saved per acre; 180 pounds feed x 2 1/2 cents per pound = \$4.50 (calculated feed saving value of an acre of pasture).

Whatley (1959) reported an Oklahoma experiment comparing pasture and confinement systems. Sows raising litters on pasture weaned heavier pigs and heavier litters at 56 days than those raising litters on concrete floors in confinement. This difference was greatly reduced if adequate anemia preventative treatment by iron-dextran injections were used for confinement pigs.

After weaning, confinement fed pigs gained faster and more efficiently, although there was a tendency for them to be slightly fatter and not as straight and sound on their feet and legs as the pasture fed pigs.

The best system in this experiment was the pasture-confinement system in which the litters were raised by their dams on pasture from 6 days of age until weaning at 56 days of age. Then the pigs were moved to confinement lots for feeding to a market weight of 210 pounds. Pigs on this pasture-confinement system gained 1.62 pounds per day with a feed requirement per pound of gain of 3.29 pounds. The poorest system was the confinement-pasture system (pigs raised to 56 days of age in confinement and then put on pasture) on which the pigs gained 1.32 pounds per day and required 3.55 pounds of feed per pound of gain.

The pigs on the pasture system for the total time gained 1.47 pounds per day and required 3.46 pounds of feed per pound of gain. Pigs in confinement from birth to market gained 1.47 pounds per day and required 3.50 pounds of feed per pound of gain.

Speer et al. (1957), in an experiment to determine protein requirements, fed seventy-two weanling boars, divided equally between two breeds, complete pelleted rations containing 10, 13, 16, 19, 22 or 25 per cent protein from a beginning weight of approximately 30 pounds to 195 pounds. One of each littermate pair was fed on alfalfa pasture and the other on concrete. Both members of the pair were fed the same level of protein.

Weight gains after 56 days on test showed an improvement with increasing levels of protein up to the 19 per cent level when averaged for both the groups on pasture and concrete, but a depression at the highest level of protein. This quadratic response was shown to be statistically significant. The response to 10 per cent protein was so poor that this protein level was discontinued after 56 days of the test period.

The results from 30 to 195 pounds live weight showed that a 13 per cent protein ration was adequate for boars fed on legume pasture, but inadequate for concrete drylot feeding. There were only small differences between the groups fed 16, 19, 22, or 25 per cent protein whether on concrete or pasture with respect to final gains. An average saving of 0.14 pound of feed per pound of gain was realized under pasture feeding conditions, which was a significant difference for the

average of the above four protein levels.

Backfat thickness, measured by live probe, decreased as level of protein was increased. This proved to be a significant linear relation.

Warner et al. (1954), in an experiment comparing free-choice feeding of yellow corn and protein supplement versus feeding of mixed rations to growing-fattening pigs on alfalfa pasture, found there was no definite advantage for the mixed rations if a reasonably palatable protein supplement of good quality was used.

Pigs fed mixed rations containing 14 per cent protein gained slightly faster than pigs fed mixed rations containing 12 per cent protein; however, the extent of this advantage was not considered important to economical hog production. Soybean oil meal fed alone free-choice did not produce acceptable gains, but in a complete mixed ration on alfalfa pasture did produce acceptable gains.

Pigs fed protein supplements with part animal protein did well in both feeding methods. Pigs fed soybean oil meal supplements gained 1.18 pounds daily from start to final weight when fed free-choice compared with 1.41 pounds daily gain for pigs fed a 12 per cent protein mixed ration. This 1.41 pounds daily gain compared favorably with the other supplements fed free-choice and complete mixed feeds in this experiment.

Morrison (1959) made the following statement concerning feeding on pasture versus drylot for growing and fattening pigs: "The advantage from pasture feeding in comparison with feeding an efficient ration in drylot is shown by the results secured in 40 experiments. In each

experiment one lot of pigs was full-fed corn and a suitable supplement on good pasture from shortly after weaning until the pigs reached market weight. Another lot was fed in drylot on corn and an efficient modern supplement which contained ground legume hay. The pigs on pasture gained 1.43 pounds per head daily and required 359 pounds of concentrates per 100 pounds gain. Those fed the efficient ration in drylot gained nearly as rapidly (1.40 pounds per day), but they consumed 399 pounds of feed per 100 pounds of gain. Thus, 40 pounds more concentrates (11 per cent), were required per 100 pounds of gain by the drylot pigs. The greater part of this additional feed was expensive protein supplement, for pigs in drylot need more protein supplement than do pigs on good pasture."

Jacks et al. (1961) reported costs for producing pigs from birth to market weight in a fifty sow confinement system with eight pigs produced per litter and a feed conversion of 3.50 pounds of feed per pound of gain to be \$12.72 per hundred weight. This figure included both investment and annual costs. A continuous use of the facilities will be necessary if the investment costs are to be kept low. Annual costs included feed, labor, repairs, veterinary and medicines and electricity. The total costs also included sow and boar cost. Two boars were used with the fifty sow unit. Veterinary and medicine costs were estimated to be \$1.00 per head for sows, pigs and boars. Labor charges were \$1.00 per hour and labor requirement per day averaged 1.95 for the 50 sow feeder pig operation and 1.10 hours per day for the feeding-out operation, making a total of 3.05 hours per day. A reduction

in feed conversion ratio from 3.75 to 3.25 reduced the costs by \$1.06 per hundred weight. Increasing size of operation from fifty sows to one hundred sows only reduced costs of production by \$0.18 per hundred weight. Size of litter and feed conversion were the big factors influencing profits. In the same size operation and at the same feed conversion there was a difference of \$0.92 per hundred weight in costs of producing seven pigs compared with nine pigs per litter. The investment required in the confinement systems studied in this report was \$18.74 per pig (800 pigs produced per year divided into investment required for 50 sow enterprise).

CHAPTER III

EXPERIMENTAL PROCEDURE

Source of Data

The data used in this study were obtained from two trials involving comparisons of systems of confinement and pasture feeding of pigs at the Tennessee Agricultural Experiment Station Field Station at Ames Plantation, Grand Junction, Tennessee. Trial I involving 22 sows and their litters, equally divided between confinement and pasture treatment groups, was started April 10, 1962 and terminated October 1, 1962. Trial II involving 12 sows and their litters in the confinement group and 11 sows and their litters in the pasture group was started May 11, 1962 and ended October 1, 1962.

Allotment to Treatment Groups

In Trial I, sows and their litters were allotted to confinement and pasture groups when the litters averaged about 14 days of age and 8 pounds in weight. In Trial II, sows and their litters were allotted to treatment groups when the litters averaged about 28 days of age and 13 pounds in weight. Up to the time of allotment to treatment groups all sows and litters were fed and handled in a similar manner either in farrowing stalls or in pens in the central farrowing barn. At the time of allotment, the sows and litters were transferred from the central farrowing barn to respective confinement or pasture lots.

Sows and their litters were assigned to confinement or pasture

treatment groups on the basis of the following:

1. Breeding of pigs in litter
2. Age of sow
3. Number of pigs alive in litter
4. Sex distribution of pigs in litter
5. Thriftiness and health of litter
6. Weight of litter

Insofar as possible, sows and litters were paired on the basis of these factors and then randomly assigned to either the confinement or pasture groups.

Allotment data and assignment of litters to confinement and pasture groups are given in Tables I and II for Trial I and Tables III and IV for Trial II.

Most of the pigs in the litters in both trials were from crossbred females and by purebred boars. In Tables I through IV the following letters were used to denote breed of swine: L for Landrace; H for Hampshire; Y for Yorkshire; and D for Duroc. The first letter in each breeding group denotes the breed of boar. For example, in the L x D cross, L indicates a Landrace boar was bred to a Duroc sow. A crossbred LH sow is one by a Landrace boar and out of a Hampshire sow. A crossbred DLH sow is one sired by a Duroc boar and out of a LH sow. If more than three breeds are involved, the first letter always represents the breed of the sire.

All sows used in these trials were first litter gilts except for two second litter sows included in Trial II, one in confinement and one

TABLE I

ALLOTMENT OF SOWS AND LITTERS FED IN CONFINEMENT - TRIAL I

Breeding of pigs	Litter number ^a	Birth date ^b	Sex of pigs		Litter birth weight ^c lb.	Litter birth weight 4/10/62 ^d lb.	No. pigs born alive	No. pigs alive 4/10/62	Litter weight 4/10/62 lb.
			M	F					
HxDLHD	3470	80	6	4	30.2	30.2	10	10	100.5
HxDLHD	3480	80	3	4	22.6	22.6	7	7	81.5
HxDLHD	3600	85	4	3	23.9	17.7	10	7	56.0
HxDLHD	3580	84	2	5	18.8	17.2	8	7	47.0
DxHDHD	3660	86	4	6	28.0	28.0	10	10	84.5
DxHDHD	3810	87	5	3	25.0	25.0	8	8	74.5
DxHDHD	3860	90	7	6	30.4	29.2	14	13	72.5
HxDYHD	3610	85	2	6	22.1	22.1	8	8	82.0
HxLD	3830	87	5	2	28.9	24.1	9	7	61.5
DxYH	3640	86	3	3	17.1	14.9	7	6	39.0
LxD	3630	86	4	1	24.3	13.2	8	5	41.5
Total		936	45	43	271.3	244.2	99	88	740.5
Av./litter		85.1			24.7	22.2	9.0	8.0	
Av./pig					2.7	2.8			8.4

^aPermanent number given to each litter. Pigs within litter identified by number as 3470-1, 3470-2, etc.

^bNumerical day in year litter was farrowed.

^cLitter birth weight includes birth weight of pigs born dead.

^dBirth weight of pigs alive in the litter on 4-10-62.

TABLE II

ALLOTMENT OF SOWS AND LITTERS FED ON PASTURE - TRIAL I

Breeding of pigs	Litter number ^a	Birth date ^b	Sex of pigs		Litter birth weight ^c lb.	Litter birth weight 4/10/62 ^d lb.	No. pigs born alive	No. pigs alive 4/10/62	Litter weight 4/10/62 lb.
			M	F					
HxDLHD	3490	80	5	4	27.4	24.7	10	9	83.5
HxDLHD	3530	83	5	3	23.0	23.0	8	8	71.5
HxDLHD	3570	84	7	1	27.2	20.4	11	8	61.5
HxDLHD	3820	87	2	4	23.6	18.8	7	6	48.0
DxHDHD	3560	84	4	4	30.2	30.2	8	8	80.5
DxHDHD	3690	87	2	7	25.8	25.8	9	9	62.0
DxHDHD	3850	90	6	4	30.4	30.4	11	10	68.5
HxDYHD	3460	78	3	5	30.5	20.8	12	8	73.0
DxLH	3800	87	3	4	24.3	22.1	8	7	64.0
HxYD	3670	86	3	2	18.5	17.7	6	5	44.5
LxD	3550	83	6	4	27.6	27.6	10	10	74.0
Total		929	46	42	288.5	261.5	100	88	731.0
Av./litter		84.4			26.2	23.8	9.1	8.0	
Av./pig					2.9	3.0			8.3

^aPermanent number given to each litter. Pigs within litter identified by number as 3490-1, 3490-2, etc.

^bNumerical day in year litter was farrowed.

^cLitter birth weight includes birth weight of pigs born dead.

^dBirth weight of pigs alive in the litter on 4-10-62.

TABLE III

ALLOTMENT OF SOWS AND LITTERS FED IN CONFINEMENT - TRIAL II

Breeding of pigs	Litter number ^a	Birth date ^b	Sex of pigs		Litter birth weight ^c lb.	Litter birth weight 5/11/62 ^d lb.	No. pigs born alive	No. pigs alive 5/11/62	Litter weight 5/11/62 lb.
			M	F					
HxDLHD	3900	92	4	3	22.3	22.3	7	7	143.0
DxHDHD	3950	95	2	4	23.2	17.0	8	6	88.0
DxHDHD	180	112	1	9	28.5	28.5	10	10	86.0
HxDYHD	110	104	3	5	25.5	25.5	8	8	95.5
HxLD	200	114	5	6	38.5	34.5	13	11	93.0
DxLH	140	108	5	2	24.8	24.8	7	7	92.0
HxYD	210	114	4	5	27.4	27.4	3	9	84.5
DxYH	3930	95	3	5	23.5	20.8	9	8	125.0
HxD	3970	96	4	7	47.3	32.0	16	11	166.0
HxD	170	111	1	4	15.0	12.5	6	5	44.0
LxD	150	109	3	4	28.5	20.3	10	7	77.5
YxD	20	100	5	4	26.0	26.0	9	9	135.0
Total		1,250	40	58	330.5	291.6	112	98	1,229.5
Av./litter		104.2			27.5	24.3	9.3	8.1	102.5
Av./pig					2.9	2.95			12.54

^aPermanent number given to each litter. Pigs within litter identified by number as 3900-1, 3900-2, etc.

^bNumerical day in year litter was farrowed.

^cLitter birth weight includes birth weight of pigs born dead.

^dBirth weight of pigs alive in the litter on 5-11-62.

TABLE IV

ALLOTMENT OF SOWS AND LITTERS FED ON PASTURE - TRIAL II

Breeding of pigs	Litter number ^a	Birth date ^b	Sex of pigs		Litter birth weight ^c lb.	Litter birth weight 5/11/62 ^d lb.	No. pigs born alive	No. pigs alive 5/11/62	Litter weight 5/11/62 lb.
			M	F					
DxHHDH	3910	92	3	3	23.2	20.1	7	6	117.0
DxHHDH	10	99	4	2	15.5	15.5	6	6	101.0
HxDYHD	3940	95	5	5	33.4	26.5	13	10	153.5
HxLD	190	113	6	3	32.7	26.8	11	9	77.0
DxLH	30	100	2	8	29.7	27.0	11	10	117.5
HxLH	120	105	4	5	48.7	34.5	13	9	107.5
DxYH	100	104	3	6	26.6	26.6	9	9	109.0
LxD	130	107	4	3	22.8	22.8	7	7	76.5
HxD	3980	97	6	2	18.3	17.0	9	8	98.5
LxD	40	100	6	3	26.1	26.1	9	9	125.5
YxD	3960	96	3	6	29.4	23.0	12	9	126.5
Total		1,108	46	46	306.4	265.9	107	92	1,209.5
Av./litter		100.7			27.8	24.2	9.7	8.4	109.6
Av./pig					2.87	2.88			13.1

^aPermanent number given to each litter. Pigs within litter identified by number as 3910-1, 3910-2, etc.

^bNumerical day in year litter was farrowed.

^cLitter birth weight includes birth weight of pigs born dead.

^dBirth weight of pigs alive in the litter on 5-11-62.

^eOne sow died soon after allotment was made.

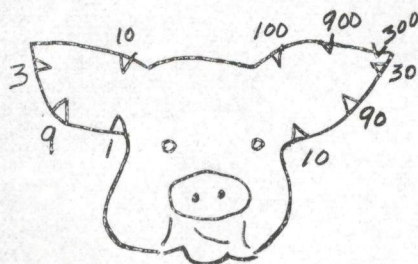
on pasture.

Sow and Pig Management

Sows were moved to the central farrowing barn from pasture breeding lots about 7 days before they were due to farrow. At this time they were wormed with piperazine. They were washed and put in farrowing stalls three to four days before farrowing. Each morning and evening, before and after farrowing, they were let out of the stalls for feeding, watering and exercise. Recommended feeding practices were followed while the sows and litters were in the farrowing barn. Generally, sows and litters were kept in the farrowing stalls for 7 to 10 days before being moved to pens in the farrowing barn where 3 to 4 sows and litters were kept together until allotment to treatment groups were made.

Immediately after the sow farrowed, the pigs were ear notched for litter and individual pig identification, and birth weight, sex of pig and teat count recorded. An ear notching system was used in which notches in the right ear designate the individual pig number and notches in the left ear together with holes in both ears designate the litter number. The following shows the ear notching system that was used:

Right Ear
Pig number



Left Ear
Litter number

Hole in right ear = 1000
Hole in left ear = 2000
Hole in both ears = 3000

All pigs were given 3 cubic centimeters of anti-erysipelas serum within 24 hours after birth. At the time the pigs were ear notched for identification, the needle teeth were clipped and ear notches, needle teeth and navels were painted with iodine. Iron dextran injections (100 milligrams) were administered at 3 days of age to all pigs. Pigs placed in confinement on concrete were given an additional injection at 21 days of age. All pigs received erysipelas vaccine at 4 days of age and crystal violet cholera vaccine at weaning. Boar pigs were castrated before being weaned. All pigs in both confinement and pasture groups were wormed soon after weaning and later, if needed, with piperazine.

Sows in the herd are vaccinated for cholera and erysipelas once each year and for leptospirosis about 30 days before farrowing.

Pastures

The pastures used in these trials were permanent stands of orchardgrass and Ladino clover. Pasture lots were about 4 acres in size. This acreage of pasture was sufficient to carry 12 sows and their litters to weaning and about 80 to 100 growing-finishing pigs from weaning to market weight. The pasture lots were provided with automatic waterers, self-feeders, shelters and artificial shades. Creep feeders were provided for pigs up to weaning time. The pastures were scored every two weeks using the University of Tennessee Pasture Report form. Summaries of pasture composition, height and grade for Trials I and II are given in Tables V and VI, respectively.

TABLE V
COMPOSITION OF PASTURE - TRIAL I

Period (1962)	Per cent composition			Av. height (inches)		
	Orchard- grass	Ladino	Misc. ^a	Orchard- grass	Ladino	Grade ^b
4/10-4/19	75	22	3	4	1½	Very good
4/19-5/3	75	22	3	6	2	Very good
5/3-5/17	75	22	3	20	6	Very good
5/17-5/30 ^c	70	25	5	6	4	Very good
5/30-6/14	67	30	3	7	5	Very good
6/14-6/30	65	30	5	10	6	Very good
6/30-7/15	65	30	5	11	3	Good
7/15-7/31 ^d	67	15	18	9	1	Fair
7/31-8/15	67	15	18	8	1	Fair
8/15-8/31	67	15	18	7	1	Fair
8/31-9/15	66	15	19	7	1	Fair
9/15-9/30	66	15	19	7	1	Fair

^aWeeds and other plants.

^bGrades: Excellent, very good, good, fair, poor, and very poor.

^cPasture was clipped at 4 inch height to control growth.

^dPasture needed rain at this date.

TABLE VI
COMPOSITION OF PASTURE - TRIAL II

Period (1962)	Per cent composition			Av. height (inches)		
	Orchard- grass	Ladino	Misc. ^a	Orchard- grass	Ladino	Grade ^b
5/13-5/17	70	20	10	7	3	Very good
5/17-5/30	75	20	5	7	3	Very good
5/30-6/14	70	25	5	9	4	Very good
6/14-6/30	70	23	7	10	4	Very good
6/30-7/15	65	25	10	9	2	Good
7/15-7/31	60	30	10	9	1	Good
7/31-8/15 ^c	60	28	12	8	1	Fair
8/15-8/31	60	28	12	7	1	Fair
8/31-9/15	60	25	15	7	1	Fair
9/15-9/30	60	25	15	7	1	Fair

^aWeeds and other plants.

^bGrades: Excellent, very good, good, fair, poor, and very poor.

^cPasture needed rain at this date.

Confinement Feeding Facilities

Sows and their litters in the confinement system were fed on a concrete feeding floor divided into pens 30 by 14 feet in size. Each pen carried 3 sows and their litters to weaning time and then all pigs in those litters to market weight. Each pen was equipped with an automatic waterer and self-feeders for corn and supplement. In addition, each pen was provided with a pig creep feeder up to the time the pigs were weaned at about 56 days of age. After weaning of pigs, the sows were removed and placed with the breeding herd for rebreeding.

Rations

Similar rations were fed to sows and pigs in confinement and on pasture. Shelled corn and protein supplement were self-fed free choice to sows and pigs to weaning and then to the growing-finishing pigs. Up to weaning time, the pigs also had access to a creep. The composition and cost of the pig creep ration is given in Table VII. The composition and cost of the supplements fed in confinement and on pasture are given in Tables VIII and IX, respectively. These two supplements were similar with the exception that alfalfa leaf meal was included in the supplement fed to pigs in confinement.

Weight, Feed and Other Records

Weights of pigs were taken at birth, when sows and litters were allotted to the treatments, at weaning time, approximately 154 days and at the time they reached market weight or at the termination of the experiment. The following formulas were used to adjust weights to

TABLE VII
COMPOSITION AND COST OF PIG CREEP FEED^a

Ingredients	Amount lb.	Cost
Ground corn	1,450	\$26.85
Tankage (55%)	100	4.75
Dry whey	50	2.50
Soybean oil meal (44%)	400	15.00
Dicalcium phosphate	22	0.99
Salt	10	0.15
New Era swine mix ^b	5	2.35
Terramycin (50 gm.)	--	3.60
Vitamin B ₁₂ (4 mg.)	--	1.00
Mixing		5.00
Total	2,037	\$62.19 ^c
Cost per cwt.	--	3.06

^a17.9% crude protein.

^bNew Era swine mix (5 lb.) contained: vitamin A, 1.5 million I. U.; vitamin D, 1 million I. U.; riboflavin, 3 gm.; pantothenic acid, 8 gm.; choline chloride, 100 gm.; vitamin B₁₂, 16 mg.; arsanilic acid, 90 gm.; terramycin, 10 gm. Trace minerals (1 pound) containing manganese, 54,500 mg.; iodine, 1,090 mg.; iron, 18,100 mg.; copper, 1,810 mg.; cobalt, 181 mg.; zinc, 50 gm.

^cFeed cost calculated on the following basis: Per ton - SBOM, \$75; tankage, \$95; corn, \$37. Per cwt. - dicalcium phosphate, \$4.50; salt, \$1.43; dry whey, \$5.00. Per pound - New Era swine mix, \$0.47. Terramycin, 100 gm., \$7.20. Vitamin B₁₂, 4 mg., \$1.00. Mixing, \$0.25 per cwt.

TABLE VIII
COMPOSITION AND COST OF PROTEIN SUPPLEMENT
FED TO PIGS IN CONFINEMENT^a

Ingredients	Amount	Cost
	lb.	
Soybean oil meal (44%)	700	\$26.25
Tankage (55%)	200	9.50
Alfalfa leaf meal (21%)	200	5.80
Dicalcium phosphate	80	3.60
Salt	20	0.29
New Era swine mix ^b	10	4.70
Terramycin (100 gm.)	--	7.20
Mixing	--	3.00
Total	1,210	\$60.32 ^c
Cost per cwt.	--	4.99

^a38.3% crude protein.

^bNew Era swine mix (5 lb.) contained: vitamin A, 1.5 million I. U.; vitamin D, 1 million I. U.; riboflavin, 3 gm.; pantothenic acid, 8 gm.; choline chloride, 100 gm.; vitamin B₁₂, 16 mg.; arsanilic acid, 90 gm.; terramycin, 10 gm. Trace minerals (1 pound) containing manganese, 54,500 mg.; iodine, 1,090 mg.; iron, 18,100 mg.; copper, 1,810 mg.; cobalt, 181 mg.; zinc, 50 gm.

^cFeed cost calculated on the following basis: Per ton - SBOM, \$75; tankage, \$95; alfalfa leaf meal, \$58. Per cwt. - dicalcium phosphate, \$4.50; salt \$1.43. Per pound - New Era swine mix, \$0.47. Terramycin, 100 gm., \$7.20. Mixing, \$0.25 per cwt.

TABLE IX

COMPOSITION AND COST OF PROTEIN SUPPLEMENT FED TO PIGS ON PASTURE^a

Ingredients	Amount	Cost
	lb.	
Soybean oil meal (44%)	700	\$26.25
Tankage (55%)	200	9.50
Dicalcium phosphate	80	3.60
Salt	20	0.29
New Era swine mix ^b	10	4.70
Terramycin (100 gm.)	--	7.20
Mixing	--	2.50
Total	1,010	\$54.04 ^c
Cost per cwt.	--	5.35

^a41.7% crude protein.

^bNew Era swine mix (5 lb.) contained: vitamin A, 1.5 million I. U.; vitamin D, 1 million I. U.; riboflavin, 3 gm.; pantothenic acid, 8 gm.; choline chloride, 100 gm.; vitamin B₁₂, 16 mg.; arsanilic acid, 90 gm.; terramycin, 10 gm. Trace minerals (1 pound) containing manganese, 54,500 gm.; iodine, 1,090 mg.; iron, 18,100 mg.; copper, 1,810 mg.; cobalt, 181 mg.; zinc, 50 gm.

^cFeed cost calculated on the following basis: Per ton - SBOM, \$75; tankage, \$95. Per cwt. - dicalcium phosphate, \$4.50; salt, \$1.43. Per pound - New Era swine mix, \$0.47. Terramycin, 100 gm., \$7.20. Mixing, \$0.25 per cwt.

standard 56- and 154-day weights:

$$\text{Adjusted 56-day} = \frac{\text{Weaning wt.} - \text{birth wt.}}{\text{days of age}} \times 56 + \text{birth wt.}$$

$$\text{Adjusted 154-day} = \frac{\text{App. 154 day wt.} - 56 \text{ day adj. wt.}}{\text{days of age} - 56} \times 98 + 56 \text{ day wt.}$$

Sow weights were taken when allotment to treatment was made and again when the pigs were weaned and sows removed from the group.

Complete records of all feed fed, including pig creep feed, corn and supplement, were kept from the time the sows and litters were allotted to treatment until the termination of the various trials. Feed weighbacks were taken at the time the pigs were weaned and sows removed and at the termination of the experiment so that feed consumption could be measured by periods.

A record was kept of death losses and health problems encountered in all groups. Atrophic rhinitis was diagnosed as a serious disease problem in the swine herd during the period the trials reported in this experiment were in progress. This disease is apparently transmitted by direct contact between a carrier sow and young pigs which are most susceptible from birth to about 6 to 8 weeks of age. Its effect on the growth rate and thriftiness of the pig may not be evident until weaning time or later in the growth period. In this study there was no evidence to indicate that the incidence of the disease among pigs was greater in any one of the treatment groups as compared to another (confinement or pasture).

CHAPTER IV

RESULTS AND DISCUSSION

Two trials involving comparisons of confinement and pasture management and feeding systems for producing market hogs were conducted. Trial I, involving 22 sows and litters, equally divided among confinement and pasture groups, was initiated April 10, 1962. Trial II, involving 23 sows and litters, with 12 in confinement and 11 on pasture was initiated May 11, 1962.

Individual summaries of the data for Trials I and II are presented in Tables X and XI, respectively. Results were similar for both trials and a combined summary of the data was prepared and is given in Tables XII and XIII. In presenting the results, reference will be made to the combined summary of the data, except where data from the individual trials help to explain results.

Growth Rate

Adjusted 56-day average weaning weights of pigs raised in confinement and on pasture were 32.5 and 25.5 pounds, respectively, with a difference of 7.0 pounds (Table XII). Because of this difference in weaning weight and the fact that death losses were slightly greater in the pasture pigs up to weaning time, confinement litters were 60 pounds heavier at 56 days than pasture litters (256 vs. 196 pounds, respectively). The difference may have been partially due to a more pronounced

TABLE X

PERFORMANCE AND FEED REQUIREMENTS OF PIGS FED IN CONFINEMENT AND ON PASTURE
TRIALS I AND II

	Trial I		Trial II	
	Confinement	Pasture	Confinement	Pasture
No. of litters	11	11	12	11 ^e
No. of pigs	88	88	98	92
Av. birth wt. of pigs lotted, lb.	3.0	2.8	2.9	2.9
Av. pig wt. at allotment, lb.	8.4	8.3	12.5	13.1
Adj. 56-day wt., lb.	31.6	25.1	33.3	25.9
Av. final wt. of pigs, lb.	192	189	180	156
Av. days on test	161	171	139	145
Av. daily gain, lb. ^a	1.14	1.03	1.22	0.98
Feed/cwt. gain - lotting to weaning, lb. ^b	347	431	333	267
Feed/cwt. gain - weaning to final wt., lb. ^c	377	317	400	318
Feed/cwt. gain - lotting to final wt., lb. ^d	373	338	390	312
No. pigs alive at weaning	86	81	97	88
No. of pigs alive at final wt.	86	67	92	83

^a Average daily gain from lotting to final weight.

^b Includes sow feed and pig creep feed.

^c Feed fed to pigs only.

^d Includes sow feed to weaning time of pigs.

^e One sow died after allotment and transfer to treatment.

TABLE XI

TOTAL FEED REQUIREMENTS AND COSTS - TRIALS I AND II

	Trial I				Trial II			
	Confinement		Pasture		Confinement		Pasture	
	Pounds feed	cost	Pounds feed	Feed cost	Pounds feed	Feed cost	Pounds feed	Feed cost
No. of litters	11		11		12		11	
No. of pigs lotted	88		88		98		92	
No. of pigs alive at weaning	86		81		97		88	
No. of pigs alive at final wt.	86		67		92		83	
Lotting to final wt.:								
Pig creep	46	1.41	247	7.37	393	12.02	390	11.93
Supplement	1,911	95.36	739	39.54	1,972	98.51	655	35.04
Corn	5,454	97.39	4,401	78.59	5,108	91.21	2,643	47.14
Weaning to final wt.:								
Pig creep	--	--	--	--	202	6.18	347	10.72
Supplement	15,252	761.07	6,768	362.08	15,001	748.55	7,228	386.70
Corn	36,154	645.61	27,741	495.37	37,330	666.61	25,452	454.50
Lotting to final wt.	58,817	1,600.84	39,896	982.95	60,006	1,623.08	36,715	946.03
Total gain, lotting to final wt., lb.	15,779		11,813		15,374		11,772	
Total days, lotting to final wt.	13,845		11,429		12,758		12,025	
Feed cost/cwt. gain (\$)	10.15		8.33		10.56		8.04	
Corn cost/cwt. gain (\$)	4.71		4.86		4.93		4.26	
Supplement cost/cwt. gain (\$)	5.43		3.40		5.51		3.58	
Creep cost/cwt. gain (\$)	.01		.06		.12		.19	
Feed cost/pig alive at weaning (\$)	2.26		1.55		2.08		1.07	
Feed cost/pig alive at final wt. (\$)	18.61		14.67		17.61		11.40	

TABLE XII

PERFORMANCE AND FEED REQUIREMENTS OF PIGS FED IN CONFINEMENT
AND ON PASTURE - COMBINED SUMMARY OF TRIALS I AND II

	Confinement	Pasture
No. of litters	23	22 ^e
No. of pigs	186	180
Av. birth wt. of pigs lotted, lb.	2.9	2.8
Av. pig wt. at allotment, lb.	10.6	10.8
Adj. 56-day wt., lb.	32.5	25.5
Av. final wt. of pigs, lb.	186	171
Av. days on test	149	156
Av. daily gain, lb. ^a	1.17	1.00
Feed/cwt. gain - lotting to weaning, lb. ^b	340	313
Feed/cwt. gain - weaning to final wt., lb. ^c	388	322
Feed/cwt. gain - lotting to final wt., lb. ^d	381	325
No. pigs alive at weaning	181	169
No. pigs alive at final wt.	178	150

^aAverage daily gain from lotting to final weight.

^bIncludes sow feed and pig creep feed.

^cFeed fed to pigs only.

^dIncludes sow feed to weaning time of pigs.

^eOne sow died after allotment and transfer to treatment.

TABLE XIII

FEED REQUIREMENTS AND COSTS - COMBINED
SUMMARY OF TRIALS I AND II

	Confinement		Pasture	
	Pounds feed	Feed cost	Pounds feed	Feed cost
No. of litters				
No. of pigs allotted	23		22	
No. of pigs alive at weaning	186		180	
No. of pigs alive at final wt.	181		169	
	178		150	
Lotting to final wt.:				
Pig creep	439	13.43		19.30
Supplement	3,883	193.87	637	74.58
Corn	10,562	188.60	1,394	125.73
			7,044	
Weaning to final wt.:				
Pig creep	202	6.18	347	10.62
Supplement	30,253	1,509.62	13,996	748.78
Corn	73,484	1,312.22	53,193	949.89
Lotting to final wt.	118,823	3,223.92	76,611	1,928.88
Total gain, lotting to final wt., lb.				
Total days, lotting to final wt.	31,153		23,585	
	26,603		23,454	
Feed cost/cwt. gain (\$)	10.34		8.18	
Corn cost/cwt. gain (\$)	4.81		4.57	
Supplement cost/cwt. gain (\$)	5.47		3.49	
Creep cost/cwt. gain (\$)	.06		.12	
Feed cost/pig alive at weaning	2.19		1.30	
Feed cost/pig alive at final wt.	18.11		12.86	

effect of possible Atrophic Rhinitis infections on the growth of pigs on pasture as compared to those in confinement. Pigs infected with this disease are more susceptible to secondary bacterial and viral infections than non-infected pigs, particularly respiratory infections. Mention has been made previously of the general herd infection diagnosed during the time these trials were in progress. There was no reason to believe, however, that the incidence of infection was greater in pasture than in confinement pigs. Perhaps conditions were more favorable for expression of the disease in pigs in the pasture system. Mortality from this disease itself is not high but it does affect growth rate and feed efficiency and increases the susceptibility of the pig to secondary infections which can result in death.

The average daily gain from lotting to final weight for pigs raised in confinements was 1.17 pounds as compared to 1.00 pounds for the pigs raised on pasture (Table XII). This average difference of 0.17 pounds was significant. Under conditions of this experiment, pigs raised on pasture would require about 27 days longer to reach a market weight of 200 pounds. Differences in average daily gains of confinement and pasture pigs for the period from lotting to final weight were 0.11 and 0.24 pound for Trials I and II, respectively (Table X).

The average weights of the sows in Trial I were 305 and 290 pounds at the beginning of the trial and 287 and 291 pounds at weaning of pigs for confinement and pasture groups, respectively. In Trial II the average initial weights were 301 and 282 pounds and the weaning weights were 319 and 302 pounds for confinement and pasture

groups, respectively.

Feed Requirements and Costs

The total feed required per 100 pounds of gain from lotting of litters to final weight of pigs was 381 and 325 pounds for confinement and pasture groups, respectively, (Table XII) with a difference of 56 pounds. These figures include sow feed from lotting to weaning of pigs, pig creep feed to weaning and feed for growing-finishing pigs from weaning to final weight. The feed costs per 100 pounds of gain were \$10.34 and \$8.18 for confinement and pasture pigs, respectively (Table XIII). In these trials, in which the pigs were self-fed free-choice shelled corn and protein supplement, the consumption of protein supplement by pigs in confinement was greater than would be expected and this increased costs of gains in confinement as compared to costs on pasture. In confinement the ratio of supplement to corn consumed by pigs was 1:2.2 as compared to 1:3.8 for pigs on pasture (Table XIII). Some greater consumption of protein supplement by pigs in confinement would be expected in free-choice feeding, but was much greater than normal in these trials.

Feed requirements per 100 pounds of gain during the growing-finishing period for the pigs (weaning to final weight) were 388 and 322 pounds for confinement and pasture pigs, respectively, with a difference of 66 pounds in favor of the pigs on pasture (Table XII). Differences within trials were very similar, averaging 60 and 82 pounds for Trials I and II, respectively (Table X).

On an individual pig basis, the feed costs per pig from lotting (21 days) to weaning (59 days) were \$2.19 and \$1.30 for confinement and pasture pigs, respectively (Table XIII). This includes cost of pig creep feed and sow feed to weaning time. On the basis of total feed costs of \$10.34 and \$8.18 per 100 pounds of gain, the total feed cost per pig at 200 pounds would be \$19.57 and \$15.47 for confinement and pasture pigs, respectively.

In these trials, sows in confinement consumed 16.5 pounds of feed per head daily as compared to 10.2 pounds per head daily for sows on pasture. Total feed costs per sow from lotting (21 days) to weaning of pigs (59 days) was \$16.63 for the sows in confinement and \$9.10 for the sows on pasture.

The total costs of sow and pig creep feed per litter in confinement and on pasture were \$17.21 and \$9.94, respectively--a difference of \$7.27 in total feed cost without any charge for pasture.

Number of Pigs Raised

In these trials, a greater death loss occurred among the pigs raised on pasture as compared to those raised in confinement (Table XII). Litters raised in confinement averaged 8.09 and 7.74 pigs per litter at weaning and at the end of the experiment, respectively, while litters on pasture averaged 8.18 and 6.82 pigs, respectively. The greater portion of the death losses on pasture occurred during Trial I. From lotting to final weight, the death loss of pigs on pasture was 1.90 pigs per litter (23.9 per cent) as compared to 0.08 pigs (2.3 per cent) in

confinement. Most of the death loss on pasture occurred after weaning. In Trial II the death losses were 6.1 per cent in confinement and 9.8 per cent on pasture.

Combined death losses in both trials from lotting to final weight were 4.3 per cent for pigs in confinement and 16.6 per cent for pigs on pasture. These losses are similar to those reported by Whatley et al. (1962) who found that death losses were 3 and 16 per cent for pigs raised in confinement and pasture systems, respectively.

The reasons for the greater death losses in pigs raised on pasture than in those raised in confinement in Trial I are not known. However, this trial began one month earlier than Trial II and pigs were about 14 days younger. The incidence of respiratory infections was much greater during the early part of Trial I as compared to Trial II. Many of the deaths were apparently a result of these respiratory infections among pasture pigs in Trial I. As indicated previously, Atrophic Rhinitis was diagnosed as a serious disease problem in the herd during the progress of these trials. Although the mortality rate from this disease is not high, it does increase the susceptibility of the infected pig to secondary infections, particularly respiratory infections, because of its deteriorating effects on the nasal membranes and turbinates. This, together with weather more favorable to the development of respiratory infections during the early part of Trial I, may have been a major factor contributing to death losses on pasture.

Value of Pasture

The results obtained in this experiment indicate that pasture has considerable economic value in a system of market hog production where it is utilized from the time the pigs are born until they are marketed. On the basis of data obtained in this experiment, the return for pasture was estimated to be about \$35.00 per acre (Table XIV). This return was realized even though there was a difference of 12.3 per cent in the survival rates of pigs raised in confinement and on pasture. The survival rate in confinement was 95.7 per cent as compared with 83.4 per cent on pasture. Each pig lost will lower the total returns since the feed and other costs of pigs which die must be charged against those which are marketed. If death losses on pasture could be kept at the same rate as those in confinement, then the value of pasture per acre would be about double (\$78.72) that obtained in this study.

In this study no attempt was made to evaluate all costs relative to the systems of production. The returns for 100 pigs started (Table XIV) of \$692.32 and \$871.16 for confinement and pasture systems represent gross returns above feed costs only. These returns would have to take care of all other costs and provide a return to capital and management. The value of pasture as estimated in this study is based on the assumption that all costs other than feed costs are the same for both systems.

TABLE XIV

GROSS RETURNS ABOVE FEED COSTS FROM CONFINEMENT AND PASTURE SYSTEMS
ESTIMATED ON THE BASIS OF DATA OBTAINED IN THESE TRIALS

	Confinement	Pasture
No. of pigs started	100	100
No. of pigs marketed	96	83
Av. initial wt. of pigs, lb.	10.6	10.8
Av. final wt. of pigs, lb.	200	200
Av. initial value per pig (\$) ^a	5.00	5.00
Av. market value per pig (\$16.00/cwt.) (\$)	32.00	32.00
Feed cost per cwt. gain (\$)	10.34	8.18
Total initial value of pigs (\$)	500.00	500.00
Total feed costs for pigs marketed (\$)	<u>1,879.68</u>	<u>1,284.84</u>
	2,379.68	1,784.84
Total value of pigs marketed (\$)	3,072.00	2,656.00
Gross returns above initial value and feed costs (\$)	692.32	871.16
Difference in returns (pasture minus confinement) (\$)	--	178.84
Gross returns above feed costs per acre of pasture (\$) ^b	--	35.77

^aEstimated feed and cash outlay cost of pig to about 21 days of age or 10 pounds of weight.

^bEstimated carrying capacity of approximately 20 pigs per acre--total of 5 acres.

CHAPTER V

SUMMARY AND CONCLUSIONS

Two trials involving comparisons of confinement and pasture management and feeding systems for producing market hogs were conducted at the University of Tennessee Field Station at Ames Plantation, Grand Junction, Tennessee, to obtain comparative data relative to the performance, feed requirements and costs of production of pigs produced from birth to marketing under these systems. Trial I involved 22 sows and their litters, equally divided between confinement and pasture groups. Trial II involved 12 sows and their litters fed in confinement and 11 sows and their litters fed on pasture. In Trial I, sows and litters were allotted to confinement and pasture groups when the pigs were about 14 days of age and 8 pounds in weight. In Trial II allotment was made when the pigs averaged 28 days of age and 13 pounds in weight. Similar rations were fed to sows and pigs in confinement and on pasture. Shelled corn and protein supplement were self-fed free choice to sows and pigs from allotment time to weaning of pigs and then to the growing-finishing pigs. Up to weaning time the pigs also had access to a creep feed.

Adjusted 56-day average weaning weights of pigs raised in confinement and on pasture were 32.5 and 25.5 pounds, respectively, with a difference of 7.0 pounds. Because of this difference in weaning weight and the fact that death losses were slightly greater in the pasture

pigs up to weaning time, confinement litters were 60 pounds heavier at 56 days than pasture litters (256 vs. 196 pounds, respectively). The average daily gain from lotting to final weight for pigs raised in confinement was 1.17 pounds as compared to 1.00 pound for the pigs raised on pasture. The average difference of 0.17 pound was significant.

The total feed required per 100 pounds of gain from lotting to final weight of pigs was 381 and 325 pounds for confinement and pasture groups, respectively, with a difference of 56 pounds. These figures include sow feed from lotting to weaning of pigs, pig creep feed to weaning and feed for growing-finishing pigs from weaning to final weight. The feed costs per 100 pounds of gain were \$10.34 and \$8.18 for confinement and pasture fed pigs, respectively. Feed requirements per 100 pounds of gain during the growing-finishing phase (weaning to final weight) were 388 and 322 pounds for the confinement and pasture pigs, respectively, with a difference of 66 pounds in favor of the pigs on pasture.

On an individual pig basis, the total feed cost per pig at weaning was \$2.19 for pigs raised in confinement as compared to \$1.30 for pigs raised on pasture. The total feed cost per pig at 200 pounds was \$19.57 for confinement pigs and \$15.47 for pasture pigs.

In these trials, sows in confinement consumed 16.5 pounds of feed per head daily as compared to 10.2 pounds per head daily for sows on pasture. Total feed cost per sow from lotting (21 days) to weaning of pigs (59 days) was \$16.63 for the sows in confinement and \$9.10 for the sows on pasture.

A greater death loss occurred among the pigs raised on pasture as compared to those raised in confinement. Total death losses from lotting (21 days) to final weight of pigs averaged 4.3 per cent for pigs in confinement and 16.6 per cent for pigs on pasture. The reasons for the greater death losses among pigs raised on pasture are not known but may have been due to the effects of a higher incidence of respiratory infections among pasture pigs during the early phases of the trials.

On the basis of data obtained in these trials, the gross economic returns for pasture was estimated to be about \$35.00 per acre. This return was realized even though there was a difference of 12.3 per cent in the survival rates of pigs raised in confinement and on pasture. The survival rate in confinement was 95.7 per cent as compared to 83.4 per cent on pasture. Each pig lost will decrease the total returns since the feed and other costs of pigs must be charged against those which are marketed. If death losses on pasture can be kept at the same rate as those in confinement, the value of pasture per acre would be about double that obtained in this study.



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