Alfalfa levels in gestation rations for swine
by Stuart W Tilton

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of Master of Science in Animal Industry at Montana State College
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Abstract:
The results of feeding forty-five sows three levels of alfalfa in a gestation ration are described. The alfalfa levels used were 20, 50, and 100 percent. The 20 percent alfalfa level was ground and hand-fed in a grain mixture5 the 5>0 percent alfalfa-level was ground and self-fed in a grain mixture; and the 100 percent alfalfa level was self-fed in racks. Sun-cured alfalfa hay was used in the experiment. The 20 and 50 percent alfalfa lots had the mineral and salt mixed with the ration at the level of 1.5 percent. Mineral and salt were self-fed in the 100 percent alfalfa lot. The 50 and 100 percent alfalfa lots had two. replicates' of nine sows per lot. The sows and pigs from the three lots were handled and fed in the' same manner from the time that the sows were put in the farrowing houses, approximately 10 to 12 days before farrowing, until the pigs were weaned. Replicates contained equal number of gilts whenever it was possible to allot them in this manner.

When all of the sows in a treatment were considered together, 89 percent of the sows started on the 20 percent alfalfa ration farrowed and weaned litters. They consumed 8.41 pounds of feed per sow per day during gestation. On the $0 percent alfalfa level, 77.7 percent of the sows farrowed, and the same number weaned litters. They consumed 9.92 pounds of feed per sow per day during gestation. On the 100 percent alfalfa level, 6l.l percent of the sows farrowed, but only 55.5 percent of the sows weaned litters. The sows receiving 100 percent alfalfa consumed only 3.76 pounds of feed per sow per day during gestation. Quality of alfalfa may have been a determining factor in this low feed consumption.

"When the analyses of the lots was broken down into gilts and ma-ture sows, the 20 percent alfalfa level produced the heaviest pigs at birth among the gilts; the 50 percent level produced the heaviest pigs at birth among the mature sows. The 20 percent level produced the greatest number of live pigs at birth among both the gilts and mature sows. There was no difference demonstrated statistically among the mature sows on the 50 and 100 percent alfalfa levels in number of live pigs at birth. The gilts on the 50 percent alfalfa level weaned the largest numbers and heaviest litters among the gilts. The 20 percent level weaned the largest numbers and the heaviest litters among the mature sows.

Both gilts and mature sows lost weight on the average during gestation on the 100 percent alfalfa ration. Gilts on all levels and mature sows on the 100 percent alfalfa ration gained on the average during lactation when all lots were" on the same ration.

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TABLE OF CONTENTS

INDEX TO TABLES

ABSTRACT

The results of feeding forty-five sows three levels of alfalfa in a gestation ration are described. The alfalfa levels used were 20, 50, and 100 percent. The 20 percent alfalfa level was ground and hand-fed in a grain mixture; the 50 percent alfalfa level was ground and self-fed in a grain mixture; and the 100 percent alfalfa level was self-fed in racks. Sun-cured alfalfa hay was used in the experiment. The 20 and 50 percent alfalfa lots had the mineral and salt mixed with the ration at the level of 1.5 percent. Mineral and salt were self-fed in the 100 percent alfalfa lot. The 50 and 100 percent alfalfa lots had two replicates of nine sows per lot. The sows and pigs from the three lots were handled and fed in the same manner from the time that the sows were put in the farrowing houses, approximately 10 to 12 days before farrowing, until the pigs were weaned. Replicates contained equal number of gilts whenever it was possible to allot them in this manner.

When all of the sows in a treatment were considered together, 89 percent of the sows started on the 20 percent alfalfa ration farrowed and weaned litters. They consumed 8.41 pounds of feed per sow per day during gestation. On the 50 percent alfalfa level, 77.7 percent of the sows farrowed, and the same number weaned litters. They consumed 9.92 pounds of feed per sow per day during gestation. On the 100 percent alfalfa level, 61.1 percent of the sows farrowed, but only 55.5 percent of the sows weaned litters. The sows receiving 100 percent alfalfa consumed only 3.76 pounds of feed per sow per day during gestation. Quality of alfalfa may have been a determining factor in this low feed consumption.

When the analyses of the lots was broken down into gilts and mature sows, the 20 percent alfalfa level produced the heaviest pigs at birth among the gilts; the 50 percent level produced the heaviest pigs at birth among the mature sows. The 20 percent level produced the greatest number of live pigs at birth among both the gilts and mature sows. There was no difference demonstrated statistically among the mature sows on the 50 and 100 percent alfalfa levels in number of live pigs at birth. The gilts on the 50 percent alfalfa level weaned the largest numbers and heaviest litters among the gilts. The 20 percent level weaned the largest numbers and the heaviest litters among the mature sows.

Both gilts and mature sows lost weight on the average during gestation on the 100 percent alfalfa ration. Gilts on all levels and mature sows on the 100 percent alfalfa ration gained on the average during lactation when all lots were on the same ration.

INTRODUCTION

The value, as well as the limitations, of alfalfa and other legumes in swine rations has been studied over a period of years. Studies of carotene and vitamin A, the water soluble vitamins, and the amino acids have aided in determining the value of alfalfa in swine rations. Much of the work with alfalfa has been done in growing-fattening rations, and, due to the high crude fiber content, minimum levels of the alfalfa have been sought in these rations as a means of improving rate of gain and feed efficiency.

Gestation rations of swine have had a tendency to follow this same pattern, especially in the corn belt, although extra alfalfa has been added to these rations in many cases in the field to prevent over-fatness of the sows.

This experiment was set up to find a practical maximum level of alfalfa to be used in a gestation ration. Top performance of the sow was not the prime objective. The objective was to find a ration including the optimum amounts of alfalfa on which sows could be carried through gestation successfully at the lowest costs.

REVIEW OF LITERATURE

Mitchell et al (1933) found the digestibility of crude fiber in alfalfa in swine to be low--about two percent. Ellis et al (1943) using a basal ration of ground yellow corn, tankage, and linseed meal in a growing-fattening ration and substituting ground hays (soybean, alfalfa, and lespedeza) at the 5, 10, 15, and 20 percent level found that one pound of ground hay replaced 0.58 pounds of the grain mixture at the 5 percent level, 0.73 pounds of the grain at the 10 percent level, and 0.46 pounds of grain at the 15 percent level, and 0.40 pounds of the grain at the 20 percent level. In these tests, soybean, alfalfa, and lespedeza hay ranked in the order given according to their replacement values.

Krider et al (1948) used a basal ration composed chiefly of corn and soybean oilmeal with essential fat-soluble vitamins and minerals in a growing-fattening ration. He added the six B-vitamins (B_1, B_2, B_6, pantothenic acid, niacin, and choline) to form another ration. He added 1.5 percent AB liver extract or 10 percent dehydrated alfalfa meal to each of these two rations. When 1.5 percent AB liver extract was added to the basal plus six B-vitamins, there was a significant increase in average daily gain. Addition of 10 percent dehydrated alfalfa meal to the basal ration plus six B-vitamins gave no significant increase in average daily gain, but pigs so fed showed sleeker coats and fewer abnormalities of feet, legs, and gait.

Synge (1951) found that the protein in the leaves of green plants would satisfy the amino acid requirements of the rat, chicken, pig, and

man. Methionine is low in the leaf, and the amino acid content of the leaf varied very little with season and species. Given suitable maceration to render it accessible, leaf protein was well hydrolyzed by the intestinal proteases. Its drawback as a main source of protein for these species was the large quantity of indigestible material, mainly carbohydrates, accompanying it. He found the tissues of green plants (other than leaves) tend to predominate in glutamic and aspartic acids and their amides, glutamine and asparagine, with alanine, serine, y-amino butyric acid.

Witz et al (1951) did work on fat levels in rations of growing-fattening swine. He compared pigs on a .06 percent fat level with those on a 5 percent fat level diet. He found that in pigs fed the lower fat level, vitamin A storage was lower, sexual maturity came later, thyroid glands were enlarged, and digestive systems were underdeveloped with small gall bladders. Outward signs of the low-fat diet were manifested in scaly dermatitis on tail, back, and shoulders, in loss of hair with remaining hair being dull and dry, in dry, gummy exudate on belly and sides, in necrotic areas on the skin around neck and shoulders, and in an unthrifty appearance. Feed consumption and feed efficiency were the same in both lots.

Crampton et al (1954) found that the quality of the bacon carcass can be improved by "diluting" highly digestible rations with fibrous feeds during the finishing period. The improvement in carcass quality was accompanied by a decrease in rate of gain and an increase in length of the finishing period when one-half of a high energy basal ration was

replaced by either alfalfa or wheat bran, or when the basal portion of the ration consisted entirely of oats. Lloyd and Crampton (1955) found that increasing the protein percentage or decreasing the crude fiber percentage of the pig rations tends to increase the apparent digestibility of protein, and the partial regression coefficients of protein percentage and of crude fiber percentage on apparent protein digestibility are approximately equal.

McCormick et al (1953) used first and third cuttings of well-cured, leafy alfalfa hays, in a growing-fattening ration. They showed 1 pound of the hay substituted for 1 pound of concentrate at the 30 percent alfalfa level, and 1 pound of hay substituted for approximately one-half pound of gain at the 50 percent level and required more total feed for 100 pounds of gain and slowed the gain. By pelleting the ration at the 50 percent level, the entire group reached 200 pounds at less than six months of age and consumed 452 pounds of feed per 100 pounds of gain. Each pound of alfalfa in the 50 percent alfalfa pelleted ration substituted for nearly 1 pound of grain. They further postulated that selection for ability to utilize large quantities of alfalfa can be effective, and that pork produced from such feeding and breeding fulfills every requirement of the present demand for lean carcasses of top quality.

Gard et al (1955) observed a growth depressing effect when 10 percent dehydrated alfalfa was added to a basal growing-fattening ration. He could not attribute the effect to the added crude fiber, as the basal ration plus added crude fiber at the same level as the basal plus alfalfa did not give the growth-depressing effect experienced with the alfalfa.

Hanson et al (1956) found that adding dehydrated alfalfa meal to a corn-soybean oil meal diet for growing-fattening pigs at the 15 and 30 percent level, either ad libitum or on an equal feeding regime, resulted in a significant decline in performance. He found that the majority of the growth depressing property of the dehydrated alfalfa meal was due to a lowered total digestible nutrient content of the diet and thereby to a lowered feed intake by the pig.

The addition of 10 or 20 percent alfalfa meal to a low-protein (8.8 percent) corn diet had a very limited ability to provide supplementary protein and increase gains in a growing-fattening ration. Becker et al (1956). Levels of 30 and 40 percent alfalfa meal added to this diet markedly depressed the rate and efficiency of gain. In the presence of adequate protein dietary levels, alfalfa meal added at a level of 20 percent or more depressed the rate and efficiency of gain. This inhibition was similar when either soybean oilmeal or menhaden fish meal was the source of supplementary protein to the yellow corn. When levels of 20 or 30 percent alfalfa meal replaced the yellow corn in the ration, the decrease in efficiency of gain, but not in the rate of gain, was completely eliminated by the addition of corn oil to equalize the calculated total digestible nutrient content of the diets. Live-weight shrinkage prior to slaughter was lower on the low-protein diet than on a standard diet. Specific gravity of carcasses of pigs fed the standard diet was higher than for those fed the low-protein diet. This was true either with or without alfalfa meal in the low-protein diet. Further, levels of 10 to 40 percent alfalfa meal added to the low-protein diet

decreased the dressing percentage.

Snyder (1915) found in wintering old sows on high-alfalfa gestation rations that feeding a light grain ration and allowing the sows free choice to alfalfa hay in racks provided a better practice than mixing equal portions of the grain and chopped alfalfa.

Grimes (1921) found that alfalfa hay alone did not maintain sows in proper condition during pregnancy, but it seemed to supply sufficient nutrients for development of the unborn litter according to the standards of that time. Sows on straight alfalfa rations during gestation ate larger amounts of feed during lactation. The gestation rations fed were as follows: straight alfalfa according to appetite; alfalfa hay ad libitum plus shelled corn at the rate of 1 pound per 100 pounds live weight daily; a mixture of 10 parts of shelled corn and one part of tankage; and a mixture of equal parts of corn meal, ground oats, and wheat middlings. The feed cost of raising a pig to time of weaning (all lots on the same lactation ration) was lowest for those sows on an alfalfa hay ration fed according to appetite.

Martin (1936) found that sows or well-developed spring gilts may be fed through the gestation period without pasture with fairly satisfactory results when good quality legume hay, either ground and included in a mixture or fed loose in a rack, forms as much as 10 percent of the ration. However, when the sows were fed on this ration during the suckling period, they lost heavily in flesh, and the pigs were inadequately nourished. It should be noted that this trial was conducted prior to wide-spread use of creep rations.

Freeman (1938) fed one-third ground alfalfa hay and two-thirds grain in a gestation ration. This high level of alfalfa compared favorably to a ration of corn with 6 percent tankage during gestation. He found that 243 pounds of ground alfalfa hay replaced 119 pounds of grain plus 39 pounds of tankage plus 6 pounds of bran, and 7 pounds of loose hay.

Ross et al (1942) fed a basal gestation ration composed of 82.0 percent ground yellow corn, 11.5 percent soybean oil meal, 5.0 percent ground alfalfa hay, 0.5 percent salt, and 1.0 percent limestone. Litters weaned from sows on these gestation rations were small in both number of pigs and in size of pigs. When alfalfa was increased to 15 percent at the expense of corn, reproduction was normal. Brood sows on the latter ration weaned twice as many pigs as the sows on the 5 percent alfalfa ration, and the pigs were 25 percent heavier at weaning time. Gilts from the sows on the basal ration were continued on that ration and allowed to farrow. The deficiency or deficiencies were more acute in the second generation gilts.

Krider et al (1946) fed a basal gestation ration in dry lot composed of 67 percent ground yellow corn, 25 percent expeller soybean oil meal, 5 percent dehydrated alfalfa meal, and 2.5 percent complex mineral mix. The deficiency or deficiencies of this ration were corrected by supplementing it with one of the following: rye pasture; 10 percent dehydrated alfalfa meal; or either 2 or 4 percent of condensed fish solubles (fresh basis either sardine or menhaden).

Fairbanks et al (1945) found that a basal ration composed of yellow

corn, soybean oil meal, tankage, fish meal, fortified cod liver oil, and minerals was nutritionally inadequate for gestation and lactation under dry lot conditions. The addition of either 6 or 12 percent of dried corn distiller's solubles, alfalfa meal, or six crystalline B-vitamins improved breeding efficiency, fertility, and strength of pigs farrowed. The value of alfalfa meal and solubles was attributed to the water-soluble vitamins, known or unknown, found in these products. According to the author, feeding during gestation is an important factor for satisfactory results during lactation and must not be ignored when considering the question of high mortality among baby pigs.

Catron et al (1948) found that the riboflavin content of sow's milk was increased significantly by supplementing the ration with alfalfa meal as a source of this vitamin.

DePape et al (1953) found that the addition of 0.5 percent A.P.F. (antibiotic-B_{12} supplement) to a basal ration of barley, wheat soybean oil meal, 15 percent sun-cured alfalfa, and meat meal for brood sows during pre-breeding, gestation, and lactation resulted in no significant improvement in the following factors: number of pigs farrowed, number of pigs farrowed alive; average birth weight; and number of pigs weaned per sow. A highly significant adverse result was obtained by substituting dehydrated alfalfa pellets for sun-cured alfalfa meal in the gestation-lactation ration. This effect was shown in the number of pigs weaned per sow and the total weight of pigs weaned per sow. The percent of mortality to weaning was 16 to 20 percent higher when dehydrated alfalfa pellets were substituted for sun-cured alfalfa.

Teague et al (1954) fed a diet containing 18 percent ground sun-cured alfalfa and another basal diet containing no legume to both gilts and mature sows during gestation in dry lot. Dietary crude fiber was equalized by ground ear corn in the non-legume basal ration. Vitamins A, D, E, and eight B-vitamins were added to the non-legume basal diet to more than offset those contained in the alfalfa ration. The diets were fed 19 days prior to breeding and during gestation. The alfalfa-fed gilts farrowed on the average of 9.83 live and 0.87 stillborn pigs. The gilts on the non-legume ration farrowed 8.64 live and 0.96 stillborn pigs. No difference of vigor at birth or birth weight was apparent between the two diets. On the alfalfa ration, sows produced 13.0 corpora lutea on the average, and gilts produced 13.5 corpora lutea on the average. On the non-legume basal ration, sows produced 12.0 corpora lutea on the average, and gilts produced 11.9 corpora lutea on the average. The results suggested that a factor or factors in alfalfa affected ovulation rate primarily and not prenatal growth or survival.

Gard (1955) compared a 10 percent dehydrated alfalfa ration to a purified basal control ration during gestation and lactation. Dehydrated alfalfa meal did not have any consistent effect on litter weaning weight. While 88 percent of the alfalfa-fed sows weaned litters, only 55 percent of the control-fed sows weaned litters. After the sows had been on the diets for 233 days, 29 percent fewer services per conception were required by the alfalfa-fed sows. However, after 448 days there was no difference in the ovulation rates or number of abnormalities of the reproductive tract. Dehydrated alfalfa meal decreased the creep consumption of

the suckling pigs.

Teague et al (1956) fed dehydrated alfalfa meal at the 18 percent level, an acetone-hexane extract of dehydrated alfalfa meal in a legume-free ration, and a legume-free basal gestation ration in dry lot the first year. The second year he fed 18 percent alfalfa plus 0.29 microgram stilbestrol per pound of ration, legume-free, legume-free plus 0.29 microgram stilbestrol per pound of ration, and legume-free plus 0.58 microgram stilbestrol per pound of ration. The first year the 18 percent alfalfa and legume-free ration plus extract showed an advantage over the legume-free ration in both number of corpora lutea and live embryos at 25 and 27 days. In the second year, neither the addition of extract or the non-saponifiable fraction of extract appeared to influence ovulation rate or number of embryos. The addition of 0.29 or 0.58 microgram of stilbestrol per pound of legume-free ration appeared to lower ovulation rate and decrease embryonic survival. Both years an advantage was obtained in both number of corpora lutea and live embryos by the 18 percent alfalfa ration over the legume-free ration. The addition of 0.29 or 0.58 microgram of stilbestrol per pound of legume-free ration appeared to lower ovulation rate and decrease embryonic survival.

Flower et al (1956), used gestation-lactation rations with alfalfa levels of 5, 20, 35, and 50 percent with terramycin added to all levels. In addition they used a 20 percent alfalfa level without the antibiotic. They found no significant differences between treatments for any production criterion using analysis of variance. Analysis of covariance also failed to show differences between treatments for weaning weight of pigs

or number of pigs weaned per litter when adjustments were made for birth weight of pigs and number of live pigs born per litter, respectively. A nonsignificant trend developed indicating that the 50 percent alfalfa level during lactation may contribute to heavier losses in weight of daily allowance according to appetite and condition. There was some indication that antibiotics may have contributed to successful reproduction-lactation in these trials.

METHODS AND PROCEDURE

The sows used in this experiment were purebred Duroc, Montana No. 1 (Hamprace) and also crosses of these two breeds. Five boars consisting of three purebred Duroc and two purebred Montana No. 1 were mated to the forty-five sows. The sows were pen mated to the boars starting in late December. If the sows were not settled by about the middle of February, they were removed from the experiment. Sows and gilts in the three treatments were not separated, but were lotted together in five large lots, with nearly equal numbers of gilts in each lot. Portable colony houses were supplied as shelter. Water was supplied by a creek at one end of the lots. Sows were lotted and put on the 20, 50, and 100 percent alfalfa rations at the start of the breeding season. Troughs, self-feeders, and hayracks were supplied to the various lots, respectively. One-hundred percent alfalfa lots were provided with mineral boxes.

The sows were weighed when they were put on experiment, and weights were retaken if sows were removed. Weights were taken again at 102 days of gestation, when the sows went into farrowing quarters.

The farrowing pens were disinfected with a steam cleaner before the sows were placed in them. Pens were provided with guard rails and heat lamps; wheat straw was used for bedding.

All sows were fed the same lactation ration after they were moved to the farrowing barn. The majority of sows were fed lactation rations about twelve days before farrowing. Records of feed consumed on the gestation rations were kept by the swine herdsman. Separate feed records were not kept after the sows were placed in the farrowing quarters.

Shortly after the pigs were born, weights were taken of the pigs, and numbers of live and dead pigs were recorded. The various litters were ear-notched, and any abnormalities were recorded. Numbers made it necessary in some cases to combine two sows and their litters several days after farrowing. The pigs were fed a creep ration as soon as they would eat, and sows and pigs were transferred to alfalfa pastures as soon as the pigs could survive without heat lamps.

On the alfalfa pastures, sows were confined to individual houses and pens, but the pigs were allowed to run to the pasture and creep ration. The pigs were weaned on or near 56 days of age. Weaning weights of individual pigs and litters were recorded. Corrections to 56 day weight were made when necessary by means of Whatley's formula. (1937). The sows' individual weights were recorded at this time.

Alfalfa hay used in the 20 and 50 percent gestation rations was put through a hammer mill before being mixed with the ration. Mineral used in the gestation rations contained 35 percent steamed bonemeal.

TABLE NO. I
GESTATION RATIONS

INGREDIENTS	% OF RATION
20% ALFALFA	
Barley	70.75
Alfalfa	20.00
Soybean oil meal	4.50
Meat meal	3.00
Mineral mixture	1.50
TM-5 1/	0.10
Vitamin supplement No. 1 2/	0.05
Vitamin B_{12} supplement No. 9 3/	0.10
50% ALFALFA	
Barley	45.28
Alfalfa	50.00
Meat meal	3.00
TM-5 1/	0.10
Vitamin supplement No. 1 2/	0.05
Mineral mixture	1.50
Vitamin B_{12} supplement No. 9 3/	0.10
100% ALFALFA	
Alfalfa	100.00
Mineral mixture	free choice

1/ TM-5-- An antibiotic feed supplement containing a guaranteed equivalent of 5.0 grams of crystalline Oxytetracycline (Terramycin) Hydrochloride per pound.

2/ Vitamin Supplement No. 1-- Contains a minimum of 2,000 mg. riboflavin, 4,000 mg. pantothenic acid, 9,000 mg. niacin, 10,000 mg. choline chloride per pound.

3/ Vitamin B_{12} Supplement No. 9-- Contains a guaranteed 9.0 mg. of vitamin B_{12} activity per pound (L.L. assay).

TABLE NO. II
SOWS' LACTATION RATION

INGREDIENTS	% OF RATION
Barley	65.00
Wheat bran	20.00
Alfalfa	5.00
Soybean oil meal	5.00
Meat meal	3.00
TM-5 1/	0.10
Vitamin supplement No. 1 2/	0.05
Vitamin B_{12} supplement No. 9 3/	0.10
Mineral mixture	1.50
Salt, iodized	0.25

1/ TM-5-- An antibiotic feed supplement containing a guaranteed equivalent of 5.0 grams of crystalline Oxytetracycline (terramycin) Hydrochloride per pound.

2/ Vitamin Supplement No. 1-- Contains a minimum of 2,000 mg. riboflavin, 4,000 mg. pantothemic acid, 9,000 mg. niacin, 10,000 mg. choline chloride per pound.

3/ Vitamin B_{12} Supplement No. 9-- Contains a guaranteed 9.0 mg. of vitamin B_{12} activity per pound (L.L. assay).

TABLE NO. III
SPECIFICATIONS OF CREEP FEED PELLETS

INGREDIENTS	POUNDS PER TON
Oat groats	800
Corn	200
Fish meal (60% protein)	50
Flavone 1/	50
Soybean oil meal	400
Sugar	300
Molasses	108
Salt, iodized	10
Steamed bonemeal	30
Ground limestone	20
Trace mineral mixture	4
Vitamin A and D (10,000/gm.)	1
Vitamin supplement No. 1 2/	3
Vitamin B_{12} supplement No. 9 3/	4
TM-5 4/	20

1/ Flavone--- Contains a minimum of riboflavin - 22.7 mg., pantothenic acid 16.34 mg., choline chloride - 1,500.0 mg., niacin 28.6., vitamin B_{12} 0.06 mg. per pound of feed. Crude protein 34.0%, Crude fat 1.0%, Crude fiber maximum 6.0%, N.F.E. 30.0%.

2/ Vitamin Supplement No. 1--- Contains a minimum of 2,000 mg. riboflavin, 4,000 mg. pantothenic acid, 9,000 mg. niacin, 10,000 mg. choline chloride per pound.

3/ Vitamin B_{12} Supplement No. 9-- Contains a guaranteed 9.0 mg. of vitamin B_{12} activity per pound (L.L. assay).

4/ TM-5--- An antibiotic feed supplement containing a guaranteed equivalent of 5.0 grams of crystalline Oxytetracycline (Terramycin) hydrochloride per pound.

TABLE NO. IV

COMPARISON OF EXPERIMENTAL RATIONS WITH DAILY NUTRIENT ALLOWANCES RECOMMENDED FOR SWINE

	PREGNANT STOCK		EXPERIMENTAL RATIONS					
			20% Alfalfa		50% Alfalfa		100% Alfalfa	
	Young 300#	Mature 500#	Young	Mature	Young	Mature	Young	Mature
Expected Daily Gain, Lbs.	0.75	0.50	1.01	1.50	0.78	1.13	-0.10	-0.002
Total Feed (air dry) lbs.	6.00	7.50	8.41		9.92		3.76	
T.D.N. lb. (75% T.D.N. on recommended level)	4.50	5.60	5.26		4.94		1.13	
Crude Protein, Lb.	0.90	1.05	1.38		1.63		0.66	
VITAMINS								
Carotene, mg.	15.00	18.70	33.64		99.20		75.20	
Vitamin D, I. U.	540.00	675.00	- - -		- - -		- - -	
Thiamine, Mg.	3.00	3.80	14.31		13.12		4.13	
Riboflavin, Mg.	7.20	9.00	22.83		37.54		18.80	
Niacin, Mg.	30.00	37.50	218.50		232.98		60.50	
Pantothentic Acid, Mg.	27.00	33.80	64.56		97.10		47.80	

RESULTS AND DISCUSSION

The mature sows and gilts fed the 20 and 50 percent alfalfa gestation rations consumed more air dry feed during gestation than was required according to the N.R.C. requirements. These requirements are quoted as 6.0 pounds air dry feed for a 300 pound pregnant gilt, and 7.5 pounds air dry feed for a 500 pound pregnant mature sow. The sows and gilts fed the 100 percent alfalfa gestation ration consumed much less air dry feed. The average in these lots was below 4 pounds. This low consumption of feed in the 100 percent alfalfa lot is reflected in a loss of weight during gestation. The high crude fiber content of the feed also contributed to the loss of weight of the sows at farrowing on the 100 percent alfalfa level. The sows on the 20 and 50 percent alfalfa gestation rations, on the other hand, ate much more than the average amount of feed required for even gilts on the gestation rations to gain the suggested average of 0.75 pound per day. However, this intake of feed was calculated on a 75 percent total digestible nutrient value.

Even though the sows on the 20 percent alfalfa ration were hand-fed, the gilts gained 1.01 pounds per day on the average, and the mature sows gained 1.50 pounds per day on the average during gestation. The sows on the 50 percent alfalfa ration used a self-feeder. The gilts on the 50 percent ration gained 0.78 pound per day on the average, and the mature sows gained 1.13 pounds per day on the average, this is double the recommended gain for mature sows. Gilts gained the recommended 0.75 pound per day. The sows on the 50 percent alfalfa ration consumed more alfalfa daily on the average than did the sows on the 100 percent alfalfa

ration, 4.49 pounds of alfalfa at the 50 percent level and only 3.76 pounds of alfalfa at the 100 percent level. The sows on the 20 and 50 percent alfalfa levels received enough of thiamine, riboflavin, niacin, anc pantothenic acid without the added vitamin supplement number 1. This is according to the N.R.C. tables for pregnant mature 500 pound sows and 300 pound pregnant gilts. Crude protein was also adequate for both gilts and mature sows.

Feed conversion for the 20 and 50 percent alfalfa level sows during gestation was satisfactory. Their T.D.N. intake was slightly above the required, and the body gain was above the expected daily gain. It must be remembered, however, that the number of mature sows in each lot was larger than the number of gilts, and that the value used for the feeds were taken from the N.R.C. tables and were not the result of our own feed analysis.

The sows on 100 percent alfalfa ration had an average feed consumption which was not adequate in providing crude protein but ample in carotene, thiamine, riboflavin, niacin, and pantothenic acid. It was inadequate in total digestible nutrients. The sows on this ration were noticeably reduced in physical vigor compared with the sows on the 20 and 50 percent alfalfa rations. Late in gestation, the sows on the 100 percent alfalfa ration showed a scaly dermatitis with loss of hair. There was a deficiency of fat in the ration. The number of sows farrowing and weaning litters on the 100 percent alfalfa gestation ration was low. Of the sows started on the 100 percent alfalfa gestation ration, only 61 percent farrowed litters, and only 55.5 percent weaned litters.

The alfalfa hay used in the rations varied in quality, and part of the poorer quality hay was rooted to one side and wasted by the sows on the 100 percent ration. Production data for sows is shown in Table V.

TABLE NO. V
PRODUCTION AND FEED RECORDS, ALL SOWS

ALFALFA LEVELS		20%	50%	100%
Number of sows in treatment	(exposed)	9	18	18
	(farrowing)	8	14	11
Number of sows in treatment	(exposed)	9	18	18
	(farrowing)	8	14	10
Feed per sow per day during gestation, pounds		8.41	9.92	3.76
Percent farrowing		88.80	77.70	61.10
Percent weaning		88.80	77.70	55.50

The sows on the 20 percent alfalfa gestation ration wasted little of their feed, and there was only a moderate amount of wastage from the self-feeders by the sows on the 50 percent alfalfa gestation ration. Of the sows started on the 20 percent alfalfa ration, 88.8 percent farrowed and weaned litters, and 77.7 percent of the sows started farrowed and weaned litters on the 50 percent alfalfa gestation ration.

When results of the three treatments on mature sows are compared, the 20 percent alfalfa lot excelled in almost every respect. The 20 percent alfalfa lot produced the largest average number of pigs born alive per sow farrowing, 11.40 live pigs per sow. There was no difference between the 50 and 100 percent alfalfa lots in number of live pigs, 9.83. The 20 percent alfalfa lot of mature sows weaned the heaviest

litters,--271.14 pounds average per sow. The 50 percent alfalfa level mature sows had an average litter weaning weight of 250.98 pounds, and the 100 percent alfalfa level sows weaned litters that averaged 226.10 pounds. The mature sows on the 20 percent alfalfa ration weaned an average of 7.50 pigs. The 50 percent alfalfa ration mature sows weaned 6.56 pigs, and the 100 percent alfalfa ration mature sows weaned almost the same number--6.50 pigs. The percentage survival of baby pigs from mature sows was highest at the 50 percent alfalfa level, lower among the mature sows on the 20 percent alfalfa gestation ration and lowest on the mature sows on the 100 percent alfalfa ration. Although separate feed records were not kept during lactation, and all lots were on the same lactation ration, mature sows on the 100 percent alfalfa gestation ration gained during lactation. Therefore, feed consumption during the lactation period was excessive on these sows.

When average daily feed consumption per sow during gestation is compared between the lot on 50 percent alfalfa and the lot on 20 percent alfalfa, the 20 percent alfalfa lot consumed on the average 1.46 pounds more of barley, 0.38 pound more of soybean oil meal, 0.05 pound less of meat meal, and 3.28 pounds less of alfalfa meal per day than did the sows on the 50 percent alfalfa gestation ration. This calculation includes both the gilts and the mature sows in both lots.

When production among gilts was statistically analyzed, the gilts on the 50 percent alfalfa gestation ration weaned the heaviest average litters (275.88 pounds) of any group on the three gestation rations, including both gilts and mature sows. There were, however, only three

gilts on the 20 percent alfalfa gestation ration that farrowed and weaned litters. Five gilts on the 50 percent alfalfa gestation ration farrowed and weaned litters. Five gilts on the 100 percent alfalfa gestation ration farrowed litters, but only four weaned litters.

Percent death loss among baby pigs from birth to weaning was least for the gilts on the 50 percent alfalfa gestation ration, higher on the gilts from the 100 percent alfalfa ration, and highest on the gilts from the 20 percent alfalfa gestation ration. The gilts on the 100 percent alfalfa gestation ration produced the largest number of dead pigs at birth. The gilts on the 100 percent alfalfa gestation ration lost on the average of 10 pounds during gestation, but gained the most during lactation, indicating again that feed consumption of the lactation ration was high within this lot.

The variation among gilts within lots in the measured characteristics was high, especially in the 50 and 100 percent alfalfa lots. This variation can be noted in the standard error of the means which is tabulated directly below the mean values in the Tables Number VI and VII. When analysis of variance was applied to the different results listed in the tables on the basis of all sows, significance was obtained only in: loss or gain in the sow during gestation; loss or gain in the sow from prefarrowing to weaning. Significance was obtained ($P < 0.01$) in both cases. When the replicates on the 50 percent alfalfa gestation ration were tested against each other by analysis of variance, significance was obtained ($P < 0.01$) on sow's gain or loss during gestation and obtained ($P < 0.01$) on sow's gain or loss from prefarrowing to weaning.

Significance could be attributed to wide variations between sows, and also to the small number per replicate when the treatment was broken down into the separate replicates.

Individual weaning weights on the pigs did not average high in any of the lots. The highest average individual weaning weight was obtained in the gilts on the 20 percent alfalfa gestation ration. This was 38.91 pounds. The mature sows on the 50 percent alfalfa gestation ration produced pigs at weaning that averaged 38.26 pounds. The sows on the 100 percent alfalfa gestation ration produced pigs that averaged 34.78 pounds and the gilts produced pigs that averaged 31.74 pounds.

Morrison (1956) states, "For wintering pregnant sows a year old or more, a ration consisting of only grain, legume hay, and a mineral supplement is satisfactory if the hay is of excellent quality." This statement was substantiated by Freeman at Michigan. From the results of the trial reported in this thesis, the author believes that when alfalfa constitutes 50 percent of the gestation ration and is self-fed the results will not quite come up to the results obtained from a 20 percent alfalfa gestation ration hand-fed. Whether the 50 percent level of alfalfa is economical depends on the relative price and availability of alfalfa and barley. The 50 percent alfalfa gestation ration had an advantage--it can be self-fed successfully to gilts. Self-feeding required less labor than hand-feeding. The wastage of feed by the sows on the 50 percent ration was not excessive.

Much of the weight loss of sows fed 100 percent alfalfa during gestation had to be gained back on the more expensive lactation ration.

This fact plus the poor performance of these mature sows and gilts substantiate the fact that 100 percent alfalfa gestation ration did prove inadequate under the conditions of this trial.

TABLE NO. VI
PRODUCTION, GILTS

ALFALFA LEVELS	20%	50%	100%
Total pigs born alive per gilt farrowing.	8.33	8.00	5.80
Standard error.	2.10	2.65	3.70
Total pigs born dead per gilt farrowing.	0.00	0.60	2.00
Standard error.	0.00	1.34	1.22
Birth weight of litters (live pigs) pounds.	22.43	20.58	12.34
Standard error.	2.03	8.32	8.10
Weight of live pigs at birth, pounds.	2.70	2.57	2.13
Standard error.	0.74	0.68	0.20
No. of pigs weaned per litter farrowed.	5.00	7.40	4.40
Standard error.	1.22	2.41	4.72
Percent mortality birth to weaning	40.00	7.50	24.14
Litter wean weight per gilt weaning litters, pounds.	194.53	275.88	139.65
Standard error.	109.67	113.59	121.91
Gilts' avg. gain or loss during gestation, pounds.	103.30	79.80	-10.00
Standard error.	33.62	52.51	36.28
Gilts' avg. gain or loss pre-farrowing to weaning, pounds.	4.33	28.60	63.30
Standard error.	30.92	49.43	61.15

TABLE NO. VII
PRODUCTION, MATURE SOWS

ALFALFA LEVELS	20%	50%	100%
Total pigs born alive per sow farrowing.	11.40	9.83	9.83
Standard error.	2.41	1.94	1.94
Total pigs born dead per sow farrowing.	3.20	0.67	1.17
Standard error.	3.60	1.00	2.04
Birth weight of litters (live pigs) pounds.	32.26	28.17	25.85
Standard error.	10.57	6.75	5.70
Weight of live pigs at birth, pounds.	2.83	2.88	2.63
Standard error.	0.71	0.56	0.50
Number of pigs weaned per litter farrowed.	7.50	6.56	6.50
Standard error	3.12	2.07	1.22
Percent mortality birth to weaning	23.40	9.23	33.90
Litter wean weight per sow weaning litters, pounds.	271.14	250.98	226.10
Standard error.	91.74	80.00	44.97
Sows' avg. gain or loss during gestation, pounds.	153.20	115.56	-00.17
Standard error.	27.10	38.77	24.68
Sows' avg. gain or loss pre-farrowing to weaning, pounds.	-89.60	-52.56	38.83
Standard error	40.62	48.44	20.62

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