of supplementation was the most profitable, but not greatly different than returns for the high level. Although cost for wintering of the low level cows was small, returns for these cows were low due to greatly decreased weaning weights. It appears that the "low" level under Ft. Reno conditions approximates the medium level in the Lake Blackwell tests.

Summary

Data from the 11-year test at Ft. Reno indicate that low levels of supplemental feed under range conditions at this station have not adversely affected the reproductive performance or longevity of beef cows, nor affected the weaning weights of their calves. Low level cows have shown a greater survival rate under the conditions of this test. They have matured into as large cows as those fed at higher levels, with the possible exception of those calving first as two-year-olds. At 11½ years of age, cows that calved first as two-year-olds had weaned 1.19 more calf per cow than those which calved first as three's. Total feed, pasture, and mineral costs for medium and high levels have been 32 percent and 75 percent greater than those cows wintered each year on the low level.

Results of a wintering trial with mature cows at the Lake Blackwell range indicate a marked increase in weaning weight of the calves due to increased supplementation of the cows. Profits have favored the medium level in terms of return for calf above cow cost and creep feed cost. Little difference was noted in yearly weight gains of the cows or in reproductive performance.

Thus it appears that small amounts of winter supplement as practiced under conditions of the Ft. Reno study were adequate. Larger amounts were needed under Lake Blackwell conditions. Of considerable importance is the apparent trend for a shorter productive life span and reduced percent calf crop where beef cows were fed relatively large amounts of supplemental winter feed each winter for 11 consecutive years.

Lactation and Creep Rations for Sows And Pigs Raised on Pasture and in Confinement

J. C. Hillier and J. Martin

One of the very critical periods in the life cycle feeding and management of swine is the period from birth to eight weeks of age. Anemia is common among pigs of this age unless special precautions are taken to prevent it. The trials discussed in this paper dealt with the period from 14 to 56 days of age for the pigs and from farrowing to 42 days post farrowing for the sows. Hampshire, Poland China and Yorkshire

sows and litters were used in these tests. Every effort was made to assign sows and litters to the various treatments as uniformly as possible and on the basis of breed, age of dam, size of litter, and farrowing date.

Pasture Test

In the first trial, mature sows and their litters were assigned to two treatments. The sows in both groups received the ration shown in Table 1. This is the same ration as was fed to sows in confinement tests dis-

Table 1.—The Ration Self-fed to Nursing Sows Grazing Small Grain Pasture, February to May, 1959.

Feed	% Consumption
Milo (ground)	75.8
Soybean meal	11.4
Alfalfa leaf meal	10.0
Dicalcium phosphate	1.5
Calcium carbonate	0.6
Salt	0.5
Vitamin pre-mix[1]	0.2
TOTAL	100.0
Ration Cost ($)	2.16

[1]Provides 4.0 mgs. niacin, 5.0 mgs. pantothenic acid, 1.2 mgs. riboflavin, 200 mgs. choline, 10 mcgs. B_{12} and 180 I.U. vitamin D per pound of ration.
This ration was calculated to contain 15.0% crude protein, 0.8% calcium and 0.6% phosphorus.

cussed later. The creep rations used are shown in Table 2. Creep ration 1, considered the basal ration, contains the vitamin, antibiotic, and zinc fortification previously used in creep rations at this station. Ration 2 contains, in addition, the trace mineral fortification indicated. Sows and litters were moved to small grain pasture when the pigs were about 14 days of age. Two sows and their litters occupied a two unit portable house located in a pasture plot of about .3 of an acre. The self-feeders for the sows were placed outside but the creep area was inside the house. Water was available at all times for both the sows and pigs. The sows were removed 42 days post farrowing but the pigs remained in these quarters until they were 56 days of age.

A summary of the results is given in Table 3. The average weight per pig at 42 days of age was 31.8 pounds for those on the non-trace mineral ration and 30.5 pounds for those receiving the creep ration fortified with trace minerals. At 56 days of age, the pigs from these two groups averaged 47.8 and 46.6 pounds, respectively. Differences in the

Table 2.—Creep Rations Self-fed to Pigs Nursing Sows on Small Grain Pasture and to Pigs Nursing Sows in Confinement, February to May, 1959.

Creep Ration Description of Ration	Percentage Composition	
	1 Basal	2 Basal + Trace Minerals
Corn, ground	32.0	32.0
Milo, ground	32.2	32.2
Soybean meal (44%)	12.4	12.4
Fish meal	6.6	6.6
Dried buttermilk	10.0	10.0
Cane sugar	5.0	5.0
Dicalcium phosphate	0.5	0.5
Calcium carbonate	0.5	0.5
Mineral-vitamin-antibiotic mix[1]	---	0.3
Vitamin-antibiotic mix[2]	0.3	---
Salt	0.5	0.5
TOTAL	100.0	100.0
Ration Cost ($)	4.56	4.57

[1]Pre-mix no. 1 provides 4.0 mgs. niacin, 5.0 mgs. pantothenic acid, 1.2 mgs. riboflavin, 200 mgs. choline, 10 mcgs. B_{12}, 180 I.U. vitamin D and 2000 USP units of vitamin A per pound of ration. This supplement also provides 15.0 grams of iron, 2.0 mgs. copper, 0.88 mgs. cobalt, 18 mgs. manganese and 50 ppm. of zinc. In addition, aureomycin was provided at the rate of 50 mgs. per pound of ration.

[2]Pre-mix no. 2 provides 4.0 mgs. of niacin, 5.0 mgs. pantothenic acid, 1.2 mgs. riboflavin, 200 mgs. choline, 10 mcgs B_{12}, 180 I.U vitamin D and 2000 USP units vitamin A per pound of ration. In addition, aureomycin was provided at the rate of 50 mgs. per pound of ration and zinc at the rate of 50 ppm.

Table 3.—Summary of Results—Trace Mineral Fortification of a Creep Ration Fed to Nursing Pigs on Pasture, February to May, 1959.

Creep Ration Ration Treatment	1 Basal	2 Basal + Trace Mineral
No. litters	12	12
No. pigs at 14 days	97	94
No. pigs at 42 days	95	94
Percentage of pigs weaned	97.9	100.0
Av. no. pigs weaned per litter	7.9	7.8
Total wt. of pigs (lbs.)		
42 days	3021	2867
56 days	4541	4380
Av. wt. per litter (lbs.)		
42 days	251.7	238.9
56 days	378.5	365.0
Av. wt. per pig (lbs.)		
42 days	31.8	30.5
56 days	47.8	46.6
Total creep feed consumed (lbs.)	3289	3344
Av. consumption per pig		
to 42 days	11.3	12.7
42 to 56 days	23.3	22.9
up to 56 days	34.6	35.6
Total feed consumed by sows (lbs.)		
Farrowing to weaning	3853	4450
Av. daily feed consumption	9.2	10.6

Table 3.—Summary of Results—Trace Mineral Fortification of a Creep Ration Fed to Nursing Pigs on Pasture, February to May, 1959. (Cont'd.)

Creep Ration Ration Treatment	1 Basal	2 Basal + Trace Mineral
Av. weight loss per sow	128.6	159.5
Feed cost ($)		
Total creep feed	149.97	152.82
Per pig to 42 days	.52	.58
Per pig to 56 days	1.58	1.63
Total sow feed (Farrowing to 42 days)	83.22	96.12
Per sow	6.94	8.01
Total feed cost[1]	233.16	248.94
Per pig	2.45	2.65
Per cwt. pig produced (56 days)	5.13	5.68

[1]Includes weight loss of sows figured at $12.00 per cwt.

average consumption of creep feed for the various periods were very small. The sows in group 2 were somewhat heavier at farrowing than those in group 1. They also lost more weight during the nursing period and consumed a greater quantity of feed. Because of these differences, the feed cost per pig and per hundred weight of pigs produced was greater ($5.13 vs. $5.68) in group 2. However, these differences are not attributable to the creep ration treatments.

Creep Rations for Pigs in Confinement

In the second trial, the sows and pigs were retained in confinement. Each sow and her litter occupied a pen 6 by 30 feet, about 16 feet of which was under roof. A creep was arranged inside with both feed and water available in this area. The sows were self-fed the rations indicated in Table 4. The two creep rations were the same as those fed to the pigs on pasture. First litter gilts and their pigs were used in this test.

Table 4.—The Ration Self-fed to Nursing Sows in Confinement. Trial 2, February to May, 1959.

Feed	% Composition
Milo, ground	75.8
Soybean meal (44%)	11.4
Alfalfa leaf meal	10.0
Dicalcium phosphate	1.5
Calcium carbonate	0.6
Mineral-vitamin mix[1]	0.2
Salt	0.5
TOTAL	100.0
Ration Cost per cwt. ($)	2.17

[1]Provides 4.0 mgs. niacin, 5.0 mgs. pantothenic acid, 1.2 mgs. riboflavin, 200 mgs. choline, 10 mcgs. B_{12} and 180 I.U. vitamin D per pound of ration. This pre-mix also provides 15.0 mgs. iron, 2.0 mgs. copper, 0.88 mgs. cobalt, 18 mgs. manganese per pound of ration.

The results of this test are summarized in Table 5. The 42- and 56-day weights of the pigs on the two ration treatments did not differ significantly. (29.2 vs. 28.0 and 43.6 vs. 41.8) The two creep rations were consumed at about the same rate with an average total consumption of 37.9 pounds on ration 1 and 36.6 pounds on creep ration 2. Likewise, the feed cost per pig or per hundred weight of pig produced did not differ significantly between those on the two treatments.

Table 5.—Summary of Results—Trace Mineral Fortification of a Creep Ration Fed to Nursing Pigs in Confinement, February to May, 1959.

Creep Ration Ration Treatment	1 Basal	2 Basal + Trace Mineral
No. litters	8	9
No. pigs at 14 days	72	86
No. pigs at 42 days	72	85
Percentage of pigs weaned	100.0	99.0
Av. no. pigs weaned per litter	9.0	9.4
Total wt. of pigs (lbs.)		
42 days	2102	2380
56 days	3139	3553
Av. wt. per litter (lbs.)		
42 days	262.7	264.4
56 days	392.4	394.8
Av. wt. per pig (lbs.)		
42 days	29.2	28.0
56 days	43.6	41.8
Total creep feed consumed (lbs.)	2731	3115
Av. consumption per pig		
to 42 days	11.7	11.2
42 to 56 days	26.2	25.4
up to 56 days	37.9	36.6
Total feed consumed by sows (lbs.)		
Farrowing to weaning	3482	4184
Av. daily feed consumption	10.4	11.1
Av. weight loss per sow (lbs.)	111.1	109.9
Feed cost ($)		
Total creep feed	124.53	142.36
Per pig to 42 days	.53	.51
Per pig to 56 days	1.73	1.67
Total sow feed (farrowing to 42 days)	75.56	90.79
Per sow	9.45	10.09
Total feed cost[1]	213.42	246.33
Per pig weaned	2.96	2.90
Per cwt. pig produced (56 days)	6.80	6.93

[1]Includes weight loss by sows figured at $12.00 cwt.

The hemoglobin levels for the pigs raised on pasture as well as for those raised in confinement are given in Table 6. These values were determined by use of a Spencer hemoglobinmeter on four pigs per litter. Since the pigs in trial 1 were being nursed by mature sows and those in trial 2 by first litter gilts, it was felt that comparisons on rate of gain and feed costs could not be made between pasture and confinement raised pigs. However, since age of dam has not been shown to have an influence on the hemoglobin levels of their pigs, it was felt that comparisons could be made between pasture and confinement raised pigs with respect to their hemoglobin levels.

Table 6.—Hemoglobin Levels of Pigs Raised on Pasture and in Confinement and Fed Creep Rations With and Without the Addition of Trace Minerals, February to May, 1959.

Treatments	Pasture		Confinement	
Rations	1 Basal	2 Basal + T.M.	1 Basal	2 Basal + T.M.
	Grams per 100 c.c. of blood[1]			
Age				
14 days	11.6	10.2	11.4	12.1
28 days	11.6	12.0	9.7	9.7
42 days	12.0	11.9	9.5	9.4
56 days	11.5	11.9	9.6	9.4
Average for period	11.7	11.5	10.0	10.1
Average for pasture and confinement	11.6			10.0

[1]Determined by use of a Spencer hemoglobinometer.

As indicated by the figures in Table 6, the feeding of trace minerals did not increase the hemoglobin levels of the pigs so fed, either on pasture or in confinement. However, the pasture raised pigs averaged 1.6 grams more hemoglobin per 100 c.c. of blood than those raised in confinement. Both groups of pigs had been given a 2 c. c. intramuscular injection of an iron-dextran solution at three days of age.

In a third trial, two rations were fed to sows in confinement. Group 1 sows received the ration shown in Table 1, while group 2 sows received the ration shown in Table 4. The essential difference between these rations was the trace mineral fortification added to the ration in Table 4. Again, the pig creep was placed inside the building and the self-feeders and waterers for the sows were placed outside. First litter sows and their pigs were used in this test. The pigs were weaned at 42 days of age but continued on the creep rations until they were 56 days old.

The results of this test are given in Table 7. The pigs nursing sows fed the trace mineral fortified ration averaged 4.3 pounds heavier at 42 days and 5.2 pounds heavier at 56 days than those nursing sows fed the basal ration. Sows on the trace mineral fortified ration consumed an average of 1.1 pounds more feed per day (9.5 vs. 10.6) and lost an average of 9.2 pounds less weight during the nursing period than those not receiving the trace mineral additions. However, the feed cost per hundred weight of pig produced was about the same for both groups.

The fourth trial, conducted in the fall of 1959, was a continuation of the confinement studies with nursing pigs. From the results obtained

Table 7.—Summary of Results—The Addition of Trace Minerals to the Rations of Sows Nursing Pigs in Confinement, March to May, 1959.

Sow ration Ration treatment (sows)	1 Basal	2 Basal + Trace Mineral
No. litters	6	6
No. pigs at 14 days	50	51
No. pigs at 42 days	48	48
Percentage of pigs weaned	96.0	94.1
Av. no. pigs weaned per litter	8.0	8.0
Total wt. of pigs (lbs.)		
42 days	1162	1368
56 days	1757	2006
Av. wt. per litter (lbs.)		
42 days	193.6	228.1
56 days	292.8	334.3
Av. wt. per pig (lbs.)		
42 days	24.2	28.5
56 days	36.6	41.8
Total creep feed consumed (lbs.)	1468	1790
Av. consumption per pig		
to 42 days	9.6	12.1
42 to 56 days	21.0	25.2
up to 56 days	30.6	37.3
Total feed consumed by sows (lbs.)		
Farrowing to weaning	2399	2683
Av. daily feed consumption	9.5	10.6
Av. weight loss per sow (lbs.)	124.8	115.0
Feed cost ($)		
Total creep feed	67.09	81.80
Per pig to 42 days	.44	.55
Per pig to 56 days	1.40	1.70
Total sow feed (farrowing to 42 days)	51.82	58.22
Per sow	8.64	9.70
Total feed cost[1]	133.88	153.82
Per pig weaned	2.79	3.20
Per cwt. pig produced (56 days)	7.62	7.68

[1]Includes weight loss by sows figured at $12.00 cwt.

in Trial 2, trace mineral additions to the creep ration had little effect on the 56-day weights or the hemoglobin levels of the pigs. Furthermore, it was observed that the hemoglobin levels of the confinement raised pigs were 1.6 grams lower than those raised on pasture. Trial 4 was designed to determine: 1) the effect of an addition of 3 percent soil to a fortified creep ration, and 2) the effect of an additional iron injection on the performance and hemoglobin levels of pigs raised in confinement.

First and second litter gilts and their pigs were used in this test. The sows and litters were housed in the same units as were used in the second trial. The creep rations fed are shown in Table 8. Ration 2 was fortified with vitamins and trace minerals, and ration 3 contained, in addition, three percent black soil. The sow ration was the same as that fed in the second trial.

In addition to the ration treatment imposed, all of the pigs received an initial injection of 2 c.c. of an iron-dextran solution at three days of age, and half of the pigs in each litter received a second 2 c.c. injection at 21 days of age. Pig weights and hemoglobin levels were determined at 21, 28, 42, and 56 days of age. The pigs were weaned at 42 days of age and continued on the respective ration treatments until they were 56 days old. Creep ration consumption was determined when the pigs were weaned and again when they reached 56 days of age. In addition to the measurements on the pigs, the weight of the sow at farrowing and 42 days following farrowing plus sow feed consumption were recorded.

Table 8.—Creep Rations Fed to Pigs Nursing Sows in Confinement, September to November, 1959.

Creep Ration Description of Ration	Percentage Composition	
	2 Trace mineral	3 Soil
Corn, ground	31.7	28.7
Milo, ground	32.0	32.0
Soybean meal	12.4	12.4
Fish meal	6.6	6.6
Dry buttermilk	10.0	10.0
Cane sugar	5.0	5.0
Dicalcium phosphate	0.5	0.5
Calcium carbonate	0.5	0.5
Salt	0.5	0.5
Soil (black)		3.0
Vitamin-mineral-antibiotic pre-mix[1]	0.8	0.8
TOTAL	100.0	100.0
Ration Cost ($)	4.57	4.52

[1]Pre-mix provides 4.0 mgs. niacin, 5.0 mgs. pantothenic acid, 1.2 mgs. riboflavin, 200 mgs. choline, 12.5 mcgs. B_{12}, 180 I.U. vitamin D, 2000 USP units of vitamin A, 15 mgs. iron, 2.0 mgs. copper, 0.88 mgs. cobalt, 18 mgs. manganese, 50 ppm. zinc, 25 mgs. aureomycin and 6000 units of hygromycin B per pound of ration.

A summary of the results obtained in this trial are presented in Tables 9 and 10. The addition of soil to the creep ration did not affect significantly either the 42- or 56-day weights of the pigs. The average 56-day weights of the pigs fed creep rations 2 and 3 were 35.5 and 36.1 pounds, respectively. Creep feed consumption by the two groups indicated that the addition of three percent soil to the creep ration did not affect the palatability of the ration. There was very little difference between the treatments in the feed cost per pig weaned or per hundred weight of pig produced.

Table 9.—Summary of Results, the Addition of Soil to Creep Rations and to Nursing Pigs in Confinement, September to November, 1959.

Creep Ration Ration Treatment	2 Basal	3 Basal + Soil
No. litters	9	9
No. pigs at 14 days	68	75
No. pigs at 42 days	67	74
Percentage of pigs weaned	98.5	98.6
Av. no. pigs weaned per litter	7.4	8.2
Total wt. of pigs (lbs.)		
42 days	1559	1741
56 days	2382	2674
Av. wt. per litter (lbs.)		
42 days	173.2	193.4
56 days	264.7	297.1
Av. wt. per pig (lbs.)		
42 days	23.3	23.5
56 days	35.5	36.1
Total creep feed consumed (lbs.)	1651	1971
Av. consumption per pig		
to 42 days	5.7	6.1
42 to 56 days	18.9	20 5
up to 56 days	24.6	26.6
Total feed consumed by sows (lbs.)		
Farrowing to weaning	3830	4205
Av. daily feed consumption	10.1	11.1
Av. weight loss per sow	93.7	99.6
Feed cost ($)		
Total creep feed	75.45	89.09
Per pig to 42 days	.26	.29
Per pig to 56 days	1.13	1.20
Total sow feed (farrowing to 42 days)	$83.11	$ 91.25
Per sow	9.23	10.14
Total feed cost[1]	169.80	192.29
Per pig weaned	2.52	2.50
Per cwt. pig produced (56 days)	7.13	7.19

[1]Includes weight loss by sows figured at $12.00 cwt.

Table 10.—Hemoglobin Levels of Pigs Raised in Confinement and Fed Creep Rations Containing Additions of Either Trace Minerals Alone or Trace Minerals and Soil, September to November, 1959.

Creep Ration No. Ration Treatment	2 Trace Mineral			3 Trace mineral plus soil		
Iron injections[1]	1	2	Av.	1	2	Av.
	Grams per 100 c.c. of blood					
21 days	11.4	11.5	11.5	10.8	10.7	10.7
28 days	10.5	12.1	11.3	10.6	12.3	11.4
42 days	9.7	11.1	10.4	9.7	11.0	10.3
56 days	9.6	10.2	9.9	9.3	10.0	9.7
Average	10.30	11.2	10.8	10.1	11.0	10.5

[1]Iron injection: first injection=2 c.c. at 3 days
second injection=2 c.c. at 21 days

Table 9 summarizes the hemoglobin levels of the pigs fed the two creep rations and also the effect of the second iron injection on the hemoglobin levels of the pigs. Differences in the hemoglobin levels of the pigs fed the two creep rations were small. The second iron injection increased the average hemoglobin level of the pigs on creep ration 2 from 10.3 to 11.2 grams pr 100 c.c. of blood, and of those on creep ration 3 from 10.1 to 11.0 grams per 100 c.c. of blood.

Summary

The data presented indicates that pigs raised on pasture from 14 to 56 days of age averaged about 1.6 grams more hemoglobin per 100 c.c. of blood than those raised in confinement. The addition of trace minerals to the creep ration did not improve the hemoglobin level or the rate of gain of pigs raised either in confinement or on pasture. These pigs had received an intramuscular injection of 2 c.c. of an iron-dextran solution at three days of age. The addition of 3 percent black soil to the creep ration did not improve the rate of gain or the hemoglobin level. A second iron injection when the pigs were 21 days of age increased the hemoglobin level about 1 gram per 100 c.c. on confinement raised pigs. None of the ration treatments tested were effective in preventing the drop in hemoglobin commonly experienced when young pigs were fed in confinement. A second iron injection was effective in preventing this drop.

Sows self-fed trace mineral fortified rations in confinement consumed 1.1 pounds more feed daily and lost 9.2 pounds less weight during the nursing period than those not receiving the trace mineral addition. Pigs nursing the sows receiving trace mineral fortified ration were 4.3 pounds heavier at 42 days and 5.2 pounds heavier at 56 days of age than those nursing sows not receiving trace minerals.

It appears that rate of gain and the general well being of young pigs are not closely associated with hemoglobin levels when these values are within the range of 9 to 12 grams per 100 c.c. of blood. Obvious symptoms of anemia are associated with hemoglobin readings of 6 to 7 or lower.

Stilbestrol Implants and Urea In Protein Suplements for Wintering Steer Calves and the Effect of Stilbestrol Implants on Subsequent Summer Gains

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Cattle and sheep are able to utilize, to varying degrees, the nitrogen from urea. This utilization is possible because of the micro-organisms in parts of the ruminant stomach. Efficient utilization of urea will result only when other nutrients are present in amounts needed by the micro-organisms. There have been many studies which indicate that urea may satisfactorily replace part of the protein in the rations of fattening cattle. There is a lesser number of tests on the value of urea in wintering rations in which the quantity of concentrate feed offered as a supplement to grass hays or dry range is very limited.

Tests conducted at this station in recent years have indicated that urea apparently is not efficiently utilized by cattle wintered on dry range grass when it is added to a mixture of corn and cottonseed meal to produce a pellet containing 40 percent protein, with one-third of the nitrogen furnished by urea. However, in two of three tests the addition of trace minerals or dehydrated alfalfa meal to the urea-containing pellet resulted in increased gains. An additional test on the use of urea in wintering rations has been conducted during the 1959-60 season.

The use of stilbestrol in various systems of beef production has increased considerably. Its use with fattening cattle is generally accepted as a means of increasing gain and feed efficiency. Also, implanting of stilbestrol has usually increased the gains of suckling calves. There are indications that the response from stilbestrol is less when the energy content of a ration is low, such as is the case with many of our wintering rations. Our interest in this particular report is the value of stilbestrol implants for steer calves wintered on dry range grass after weaning, and the effect of these implants on subsequent summer gains as yearlings.

Part 1. Urea in Protein Supplements for Wintering Steer Calves

Procedure

Seventy-five grade Hereford steer calves, purchased from T. J. Blakemore and Sons Ranch near Forgan, Oklahoma, were divided into 5 lots of 15 each on November 19, 1959. They were allowed to graze the dry