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Growth and Reproduction in Swine

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ABSTRACT

The immature swine breeding projects that have been running at the Missouri Agricultural Experiment Station since 1909 are reported. Sixty sows and their offspring are included in the data. Comparisons are made between sows bred first when mature, half-mature, and immature. Immature sows were fed on high, medium or low planes of nutrition. Growth curves indicate very slight advantages for the sows bred first as yearlings or older. When the immature bred sows were maintained on restricted amounts of feed they lacked 12 to 17 centimeters of being as tall at the withers as sows bred similarly but fed liberally. Lactation and not gestation proved to be the occasion of real strain. The relation between the amount of feed consumed by the sow and the weaning weights of the pigs is discussed. The gains made by the sow the month following breeding appeared most important in the production of large litters. The sex of the pigs, the number of dead pigs, and the season of the year are studied. Retarded growth of body meant retarded development of genital organs so that sexual maturity was actually delayed for months due to the non-functioning of the ovaries. Comparisons are made with the findings of other investigators.

ACKNOWLEDGMENT

The author gratefully acknowledges his indebtedness to F. B. Mumford, E. A. Trowbridge, L. A. Weaver, and A. G. Hogan for counsel and assistance in this investigation and report. Especial credit is due to Professors Weaver and Hogan for their constructive contributions to this work.

Growth and Reproduction in Swine

FRED F. MCKENZIE*

OBJECT OF INVESTIGATION

There has been for some years a fairly widespread opinion among practical breeders that the early breeding of immature sows is undesirable. Among the undesirable effects which may be expected, are: Retarded growth of the young mother; reduced vigor and quality of the offspring; permanent decrease in the size of the herd; and loss of fecundity.

That this problem might be attacked in a scientific way, Doctor F. B. Mumford, Director of the Missouri Agricultural Experiment Station, planned an experiment in which sows of different ages were bred and the effects noted. The data that have accumulated provide material for the study of different phases of growth and reproduction in swine.

OUTLINE OF EXPERIMENTS

A project was started in 1909 when six gilts were divided into three lots of two each, one lot of gilts to be bred as young as possible, the second lot to be bred when half-mature, or about eighteen months, and the third lot at the age of two years. Gilts from the first litter of each of the sows were handled as were their dams. Thus were built up three lines of stock: an early-bred line, a half-mature-bred line, and a mature-bred line. All animals were generously fed.

In 1920 Mumford introduced a new phase into the investigation. A group of gilts from the ninth generation of continued early breeding was divided into three lots, one to be fed generously, the second to receive a medium amount of feed, and the third to be held on a scant ration. All groups here were bred as early as possible, and bred for two litters a year wherever possible.

Thus there have been two investigations in swine breeding at the Missouri Station: (1) The Original Project begun in 1909, well-fed gilts bred at different ages; and (2) the Sub-Project begun in 1920, early-bred gilts fed on three planes of nutrition.

The animals have been grouped in this study as follows:

Group I—Sows bred first as two-year-olds.

Group II—Sows bred first as yearlings (about eighteen months)

*Animal Husbandry Department, Missouri Agricultural Experiment Station, and Animal Husbandry Division, Bureau of Animal Industry, United States Department of Agriculture, Co-operating.

Group III—Sows bred at puberty or as soon after as possible.

Group IV—Sows bred at puberty or as soon after as possible, handled as were those in Group III and V, and *living contemporaneously with Group V.*

Group V—Sows bred as young as possible, and well fed, that is, on the high plane of nutrition.

Group VI—Sows bred as young as possible, and fed on a medium plane of nutrition.

Group VII—Sows bred as young as possible, and fed on a scant ration, or on a low plane of nutrition.

Thus Groups I, II, III, IV, and V were sows that were well fed, but bred first at different ages. Groups IV, V, VI, and VII were sows that were bred as early as possible, but Group VI received less feed than either Group IV or V, and Group VII received still less than Group VI.

In this report the above group numbers will be used to distinguish the various groups of sows, wherever this is feasible.

All litters were weaned at eight weeks of age and the sows rebred as soon as possible. Wherever possible boars have been mated to sows of about their own age. Fresh blood has been introduced through the boars, no attempt being made to produce breeding boars to be used on the sows in the experiments.

The records cover the following: feed consumed; weights of sow and pigs; measurements such as height at withers, height at croup or hooks, depthof chest, length of body, heart girth, etc.; photographs; and a small amount of data from autopsies.

The grain mixtures used from the beginning of the experiment in 1909 till March 11, 1917 were as follows:

Mixture I.—For lactating sows and for pigs until they weighed 125 pounds. Shorts 4 pounds, corn 2 pounds, linseed oil meal 1 pound; total 9 pounds. Total digestible nutrients per pound of feed .72 pound. Nutritive ratio 1:4.23.

Mixture II.—Fed to breeding animal over 150 pounds when not suckling pigs. Shorts 10 pounds, corn 13 pounds, bran 5 pounds, linseed oil meal 5 pounds; total 33 pounds. Total digestible nutrients per pound of feed .72 pound. Nutritive ratio 1:5.88.

Mixture III.—Fed to dry sows on grass and to fattening pigs over 125 pounds. Corn 6 pounds, linseed oil meal 1 pound; total 7 pounds. Total digestible nutrients per pound of feed .8 pound. Nutritive ratio 1:6.9.

Since March 11, 1917 the grain mixtures have been as follows:

Mixture A.—For lactating sows and for growing pigs until five months old. Corn 5 pounds, shorts 2.5 pounds, bran 1.5 pounds, tankage,

1 pound; total 10 pounds. Total digestible nutrients per pound of feed .78 pound. Nutritive ratio 1:4.3.

Mixture B.—For fattening pigs over 125 pounds weight and for dry sows on grass. Corn 8 pounds, shorts 2 pounds, tankage 1 pound; total 11 pounds. Total digestible nutrients per pound of feed .83 pound. Nutritive ratio 1:5.26.

Mixture C.—For dry sows not on pasture. Corn 5 pounds, shorts 2 pounds, bran 2.5 pounds, tankage 0.5 pound; total 10.0 pounds. Total digestible nutrients per pound of feed .67 pound. Nutritive ratio 1:4.35.

Mineral mixtures were not fed.

ANIMALS AND EQUIPMENT USED

Duroc Jersey swine registered, or eligible for registration, in the recognized record associations of the United States have been the only animals used.

Shelters consisted of two types of houses, the A-shaped cot and the ordinary 8x8-foot cot. These were placed in wire-fenced bluegrass lots. The bluegrass lots where the hogs were run were the same since the project began, except that in 1924-25 for one year they were all moved to dry lots, and since then they were moved back and forth between the dry lots and the pasture lots, special effort being made to keep all the young pigs on pasture.

A tape line and calipers were used in taking measurements. Platform and spring scales and weighing crates were used to get the weights of the pigs, and to weigh out the feed. Other sundry items ordinarily found on a hog farm made up the balance of the equipment.

PRESENTATION OF DATA AND DISCUSSION

The data afford material for the study of the effects of early breeding with poorly fed sows as well as with those well cared for, upon the sow, her offspring, and to some extent upon the breed and race. The records considered include those from the beginning of the investigation in 1909 up to the early spring of 1927.

SUMMARY OF PRODUCTION OF SOWS

Table 1 summarizes much of the data, and in this table the performance of the several groups can be reviewed at a glance. Since the gilts were not always bred at the first appearance of heat the column headed "Age at farrowing 1st litter" gives the true picture of the breeding history of the animals. The number of pigs born, the number born dead and alive, the average birth weight per pig and the average litter weight at birth are given.

TABLE 1.—BREEDING RECORD OF ALL GROUPS

GROUP	Age when first noticed in heat (days)	Age first bred (days)	Age at farrowing 1st litter	AVERAGE BIRTH WEIGHT IN POUNDS											
				Litter Number											
				1	2	3	4	5	6	7	8	9	10	11	Av. of all litters
I	456.2	837.6	962.4	2.23	4.0	2.70	3.27	3.33	1.71						2.85
II	478.6	478.6	649.7	2.45	2.57	2.02	2.77	2.49							2.38
III	194.3	212.3	360.3	2.04	2.31	2.33	2.43	2.36	2.27	2.60	2.02	1.88	2.38	1.93	2.27
IV	216.2	231.3	355.2	2.26	2.7	2.32	2.63	2.59	2.01	2.02					2.42
III, IV, V	205.7	218.1	358.1	2.12	2.38	2.30	2.41	2.46	2.37	2.61	2.16	1.97	2.38	1.93	2.30
V	220.3	220.3	355.9	2.17	2.33	2.26	2.31	2.36	2.71	2.76	2.61	2.27			2.32
VI	266.0	270.2	438.3	2.05	2.17	2.18	2.52	2.50	2.76	2.50	2.33	2.23			2.31
VII	288.0	288.6	434.8	2.06	2.07	2.28	2.39	2.47	2.19	2.02					2.20
V, VI, VII	259.5	260.7	408.4	2.09	2.19	2.25	2.36	2.43	2.59	2.53	2.54	2.25			2.29

TOTAL WEIGHT OF LITTERS AT BIRTH IN POUNDS

GROUP	Av. of all litters	Litter Number										
		1	2	3	4	5	6	7	8	9	10	11
I	14.91	13.93	24.0	16.23	18.0	10.0	12.83					
II	19.86	17.995	21.53	22.23	24.99	12.49						
III	19.56	14.72	17.62	18.46	21.07	23.77	20.62	19.2	20.89	22.14	22.16	11.6
IV	20.07	16.17	19.95	21.47	29.0	23.3	16.1	18.2				
III, IV, V	20.01	15.57	18.157	19.79	22.41	22.14	15.82	21.07	21.87	24.05	22.16	11.6
V	20.94	16.58	17.95	21.45	22.78	18.5	25.1	25.52	24.81	31.7		
VI	20.86	15.2	16.09	21.81	24.72	28.34	27.6	30.0	16.3	13.4		
VII	15.98	15.56	14.48	14.36	17.1	19.8	20.87	16.12				
V, VI, VII	19.34	15.80	16.67	18.91	21.69	21.29	24.66	23.48	21.97	22.55		

TABLE 1.—BREEDING RECORD OF ALL GROUPS—CONTINUED

NUMBER OF PIGS IN LITTER AT BIRTH

I	5.62	6.4	4.67	6.	5.5	3.	7.5					
II	8.36	7.75	8.33	11.0	9.0	5.0						
III	8.62	7.0	7.64	8.4	8.64	9.64	9.95	8.44	9.55	10.33	9.33	6.0
IV	8.28	7.14	7.4	9.25	11.0	9.0	8.0	9.0				
III, IV, V	8.68	7.2	7.615	8.85	9.217	9.238	9.41	8.71	10.	10.857	9.33	6.
V	9.00	7.6	7.7	9.5	9.9	8.2	9.25	9.25	11.3	14.0		
VI	9.10	7.4	8.3	10.0	10.75	11.3	10.0	12.	7.0	6.0		
VII	7.16	7.6	7.0	6.3	8.0	9.5	8.0					
V, VI, VII	8.42	7.54	7.62	8.42	8.82	9.00	9.50	9.29	10.25	10.00		

NUMBER OF PIGS ALIVE AFTER 12 HOURS

I	5.06	5.	7.	5.5	5.5	3.	2.5					
II	7.72	6.25	8.33	11.0	8.0	5.0						
III	6.73	4.87	6.64	6.64	6.79	8.62	8.00	5.67	7.11	6.17	7.67	3.0
IV	6.48	6.33	6.6	7.5	8.33	8.5	3.0	0				
III, IV, V	6.62	5.37	6.14	7.08	7.24	8.0	6.82	5.62	6.83	6.57	7.67	3.0
V	6.46	5.6	5.1	7.6	7.6	6.5	6.0	7.3	6.0	9.0		
VI	7.09	6.9	6.8	6.0	8.0	7.75	7.5	12.0	7.0	3.0		
VII	5.15	5.4	4.8	4.25	4.5	5.75	8.0	7.0				
V, VI, VII	6.20	5.85	5.42	5.95	6.74	6.64	6.78	8.00	6.25	6.00		

NUMBER OF PIGS WEANED

I	4.00	2.5	6.	5.	4.5	3.	3.					
II	6.36	4.5	6.67	9.5	8.0	5.0						
III	4.95	4.25	4.47	4.0	5.57	6.21	6.5	4.1	5.3	4.83	5.33	0
IV	4.00	4.83	3.60	5.0	4.33	6.0	0	0				
III, IV, V	4.42	4.25	4.10	4.40	4.68	5.13	4.47	3.43	4.89	4.86	5.33	0
V	3.54	3.9	3.8	4.75	3.25	2.7	2.2	2.75	4.0	5.0		
VI	6.26	6.2	6.2	5.4	6.4	6.75	7.0	10.0	7.0	3.0		
VII	3.90	5.0	3.0	2.75	3.7	4.5	6.0	5.0				
V, VI, VII	4.34	4.88	4.08	4.14	4.21	4.27	4.11	4.33	4.75	4.00		

Those sows that farrowed, at the youngest average age, (355-360 days) were in the high plane and early bred groups, viz: III, IV and V. These sows farrowed when from two to three months younger than those receiving less feed.

As a rule the Group VI sows on the medium plane farrowed and weaned more pigs than other sows. In this connection it is noted that the sows carrying more flesh than those on the restricted rations were less active and often laid on their young pigs and crushed them. Again, the sows on the low plane were often so ravenously hungry that they injured their young pigs when feed was placed in the troughs. Thus over-condition and under-condition worked against maximum numbers in litters throughout the suckling period.

Probably the outstanding difference to be noted is the number of pigs farrowed by the low plane sows (7.16) and by sows bred first as two-year-olds (5.62) as compared with the number of pigs farrowed by the other groups (8.28-9.1). The difference is markedly in favor of sows bred early and reasonably well cared for. Further, it is noted that the average birth weight per pig was greatest for the mature bred sows (2.85 lbs.) and least for the low plane sows (2.20 lbs.), but both these weights must be considered as within a satisfactory range. The average birth weight of the entire litter was quite low for both of these groups (I and VII), being 14.91 lbs. and 15.98 lbs., respectively, but this is accounted for by the smaller number of pigs farrowed, a fact already mentioned above.

The average birth weight is noticeably less for first litters than for later litters, but there does not appear to have been much difference between second litter birth weights and those of subsequent farrowings. Thus the Group III, IV, V, VI and VII sows farrowed first litter pigs averaging 2.04 to 2.26 pounds, and the pigs of the later litters of these sows were mostly more than 2.30 pounds. The later litters of Group VI and VII sows did not average above 2.30 pounds till the fourth litter (these sows were on restricted feed).

The number of pigs farrowed was not very different in first and second litters, a fraction more than seven, but third and later litters averaged more than eight as a rule.

FEED CONSUMED

Table 2 gives the amount of feed consumed at various times by the sows of Groups V, VI, and VII, that is, those on the high, medium and low planes of nutrition. The Group V sows were fed rather generously all the time; Group VI sows received on the average 60 to 67 per cent as much feed as the Group V sows; and Group VII sows were fed on the average 41 to 48 per cent as much as the Group V sows.

TABLE 2. —FEED CONSUMED BY SOWS

GROUP V (High Plane)	1st Litter	2nd Litter	3rd Litter	4th Litter	5th Litter	6th Litter	7th Litter	8th Litter	9th Litter	All Litters
Two weeks prior to Breeding										
Number of Sows	7	9	8	8	7	5	3	3	1	51
Average feed (lbs.)	70.1	80.9	78.6	116.8	80.7	103.3	63.	75.9	108.4	86.1
Two weeks after Breeding										
Number of Sows	7	9	9	8	7	5	3	3	1	52
Average feed (lbs.)	73.3	61.3	61.3	93.5	71.2	91.5	63.	84.	112.4	74.5
Eight weeks prior to Farrowing										
Number of Sows	7	9	8	8	7	5	3	3	1	51
Average feed (lbs.)	269.4	278.6	295.1	379.6	330.2	286.8	247.7	347.1	331.9	306.9
Eight weeks of Lactation										
Number of Sows	7	6	7	5	5	4	3	2	1	40
Average feed (lbs.)	422.2	435.5	414.3	548.9	474.	440.1	356.8	418.9	494.5	444.
GROUP VI (Medium Plane)										
Two weeks prior to Breeding										
Number of Sows	6	6	5	5	4	2	1	1	1	31
Average feed (lbs.)	39.	50.3	49.2	62.4	54.2	60.	78.	38.3	53.	51.6
Two weeks after Breeding										
Number of Sows	6	6	6	5	4	2	1	1	1	32
Average feed (lbs.)	34.8	46.1	44.9	49.9	50.7	51.5	43.	54.	38.5	45.2
Eight weeks Prior to Farrowing										
Number of Sows	6	6	5	5	4	2	1	1	1	31
Average feed (lbs.)	234.7	197.3	220.5	183.2	180.7	115.8	186.	193.5	213.5	198.7
Eight weeks of Lactation										
Number of Sows	6	6	5	5	4	2	1	1		30
Average feed (lbs.)	270.2	270.2	311.6	283.1	346.2	329.5	379.	250.		296.3
GROUP VII (Low Plane)										
Two weeks Prior to Breeding										
Number of Sows	8	9	8	6	4	4	2			41
Average feed (lbs.)	34.5	35.9	39.4	36.3	40.9	35.4	39.5			36.8
Two weeks after Breeding										
Number of Sows	9	9	8	6	4	2	2			40
Average feed (lbs.)	32.6	35.1	33.7	37.9	35.4	45.	42.			35.6
Eight weeks Prior to Farrowing										
Number of Sows	10	9	6	4	2	2				33
Average feed (lbs.)	57.2	114.2	166.4	216.6	120.7	212.7				125.2
Eight weeks of Lactation										
Number of sows	8	6	5	5	3	2				29
Average feed (lbs.)	179.8	204.5	188.4	207.7	227.1	172.8				194.3

The periods mentioned in Table 2 are critical ones in a brood sow's life, namely before and after farrowing. As might be expected all sows ate a great deal more during the lactation period than for the same length of time before farrowing. Actually, the high plane sows ate 45 per cent more, while lactating, the medium plane sows 49 per cent more, and the low plane sows 55 per cent more than they ate during the last half of the gestation period. Reference will be made again to Table 2 later in the text.

WEIGHTS OF SOWS

Table 3 presents the average weights for each group of sows. Sows have been weighed weekly for the most part; however the data given here are for each four-week period. Figures 1, 2 and 3 were drawn from the data in Table 3.

Reference has been made to the amount of grain consumed at various periods by each of Groups V, VI and VII. Here it is noted that at one year of age the Group VI sows on the medium plane weighed 175 pounds or 72 per cent of 242.5 pounds, the average weight for the Group V sows, and the Group VII sows averaged 148.7 pounds or 61 per cent of the high plane sow (Group V). Similarly at two years Group VI was 70 per cent, and Group VII was 51 per cent, of the average weight for Group V.

Judging from the weights maturity would seem to have been reached for the various groups as follows: Group I, 384.4 pounds at 112 weeks; Group II, 401 pounds at 96 weeks; Group III and IV, 485.6 pounds at 288 weeks; (however the curve flattens out greatly at 140 weeks when the weight is 415.3 pounds for Groups III and IV); Group V, 476.7 pounds at 152 weeks; Group VI, 367.7 pounds at 188 weeks; and Group VII, 323.5 pounds at 248 weeks.

Group IV sows are those of the eleventh to the sixteenth generation of continued early breeding, all well fed. These averaged 411 pounds at 91 weeks. This represents the fastest growth and the greatest size of all the groups of sows considered. One sow of Group V weighed 405 pounds at 65 weeks, but the average weight for the group would place these sows second to Group IV in reaching maturity, weight only considered.

The weight curves of Groups V, VI and VII begin to separate markedly after the sows reach 28 weeks. Whereas Group V continued to grow rather rapidly to a maximum at around 152 weeks and then to fluctuate thereafter, those of Groups VI and VII tended to grow over a longer period of time, their curves rising gradually. Fluctuations in weight due to successive lactation periods were more accentuated the greater the food supply.

TABLE 3.—AVERAGE WEIGHT OF SOWS BY GROUPS

Age (weeks)	Group I		Group II		Group III		Group IV		Group V		Group VI		Group VII	
	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.
8		----		----	4	30.5	1	28.		----	2	18.5	3	22.8
12	2	45.5	3	49.3	8	50.	3	34.	3	38.6	3	39.	7	24.8
16	2	59.	4	68.5	10	68.5	3	59.6	4	57.5	4	47.2	7	35.8
20	2	68.	4	88.2	11	95.2	4	86.2	6	74.3	6	59.3	9	52.
24	2	87.	4	109.5	16	111.2	5	99.2	8	96.1	6	66.7	10	71.8
28	2	106.	4	136.	17	139.7	5	125.6	9	114.2	7	95.	8	90.5
32	5	120.	4	158.5	15	161.5	6	151.5	9	134.9	6	117.1	7	110.7
36	5	149.	4	178.5	14	191.4	5	186.4	9	173.6	7	140.1	6	138.
40	5	179.	4	205.2	17	208.8	5	209.4	6	211.3	6	157.8	11	124.
44	5	196.6	4	225.5	15	224.5	5	241.4	7	239.5	5	162.6	11	134.
48	5	208.	4	248.	17	227.9	5	253.	7	243.7	6	178.3	10	132.7
52 (1 yr.)	5	214.4	4	264.	17	227.7	5	245.4	7	242.5	6	175.	10	148.7
56	5	224.8	4	283.2	17	231.5	5	236.8	8	229.6	7	177.1	9	150.
60	5	248.2	4	296.5	17	251.3	6	246.2	9	243.1	6	178.1	10	152.8
64	5	263.8	4	335.7	17	260.5	5	253.4	8	250.3	6	173.3	10	157.
68	5	276.	4	319.	15	277.3	6	283.6	9	282.3	4	174.7	9	147.7
72	5	279.6	4	322.2	16	280.4	5	313.8	9	301.4	5	182.4	7	162.7
76	5	287.8	4	339.7	16	286.7	3	310.3	8	296.6	5	191.4	10	159.
80	5	311.8	4	353.7	16	289.6	6	317.3	8	292.2	6	203.	10	168.4
84	5	319.4	4	369.5	16	288.4	4	360.5	9	273.2	6	213.1	8	163.8
88	5	324.2	2	388.	16	300.6	4	391.7	8	269.6	6	201.3	9	175.5
92	4	333.7	3	381.	13	326.	3	401.	8	297.5	6	194.8	8	168.5
96	4	349.2	2	401.	13	336.7	4	349.	9	318.5	6	198.1	8	172.2
100	5	354.4	4	366.	14	330.7	3	323.6	8	324.	6	208.8	9	173.3
104 (2 yr.)	5	365.2	4	351.	14	339.5	3	322.	8	338.1	6	237.5	8	173.2
108	5	377.8	4	349.5	--	----	18*	343. *	8	315.1	6	260.7	8	179.9
112	5	384.4	3	371.3	--	----	17	366.5	8	313.5	5	258.2	7	185.9
116	5	380.6	3	361.	--	----	18	372.2	8	355.4	4	259.5	8	187.4
120	5	378.2	2	371.	--	----	18	364.7	8	374.5	5	278.4	7	194.

*After this point Groups III and IV are averaged together.

TABLE 3. (CONT'D)—AVERAGE WEIGHT OF SOWS BY GROUPS

Age (Weeks)	Group I		Group II		Group III		Group IV		Group V		Group VI		Group VII	
	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.	No. Sows	Aver. Wt.
124	5	374.	3	359.7	--	----	17	362.1	8	393.7	6	271.2	3	208.
128	5	366.6	3	301.3	--	----	17	365.2	7	397.7	4	290.5	8	201.9
132	5	269.8	3	305.	--	----	17	384.6	6	382.	5	291.2	8	208.4
136	5	383.	3	343.3	--	----	17	384.8	7	391.1	5	285.	7	200.4
140	3	377.3	3	371.3	--	----	15	415.3	7	391.7	5	282.8	8	212.7
144	5	381.4	2	383.	--	----	14	403.6	7	427.7	5	262.8	7	196.1
148	5	372.	2	347.	--	----	18	390.	7	423.	5	255.8	5	203.4
152	1	482.	2	297.5	--	----	13	388.8	7	476.7	5	253.2	6	206.8
156 (3 yr.)	1	350.	2	375.5	--	----	17	388.2	6	460.8	4	276.	5	202.2
160	2	386.	2	285.	--	----	17	401.	8	467.2	3	291.3	6	215.
164	2	366.5	1	375.	--	----	16	397.2	8	486.6	4	270.7	5	207.6
168	2	367.5	1	406.	--	----	14	399.9	6	450.	4	278.2	4	229.
172	2	372.5	1	383.	--	----	14	379.8	4	411.5	5	303.	3	233.
176	2	366.5	1	321.	--	----	15	398.3	4	425.7	4	310.	3	236.7
180	2	378.5	1	292.	--	----	15	405.5	4	433.7	5	343.2	5	242.6
184	2	389.	1	356.	--	----	13	407.7	3	478.7	2	347.	4	250.
188	2	402.	1	381.	--	----	15	408.7	4	517.	4	367.7	5	222.
192	2	443.	1	375.	--	----	13	413.7	2	452.5	2	304.	4	231.5
196	2	414.5	1	436.	--	----	13	389.6	4	479.2	4	318.7	4	232.2
200	2	389.	1	388.	--	----	14	413.2	4	468.5	3	302.	2	221.5
204	2	375.5	--	----	--	----	14	413.9	4	481.	3	326.3	3	210.3
208 (4 yr.)	2	377.	--	----	--	----	11	342.3	2	417.5	2	294.5	2	248.5
212	2	396.5	--	----	--	----	11	435.8	4	488.5	4	346.5	3	238.3
216	2	412.	--	----	--	----	13	422.3	3	400.	3	302.7	2	248.
220	2	400.	--	----	--	----	13	418.6	3	434.3	2	315.5	3	269.3
224	2	362.	--	----	--	----	12	428.2	2	406.5	2	314.5	2	227.5
228	2	319.5	--	----	--	----	13	431.4	2	386.	2	346.5	2	296.
232	2	327.5	--	----	--	----	12	447.2	2	380.	2	332.5	2	260.
236	1	288.	--	----	--	----	12	446.2	2	356.	2	278.5	2	298.5

240	2	386.5	--	----	--	----	12	446.4	2	363.5	2	245.5	1	445.
244	2	352.	--	----	--	----	12	444.1	2	417.	2	262.5	2	306.5
248	2	403.	--	----	--	----	12	432.7	2	440.	2	299.5	2	323.5
252	2	402.	--	----	--	----	12	424.6	2	435.5	2	308.5	--	----
256	2	393.5	--	----	--	----	11	397.6	2	404.	2	322.	1	217.
260 (5 yr.)	2	395.	--	----	--	----	11	447.8	1	376.	2	313.5	1	219.
264	2	402.	--	----	--	----	10	445.6	2	402.	2	401.5	1	270.
268	2	410.	--	----	--	----	11	458.8	--	----	--	----	--	----
272	2	435.5	--	----	--	----	10	464.9	--	----	--	----	--	----
276	2	418.5	--	----	--	----	9	465.9	--	----	--	----	--	----
280	2	433.5	--	----	--	----	9	464.	--	----	--	----	--	----
284	2	450.5	--	----	--	----	9	466.2	--	----	--	----	--	----
288	2	469.	--	----	--	----	8	485.6	--	----	--	----	--	--
292	2	458.5	--	----	--	----	9	480.3	--	----	--	----	--	----
296	2	473.	--	-----	--	-----	9	473.8	--	-----	--	-----	--	-----
300	2	452.5	--	-----	--	-----	9	451.2	--	-----	--	----	--	-----
304	2	461.	--	-----	--	-----	8	434.8	--	-----	--	-----	--	-----
308	2	467.	--	-----	--	-----	8	427.6	--	-----	--	-----	--	----
312 (6 yr.)	2	469.	--	-----	--	-----	7	440.4	--	-----	--	----	--	----

Groups IV and V were also the earliest bred sows (Table I) therefore it would be fair to conclude that breeding to farrow the first litter when eleven months old did not interfere with the mature weight of the sows as judged by comparison with sows handled similarly except bred later. However withholding the feed did have a marked influence on the weight curve delaying mature weight indefinitely.

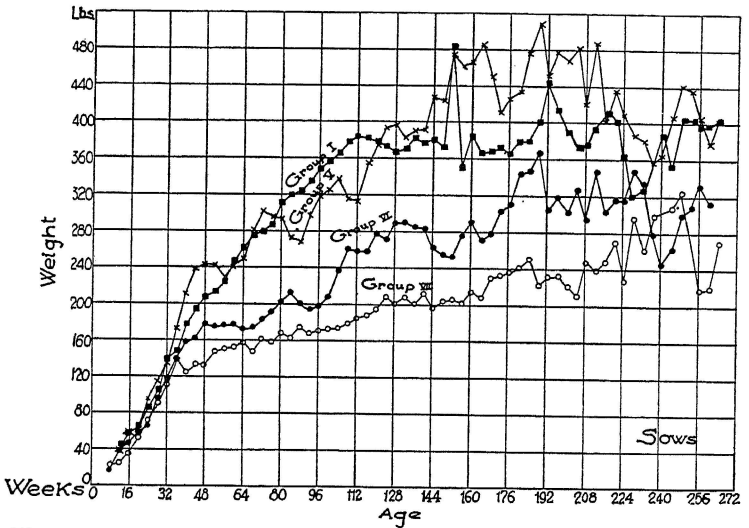

Fig. 1.—Weight curves of Sows in Groups I, V, VI, and VII. (See Table 3).

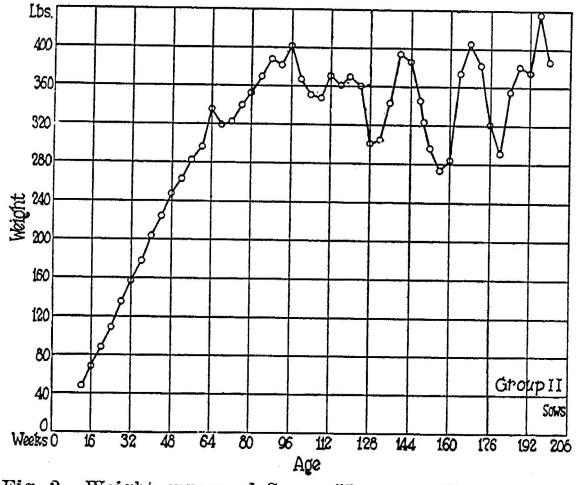

Fig. 2.—Weight curves of Group II sows. (See Table 3).

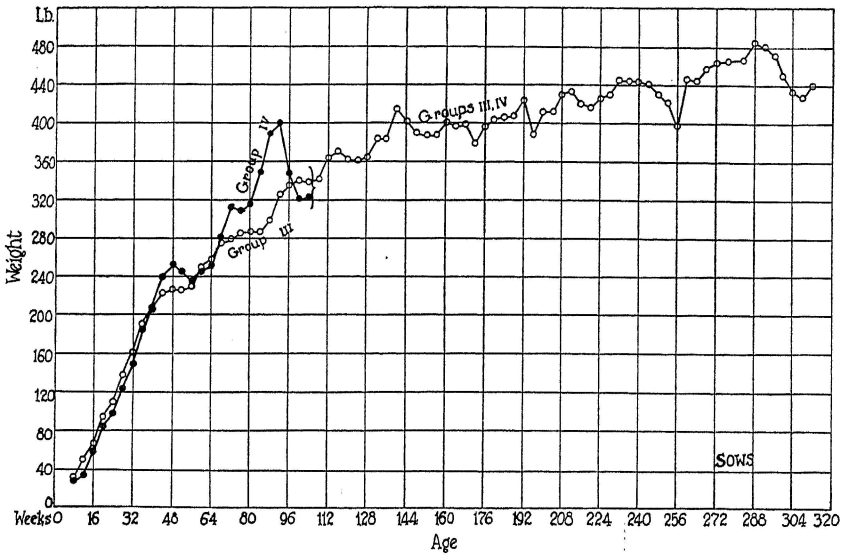

Fig. 3.—Weight curves of sows in Groups III and IV. (See Table 3).

MEASUREMENTS OF SOWS

Table 4 is a compilation of some of the measurements taken on the sows. Figures 4 to 13 were drawn from Table 4.

Growth was extremely rapid till the animals reached about fifteen months of age. From this time on there was a marked decrease in growth rate. Throughout the series of measurements Group III and IV showed somewhat less rapid growth, the curves are less steep than for Groups I or II. More specifically, the early bred sows grew less quickly the first year or two than did those sows bred at a later age. In height at withers the later bred sows are about 2 centimeters taller at 20 months, at height of croup about 1 centimeter, about the same difference for length of body and depth of chest, but about 10 centimeters greater in heart girth, than the early bred group. However, though early breeding tended to slightly slower growth the first year or two of the animal's life, there was a decided prolongation of growth in the case of the early bred sows.

And too, the ultimate size, as judged by these measurements, was greatest for early bred sows. Thus the later bred groups reached their maximum length of body about 113 centimeters, at 36 months and the early bred group seemed to be still growing at 90 months, and their length of body was around 125 centimeters. Groups I and II reached maximum height at withers, 65-68 centimeters, at 35-36 months, and

TABLE 4.—MEASUREMENTS OF SOWS BY GROUPS FROM FOUR MONTHS TO MATURITY

Length of Body

Age Months	Group I		Group II		Groups III & IV		Group V		Group VI		Group VII	
	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.
4	----	----	----	----	1	66.5	----	----	1	59	1	66.5
5	----	----	----	----	4	69.3	----	----	----	----	----	----
6	----	----	4	77.2	7	73.8	----	----	1	65.5	----	----
7	4	74.2	3	80.	18	77.5	4	80.5	4	80.6	5	75.6
8	5	80.6	4	86.2	11	82.3	2	93.5	1	93.	4	80.6
9	5	83.2	4	90.2	18	84.6	3	91.3	4	86.1	3	78.2
10	2	89.	4	92.5	16	90.6	4	96.4	4	90.7	5	86.7
11	2	92.5	4	95.	9	94.2	4	100.2	1	95.	6	93.1
12	5	88.8	4	95.2	18	93.	5	98.	3	93.5	2	88.5
13	1	88.	----	----	8	90.7	4	97.2	4	92.5	6	91.5
14	3	93.6	----	----	10	95.3	4	106.5	1	95.	2	95.7
15	1	102.	2	103.5	10	98.8	1	109.	2	96.5	2	86.5
16	3	95.	----	----	8	98.9	4	102.2	4	94.4	6	89.3
17	1	94.	----	----	5	94.6	4	112.	2	97.5	2	103.7
18	1	103.	4	107.	9	109.8	1	105.	1	98.	2	90.5
19	3	103.	----	----	7	99.8	4	104.7	4	96.7	5	93.4
20	3	104.3	----	----	8	97.2	4	111.9	2	98.7	3	100.6
21	3	107.3	4	108.5	13	107.2	1	112.	2	95.7	4	91.
22	4	108.2	----	----	6	102.2	5	106.8	2	101.5	6	95.
23	3	108.	----	----	5	104.4	5	113.4	2	108.	1	102.5
24	2	115.5	4	109.5	10	109.5	1	110.	2	104.2	2	96.
25	1	114.	----	----	3	111.	4	110.1	2	107.5	6	97.4
26	2	113.5	----	----	6	104.1	2	108.	2	105.7	----	----
27	1	114.	3	104.3	8	111.7	2	109.2	2	102.5	1	102.
28	1	110.	----	----	1	135.	4	118.9	2	108.	7	97.7
29	3	106.6	----	----	8	108.3	3	113.2	1	110.	----	----
30	1	114.	3	108.3	6	112.	1	112.5	3	109.6	2	93.
31	1	110.	----	----	4	120.5	4	108.9	2	100.	6	100.9
32	----	----	2	106.	4	113.2	1	122.	1	114.5	----	----
33	3	104.6	1	110.	11	106.9	3	117.6	2	106.5	2	88.8
34	----	----	----	----	4	120.1	4	124.9	2	108.5	5	103.5
35	----	----	----	----	2	114.5	1	120.	1	112.	2	93.2
36	----	----	1	110.	6	110.4	3	115.3	2	104.5	2	94.7
37	----	----	----	----	7	117.1	4	121.	2	105.5	4	101.6
38	1	112.	----	----	4	111.5	4	127.1	2	112.5	----	----
39	1	106.	1	112.	9	109.5	2	117.7	----	----	2	99.7
40	----	----	----	----	3	120.3	3	116.2	4	109.5	4	105.1
41	----	----	----	----	3	115.6	2	115.	2	114.	----	----
42	2	112.	1	112.	7	109.1	2	123.7	----	----	2	102.7
43	----	----	----	----	5	118.9	2	116.5	3	114.3	4	105.7
44	----	----	----	----	4	113.5	----	----	2	115.2	2	105.2
45	2	112.	1	107.	6	104.5	2	120.	----	----	----	----
46	----	----	----	----	3	127.3	2	115.2	2	110.	3	105.2
47	----	----	----	----	4	120.	----	----	1	114.5	----	----
48	2	111.	----	----	6	108.3	2	125.7	----	----	----	----
49	----	----	----	----	3	118.3	3	121.6	3	117.5	2	106.5
50	----	----	----	----	7	115.6	1	127.	----	----	----	----
51	2	109.	----	----	3	110.3	3	117.	2	111.5	1	101.
52	----	----	----	----	2	117.5	2	114.5	2	108.	2	102.7
53	1	115.	----	----	7	115.9	----	----	----	----	----	----
54	1	110.	----	----	3	106.	----	----	----	----	----	----
55	----	----	----	----	1	129.	2	113.	2	111.	2	107.
56	----	----	----	----	5	121.1	----	----	----	----	----	----
57	2	112.5	----	----	5	108.8	----	----	----	----	----	----
58	----	----	----	----	1	130.5	2	118.2	2	113.7	1	101.5
59	----	----	----	----	3	116.3	----	----	----	----	----	----
60	2	115.	----	----	8	118.2	2	118.2	2	116.5	1	101.
61	----	----	----	----	1	132.	2	120.5	----	----	----	----
62	----	----	----	----	3	118.	----	----	----	----	----	----
63	2	116.	----	----	6	113.8	----	----	----	----	----	----
64	----	----	----	----	2	121.	----	----	----	----	----	----
65	----	----	----	----	2	127.7	----	----	----	----	----	----
66	----	----	----	----	3	124.3	----	----	----	----	----	----
67	----	----	----	----	2	118.2	----	----	----	----	----	----
68	----	----	----	----	2	118.5	----	----	----	----	----	----
69	----	----	----	----	4	120.7	----	----	----	----	----	----
70	----	----	----	----	1	114.0	----	----	----	----	----	----
71	----	----	----	----	4	121.5	----	----	----	----	----	----
72	----	----	----	----	1	115.0	----	----	----	----	----	----
73	----	----	----	----	3	128.5	----	----	----	----	----	----
74	----	----	----	----	1	118.	----	----	----	----	----	----

TABLE 4.—MEASUREMENTS OF SOWS BY GROUPS FROM FOUR MONTHS TO MATURITY—CONTINUED

Height at Withers

Age Months	Group I		Group II		Groups III & IV		Group V		Group VI		Group VII	
	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.
4	----	----	----	----	1	43.	----	----	1	33.	1	41.4
5	----	----	----	----	4	44.1	----	----	----	----	----	----
6	----	----	4	49.	7	48.2	----	----	1	41.	----	----
7	4	49.2	3	51.6	18	48.4	4	50.1	4	46.4	5	46.3
8	5	53.8	4	52.2	11	53.3	2	57.2	1	51.	4	34.
9	5	54.1	4	55.4	18	53.5	3	58.1	4	50.4	3	47.6
10	2	55.	4	56.7	16	55.8	4	55.8	4	52.4	5	50.
11	2	57.	4	59.	9	58.	4	56.1	1	52.	6	53.3
12	5	57.5	4	59.2	18	57.8	5	58.3	3	55.3	2	54.3
13	1	60.	----	----	8	57.8	4	56.1	4	52.	6	52.2
14	3	61.	----	----	10	58.3	4	62.2	1	56.	2	59.2
15	1	61.	2	64.5	10	59.1	1	64.	2	55.7	2	57.2
16	3	63.3	----	----	8	62.8	4	62.2	4	57.3	6	55.5
17	1	64.5	----	----	5	59.9	4	66.6	2	58.5	2	62.4
18	1	63.	4	63.7	9	63.3	1	65.	1	61.	2	56.5
19	3	64.6	----	----	7	63.3	4	63.6	4	57.7	5	55.5
20	3	66.5	----	----	8	62.	4	65.8	2	59.2	3	60.2
21	3	65.6	4	66.5	13	64.3	1	65.	2	58.	4	55.6
22	4	65.2	----	----	6	63.	5	64.7	2	59.	6	57.1
23	3	65.8	----	----	5	63.4	5	68.1	2	60.5	1	62.3
24	2	65.6	4	65.5	11	66.4	1	67.	2	63.2	2	51.2
25	1	66.	----	----	3	68.3	4	66.5	2	62.2	6	59.4
26	2	69.	----	----	6	63.	2	63.	2	56.7	----	----
27	1	66.	3	65.6	8	68.1	2	67.5	2	64.	1	59.
28	1	62.	----	----	1	72.5	4	70.3	2	64.5	7	60.3
29	3	68.	----	----	8	66.2	3	60.	1	59.	----	----
30	1	70.	3	64.	6	63.8	1	68.	3	63.3	2	56.2
31	1	65.	----	----	4	73.9	4	73.6	2	64.5	6	60.9
32	----	----	2	66.	4	65.8	1	66.5	1	67.	----	----
33	3	67.3	1	64.	11	65.2	3	68.5	2	65.4	2	55.5
34	----	----	----	----	4	74.6	4	72.6	2	63.5	5	61.1
35	----	----	----	----	2	62.	1	70.	1	62.	2	54.7
36	----	----	1	63.	6	67.3	3	68.6	2	63.9	2	57.
37	----	----	----	----	8	72.8	4	75.5	2	61.2	4	61.7
38	1	70.	----	----	4	68.2	4	75.9	2	64.	----	----
39	1	64.	1	66.	9	64.6	2	71.7	----	----	2	59.7
40	----	----	----	----	3	75.8	3	60.1	4	60.2	4	59.2
41	----	----	----	----	3	69.3	2	63.	2	67.	----	----
42	2	69.5	1	64.	7	64.6	2	72.7	----	----	2	61.5
43	----	----	----	----	5	75.	2	71.5	3	65.6	4	60.6
44	----	----	----	----	4	66.5	----	----	2	66.5	2	59.7
45	2	70.	1	67.	6	63.6	2	75.5	----	----	----	----
46	----	----	----	----	3	76.	2	70.5	2	66.5	3	60.8
47	----	----	----	----	4	69.8	----	----	1	63.	----	----
48	2	70.	----	----	6	67.7	2	74.5	----	----	----	----
49	----	----	----	----	3	70.6	3	73.5	3	61.6	2	60.1
50	----	----	----	----	7	69.5	1	69.7	----	----	----	----
51	2	68.5	----	----	3	66.	3	71.2	2	61.5	1	56.5
52	----	----	----	----	2	68.5	2	69.	2	65.	2	61.
53	1	69.	----	----	7	70.6	----	----	----	----	----	----
54	1	64.	----	----	3	64.5	----	----	----	----	----	----
55	----	----	----	----	1	68.	2	66.	2	63.2	2	60.5
56	----	----	----	----	5	71.6	----	----	----	----	----	----
57	2	68.	----	----	5	64.4	----	----	----	----	----	----
58	----	----	----	----	1	65.	2	69.2	2	64.7	1	59.
59	----	----	----	----	3	71.6	----	----	----	----	----	----
60	2	67.	----	----	8	69.4	2	68.3	2	62.9	1	57.7
61	----	----	----	----	1	77.	2	68.5	----	----	----	----
62	----	----	----	----	3	72.6	----	----	----	----	----	----
63	2	68.5	----	----	6	70.5	----	----	----	----	----	----
64	----	----	----	----	2	73.2	----	----	----	----	----	----
65	----	----	----	----	1	81.5	----	----	----	----	----	----
66	----	----	----	----	4	73.4	----	----	----	----	----	----
67	----	----	----	----	2	73.5	----	----	----	----	----	----
68	----	----	----	----	2	71.5	----	----	----	----	----	----
69	----	----	----	----	4	69.5	----	----	----	----	----	----
70	----	----	----	----	1	73.5	----	----	----	----	----	----
71	----	----	----	----	4	70.6	----	----	----	----	----	----
72	----	----	----	----	1	75.	----	----	----	----	----	----
73	----	----	----	----	2	71.5	----	----	----	----	----	----
74	----	----	----	----	2	75.5	----	----	----	----	----	----

TABLE 4.—MEASUREMENTS OF SOWS BY GROUPS FROM FOUR MONTHS TO MATURITY—CONTINUED

Height at Croup

Age Months	Group I		Group II		Groups III & IV		Group V		Group VI		Group VII	
	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.
4	----	----	----	----	1	48.	----	----	1	44.	1	49.
5	----	----	----	----	4	50.9	----	----	----	----	----	----
6	----	----	4	56.5	7	55.4	----	----	1	47.5	----	----
7	4	56.	3	60.	18	55.8	4	58.7	4	57.4	5	54.9
8	5	59.6	4	61.2	11	59.6	2	64.	1	63.5	4	54.6
9	5	62.1	4	63.2	18	60.5	3	64.5	4	63.	3	58.8
10	2	62.5	4	65.	16	62.6	4	66.7	4	66.2	5	61.1
11	2	65.	4	67.5	9	65.5	4	65.9	1	66.	6	65.2
12	5	67.6	4	68.2	18	64.9	5	70.3	3	64.3	2	65.5
13	1	65.	----	----	8	65.3	4	68.6	4	65.7	6	63.5
14	3	70.3	----	----	10	66.7	4	71.4	1	56.	2	69.3
15	1	70.	2	71.5	10	68.6	1	81.	2	70.	2	66.5
16	3	69.3	----	----	8	69.2	4	73.7	4	69.6	6	67.8
17	1	70.	----	----	5	67.3	4	77.2	2	71.5	2	75.
18	1	71.	4	73.5	9	72.	1	81.	1	77.	2	66.5
19	3	72.6	----	----	7	71.9	4	75.6	4	70.	5	70.8
20	3	73.2	----	----	8	69.2	4	72.5	2	71.5	3	74.5
21	3	73.7	4	72.5	13	72.4	1	81.	2	70.	4	67.
22	4	72.5	----	----	6	72.1	5	76.3	2	73.2	6	69.2
23	3	74.3	----	----	5	71.2	5	76.4	2	74.5	1	78.
24	2	74.	4	72.2	10	72.5	1	81.5	2	75.7	2	63.5
25	1	71.	----	----	3	74.3	4	77.5	2	76.7	6	70.7
26	2	76.	----	----	6	73.8	2	69.5	2	70.2	----	----
27	1	74.	3	73.3	8	78.3	2	78.7	2	78.	1	69.
28	1	69.	----	----	1	78.5	4	79.5	2	78.	7	71.5
29	3	76.6	----	----	8	74.2	3	67.6	1	65.	----	----
30	1	74.	3	71.	6	73.6	1	81.5	3	75.6	2	69.2
31	1	70.	----	----	4	80.2	4	81.	2	75.5	6	73.
32	----	----	2	72.	4	77.7	1	77.	1	75.	----	----
33	3	76.3	1	72.	11	73.6	3	78.6	2	74.	2	69.5
34	----	----	----	----	4	81.7	4	80.7	2	74.5	5	72.4
35	----	----	----	----	2	75.5	1	80.	1	75.	2	67.2
36	----	----	1	73.	6	75.5	3	80.	2	76.2	2	70.
37	----	----	----	----	7	78.4	4	82.4	2	72.2	4	73.6
38	1	77.	----	----	4	76.	4	81.4	2	76.7	----	----
39	1	74.	1	74.	9	72.2	2	83.	----	----	2	70.2
40	----	----	----	----	3	81.3	3	69.1	4	71.1	4	70.4
41	----	----	----	----	3	76.3	2	73.	2	76.5	----	----
42	2	77.	1	74.	7	72.	2	84.5	----	----	2	69.7
43	----	----	----	----	5	78.2	2	79.5	3	77.8	4	73.4
44	----	----	----	----	4	73.5	----	----	2	73.5	2	69.8
45	2	77.5	1	73.	6	71.3	2	81.	----	----	----	----
46	----	----	----	----	3	81.2	2	78.7	2	77.7	3	72.
47	----	----	----	----	4	76.9	----	----	1	71.	----	----
48	2	76.5	----	----	6	72.8	2	81.	----	----	----	----
49	----	----	----	----	3	76.3	3	82.6	3	75.6	2	71.5
50	----	----	----	----	7	76.4	1	78.5	----	----	----	----
51	2	74.5	----	----	3	73.3	3	76.5	2	76.7	1	.69
52	----	----	----	----	2	78.	2	74.7	2	76.	2	77.2
53	1	75.	----	----	7	76.1	----	----	----	----	----	----
54	1	73.	----	----	3	73.2	----	----	----	----	----	----
55	----	----	----	----	1	74.	2	73.5	2	74.2	2	71.8
56	----	----	----	----	5	79.5	----	----	----	----	----	----
57	2	76.5	----	----	5	72.4	----	----	----	----	----	----
58	----	----	----	----	1	71.5	2	78.2	2	74.7	1	69.
59	----	----	----	----	3	78.6	----	----	----	----	----	----
60	2	76.	----	----	8	75.1	2	77.3	2	75.	1	66.7
61	----	----	----	----	1	85.	2	76.3	----	----	----	----
62	----	----	----	----	3	78.2	----	----	----	----	----	----
63	2	77.	----	----	6	76.1	----	----	----	----	----	----
64	----	----	----	----	2	78.2	----	----	----	----	----	----
65	----	----	----	----	1	85.5	----	----	----	----	----	----
66	----	----	----	----	4	79.2	----	----	----	----	----	----
67	----	----	----	----	2	77.5	----	----	----	----	----	----
68	----	----	----	----	2	78.	----	----	----	----	----	----
69	----	----	----	----	4	77.1	----	----	----	----	----	----
70	----	----	----	----	1	78.5	----	----	----	----	----	----
71	----	----	----	----	4	77.5	----	----	----	----	----	----
72	----	----	----	----	1	77.5	----	----	----	----	----	----
73	----	----	----	----	2	76.2	----	----	----	----	----	----
74	----	----	----	----	2	81.7	----	----	----	----	----	----

TABLE 4.—MEASUREMENTS OF SOWS BY GROUPS FROM FOUR MONTHS TO MATURITY—CONTINUED

Depth of Chest

Age Months	Group I		Group II		Groups III & IV		Group V		Group VI		Group VII	
	No.	Cm.	No.	Cm.	No	Cm.	No.	Cm.	No.	Cm.	No.	Cm.
4	----	----	----	----	1	25.	----	----	1	19.5	1	22.3
5	----	----	----	----	4	24.2	----	----	----	----	----	----
6	----	----	4	29.	7	28.8	----	----	2	26.2	----	----
7	4	29.	3	31.7	18	29.1	4	29.9	3	26.	5	27.1
8	5	31.9	4	32.2	11	32.3	2	35.7	1	31.	4	29.4
9	5	33.6	4	34.2	18	33.7	3	34.	4	30.8	3	25.9
10	2	36.5	4	35.7	16	34.8	4	33.6	4	31.4	5	28.9
11	2	38.5	4	37.5	9	36.5	4	38.6	1	33.	6	32.1
12	5	36.1	4	38.7	18	35.8	5	38.6	3	34.	2	37.
13	1	39.	----	----	8	35.5	4	34.2	4	30.7	6	31.6
14	3	37.7	----	----	10	36.7	4	41.6	1	35.	2	35.
15	1	39.	2	43.5	10	38.7	1	39.	2	34.5	2	34.5
16	3	39.7	----	----	8	39.1	4	37.	4	31.2	6	30.9
17	1	40.5	----	----	5	39.1	4	44.7	2	37.7	2	38.
18	1	40.	4	43.2	9	41.9	1	39.5	1	38.	2	32.
19	3	42.5	----	----	7	40.1	4	42.5	4	35.4	5	32.7
20	3	43.	----	----	8	38.3	4	42.	2	37.5	3	35.5
21	3	43.8	4	44.	13	42.7	1	39.	2	34.7	4	33.1
22	4	42.5	----	----	6	41.1	5	42.3	2	37.2	6	33.6
23	3	43.7	----	----	5	40.9	5	43.2	2	37.2	1	37.8
24	2	44.	4	42.	10	41.9	1	40.5	2	37.7	2	35.7
25	1	43.	----	----	3	43.3	4	43.6	2	39.7	6	33.7
26	2	45.	----	----	6	41.9	2	36.2	2	39.5	----	----
27	1	44.	3	43.	8	44.8	2	43.5	2	38.	1	39.
28	1	41.	----	----	1	49.5	4	47.1	2	45.2	7	35.7
29	3	45.7	----	----	8	43.2	3	44.6	1	46.	----	----
30	1	45.	3	43.	6	41.7	1	41.	3	39.	2	34.2
31	1	42.	----	----	4	50.6	4	48.4	2	41.	6	35.4
32	----	----	2	41.5	4	44.5	1	43.5	1	44.	----	----
33	3	44.7	1	43.	11	39.5	3	45.	2	40.2	2	34.5
34	----	----	----	----	4	49.5	4	47.6	2	38.5	5	34.6
35	----	----	----	----	2	45.7	1	46.	1	38.5	2	33.7
36	----	----	1	40.	6	42.5	3	44.8	2	38.5	2	33.2
37	----	----	----	----	7	48.1	4	50.9	2	40.7	4	33.1
38	1	48.	----	----	4	44.2	4	50.2	2	42.	----	----
39	1	42.	1	43.	9	41.8	2	46.	----	----	2	34.7
40	----	----	----	----	3	51.	3	49.	4	40.9	4	36.7
41	----	----	----	----	3	44.2	2	41.7	2	42.7	----	----
42	2	46.	1	41.	7	42.4	2	46.5	----	----	2	35.
43	----	----	----	----	5	49.9	2	47.5	3	41.5	4	37.1
44	----	----	----	----	4	46.7	----	----	2	41.5	2	36.5
45	2	45.	1	42.	6	43.6	2	45.7	----	----	----	----
46	----	----	----	----	3	52.6	2	48.7	2	41.5	3	35.6
47	----	----	----	----	4	49.6	----	----	1	40.	----	----
48	2	46.	----	----	6	44.7	2	48.2	----	----	----	----
49	----	----	----	----	3	46.8	3	47.9	3	39.8	2	36.2
50	----	----	----	----	7	45.7	1	44.	----	----	----	----
51	2	43.5	----	----	3	46.3	3	43.7	2	39.	1	36.
52	----	----	----	----	2	46.5	2	43.7	2	40.7	2	35.6
53	1	44.	----	----	7	46.3	----	----	----	----	----	----
54	1	41.	----	----	3	42.3	----	----	----	----	----	----
55	----	----	----	----	1	66.	2	41.7	2	38.2	2	37.2
56	----	----	----	----	5	46.2	----	----	----	----	----	----
57	2	43.5	----	----	5	43.	----	----	----	----	----	----
58	----	----	----	----	1	64.5	2	44.5	2	39.2	1	35.
59	----	----	----	----	3	50.6	----	----	----	----	----	----
60	2	45.	----	----	8	46.2	2	42.7	2	39.7	1	36.
61	----	----	----	----	1	54.	2	43.7	----	----	----	----
62	----	----	----	----	3	47.1	----	----	----	----	----	----
63	2	46.	----	----	6	46.	----	----	----	----	----	----
64	----	----	----	----	2	52.	----	----	----	----	----	----
65	----	----	----	----	1	54.	----	----	----	----	----	----
66	----	----	----	----	4	52.1	----	----	----	----	----	----
67	----	----	----	----	2	52.7	----	----	----	----	----	----
68	----	----	----	----	2	50.5	----	----	----	----	----	----
69	----	----	----	----	4	50.	----	----	----	----	----	----
70	----	----	----	----	1	49.5	----	----	----	----	----	----
71	----	----	----	----	4	47.9	----	----	----	----	----	----
72	----	----	----	----	1	50.5	----	----	----	----	----	----
73	----	----	----	----	3	50.8	----	----	----	----	----	----
74	----	----	----	----	2	48.5	----	----	----	----	----	----

TABLE 4.—MEASUREMENTS OF SOWS BY GROUPS FROM FOUR MONTHS TO MATURITY—CONTINUED

Heart Girth

Age Months	Group I		Group II		Groups III & IV		Group V		Group VI		Group VII	
	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.	No.	Cm.
4	----	----	----	----	1	75.	----	----	----	----	----	----
5	----	----	----	----	4	77.	----	----	----	----	1	62.5
6	----	----	4	90.	7	89.1	----	----	1	72.	----	----
7	4	91.2	3	98.7	18	93.9	4	94.1	4	86.5	5	80.5
8	5	98.	4	102.5	11	101.5	2	107.	1	100.	4	81.7
9	5	104.2	4	107.7	18	99.6	3	105.	4	91.	3	80.2
10	2	115.5	4	112.7	16	111.6	4	104.5	4	95.6	5	83.8
11	2	120.	4	120.7	9	115.6	4	110.6	1	100.	6	91.1
12	5	111.6	4	123.	18	109.9	5	109.2	3	95.6	2	90.5
13	1	123.	----	----	8	109.8	4	103.5	4	97.6	6	91.5
14	3	120.7	----	----	10	120.9	4	116.6	1	100.	2	94.5
15	1	121.	2	145.5	10	117.5	1	111.	2	97.5	2	87.5
16	3	126.6	----	----	8	115.9	4	111.6	4	96.6	6	87.3
17	1	124.	----	----	5	115.7	4	130.	2	99.7	2	103.7
18	1	122.	4	136.	9	125.5	1	115.	1	108.5	2	92.5
19	3	134.6	----	----	7	116.9	4	109.6	4	95.	5	90.8
20	3	129.6	----	----	8	117.5	4	120.2	2	104.5	3	101.
21	3	129.	4	137.5	13	125.8	1	115.	2	96.	4	94.4
22	4	139.2	----	----	6	123.	5	121.8	2	98.5	6	90.8
23	3	126.6	----	----	5	122.8	5	126.6	2	106.7	1	103.
24	2	135.5	4	131.	10	116.9	1	125.	2	106.2	2	101.5
25	1	136.	----	----	3	127.5	4	121.	2	109.5	6	92.7
26	2	140.5	----	----	6	119.5	2	118.5	2	116.5	----	----
27	1	140.	3	133.3	8	135.2	2	124.	2	107.	1	102.
28	1	127.	----	----	1	136.	4	127.6	2	120.	7	95.6
29	3	126.6	----	----	8	128.6	3	130.6	1	130.	----	----
30	1	145.	3	117.	6	129.5	1	119.	3	113.8	2	98.5
31	1	134.	----	----	4	150.	4	137.2	2	106.5	6	99.1
32	----	----	2	127.	4	127.4	1	133.5	1	110.	----	----
33	3	124.	1	135.	11	128.5	3	133.8	2	116.7	2	101.5
34	----	----	----	----	4	145.	4	149.7	2	118.	5	98.6
35	----	----	----	----	2	135.5	1	140.	1	109.	2	97.5
36	----	----	1	122.	6	130.5	3	133.3	2	107.7	2	94.
37	----	----	----	----	7	140.9	4	151.	2	119.5	4	100.5
38	1	145.	----	----	4	130.7	4	157.6	2	118.	----	----
39	1	123.	1	135.	9	124.8	2	139.5	----	----	2	96.2
40	----	----	----	----	3	131.6	3	141.6	4	120.2	4	104.4
41	----	----	----	----	3	126.6	2	125.	2	123.7	----	----
42	2	142.5	1	124.	7	128.	2	142.5	----	----	2	101.7
43	----	----	----	----	5	146.	2	150.5	3	124.3	4	107.9
44	----	----	----	----	4	139.7	----	----	2	120.	2	102.
45	2	142.5	1	131.	6	122.8	2	133.	----	----	----	----
46	----	----	----	----	3	158.3	2	146.2	2	122.5	3	100.5
47	----	----	----	----	4	139.9	----	----	1	111.	----	----
48	2	137.5	----	----	6	134.7	2	144.5	----	----	----	----
49	----	----	----	----	3	140.6	3	150.	3	114.	2	103.5
50	----	----	----	----	7	140.3	1	130.	----	----	----	----
51	2	127.5	----	----	3	140.5	3	136.8	2	119.	1	110.
52	----	----	----	----	2	139.	2	139.5	2	125.	2	102.
53	1	135.	----	----	7	138.6	----	----	----	----	----	----
54	1	121.	----	----	3	130.	----	----	----	----	----	----
55	----	----	----	----	1	167.	2	120.5	2	104.	2	106.
56	----	----	----	----	5	141.6	----	----	----	----	----	----
57	2	135.	----	----	5	132.6	----	----	----	----	----	----
58	----	----	----	----	1	165.	2	131.5	1	111.5	1	95.
59	----	----	----	----	3	141.6	----	----	----	----	----	----
60	2	136.	----	----	8	140.6	2	125.	2	115.	1	97.
61	----	----	----	----	1	172.	2	128.2	----	----	----	----
62	----	----	----	----	3	138.	----	----	----	----	----	----
63	2	137.5	----	----	6	143.	----	----	----	----	----	----
64	----	----	----	----	2	163.	----	----	----	----	----	----
65	----	----	----	----	1	162.	----	----	----	----	----	----
66	----	----	----	----	4	152.2	----	----	----	----	----	----
67	----	----	----	----	2	161.	----	----	----	----	----	----
68	----	----	----	----	2	147.	----	----	----	----	----	----
69	----	----	----	----	4	142.6	----	----	----	----	----	----
70	----	----	----	----	1	149.	----	----	----	----	----	----
71	----	----	----	----	4	144.	----	----	----	----	----	----
72	----	----	----	----	1	128.	----	----	----	----	----	----
73	----	----	----	----	2	155.	----	----	----	----	----	----
74	----	----	----	----	2	147.	----	----	----	----	----	----

Groups III and IV were above the 75 centimeters mark at 80 months, probably their maximum. Groups I and II reached maximum height at croup, 73-75 centimeters, when about 40 months old, and Groups III and IV were growing slightly in this respect at 80 months when they measured 79 centimeters.

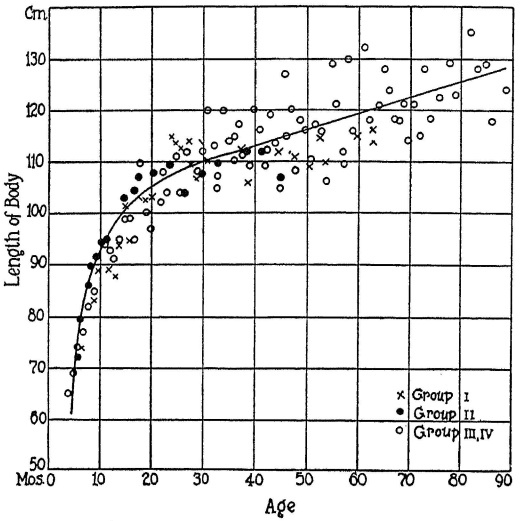

Fig. 4.—Length of Body; Growth Curves of Sows in Groups I, II, III and IV. (See Table 4).

The late bred groups attained their greatest average depth of chest when 40-45 months old, slightly over 45 centimeters. Group III and IV about reached their maximum depth of chest at 80 months, 52 centimeters. The late bred groups ceased to grow appreciably in heart girth at 35-36 months, 135 centimeters, whereas Groups III and IV exceeded this measurement at 44 months and showed signs of increasing heart girth at 80 months when they measured approximately 152 centimeters.

The difference in size at maturity between Groups I and II was slight. In length of body and heart girth the sows seemed identical but in the other three measurements here noted the sows of Group I, mature bred, were two to three centimeters larger than those of Group II.

From figures 5, 7, 9, 11 and 13 one can note the marked differences in the growth curves of the sows on the three planes of nutrition, all bred when immature. In each of the measurements considered the high plane sows exceeded sows fed less, the medium plane sows occupied an intermediate position, and the low plane sows grew least rapidly and were always rhe smallest sows. Thus, mature size was reached by the sows of groups V, VI, and VII at 40-50 months and was as indicated

in Table 5. Early breeding *combined with limited feeding* seemed to account for the sows of Groups VI and VII not attaining the size of those of Group V, Group V being bred similarly but fed liberally.

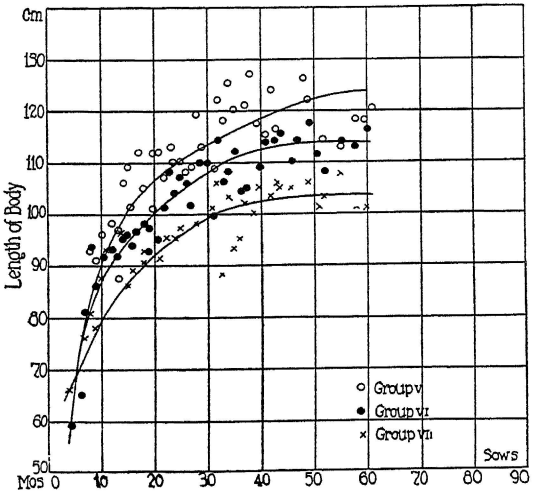

Fig. 5.—Length of Body; Growth Curves of Sows in Groups V, VI, and VII. (See Table 4.)

TABLE 5.—MATURE SIZE OF SOWS IN GROUPS I-VII

Measure of Growth	GROUP					
	I	II	III and IV	V	VI	VII
Length of body	113 cm.	113 cm.	125 cm.	123 cm.	113 cm.	103 cm
Height at withers	68	65	75	72	64.5	61.5
Height at croup	75	73	79	82	77	72
Depth of chest	45	43	52	46.5	41.5	36
Heart girth	135	135	152	143	117	103
Weight (smooth curves)	380 lbs.	360-400 lbs.	460 lbs.	460 lbs.	320 lbs.	280 lbs.

Groups III, IV, and V were handled very much alike, and the measurements for these sows are not very different. However, the low plane sows lacked on the average 20 centimeters in length of body, 10.5 centimeters in height at withers, and 40 centimeters in heart girth, in

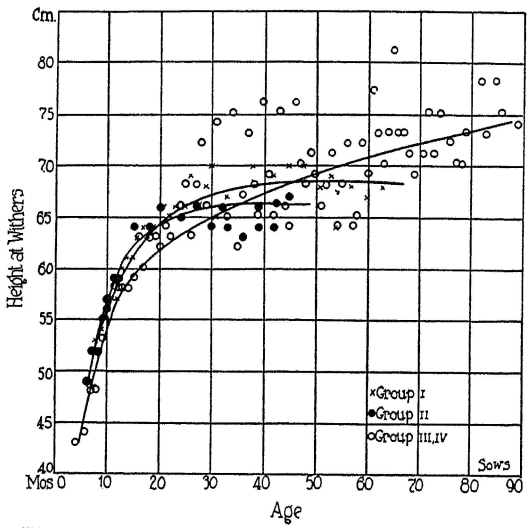

Fig. 6.—Height at Withers; Growth Curves of Sows in Groups I, II, III, and IV. (See Table 4.)

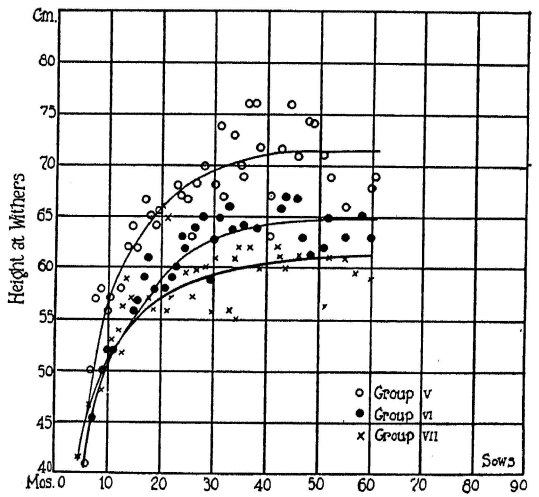

Fig. 7.—Height at Withers; Growth Curves of Sows in Groups V, VI, and VII. (See Table 4.)

attaining to the size of Group V. Other measurements show similar retardation in growth for Group VII sows.

Group VI sows received an amount of feed intermediate between Groups V and VII, and Group VI sows reached a mature size intermediate between Groups V and VII.

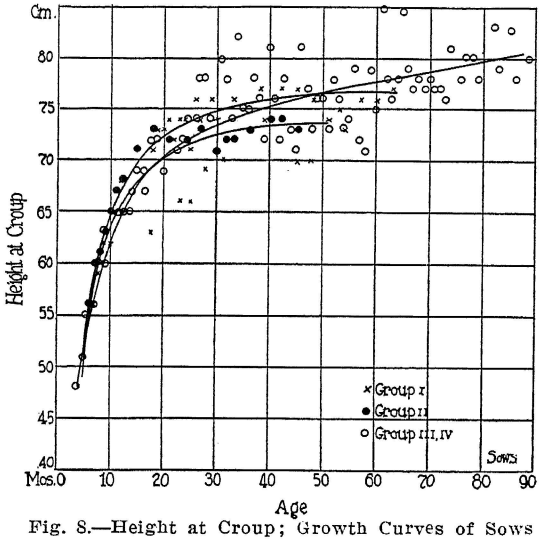

Fig. 8.—Height at Croup; Growth Curves of Sows in Groups I, II, III, and IV. (See Table 4.)

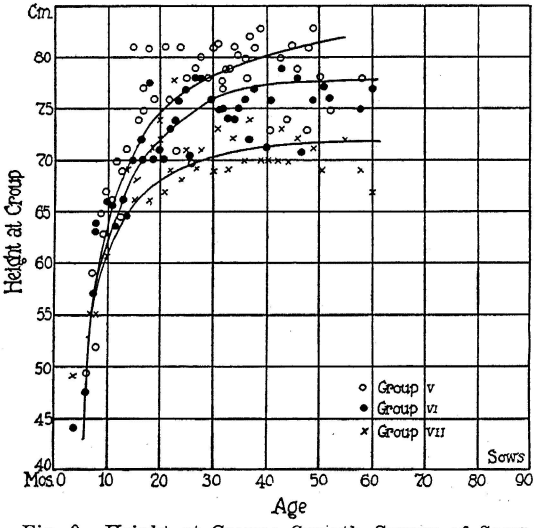

Fig. 9.—Height at Croup; Growth Curves of Sows in Groups V, VI, and VII. (See Table 4.)

To summarize, one can conclude from Table 4 and Figures 4-13 that:

(1) Differences between the growth of sows bred first when a year and a half old and those bred first at two years were slight or negligible.

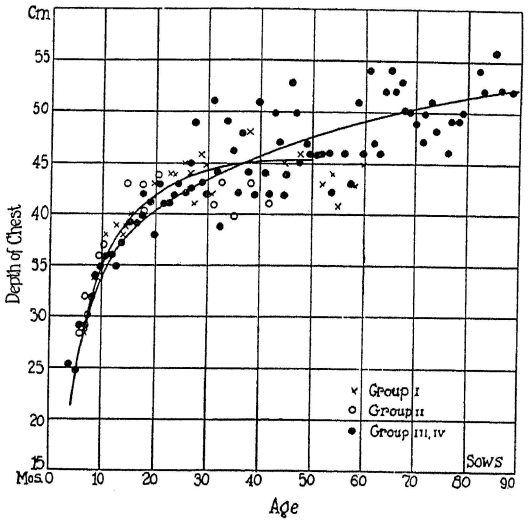

Fig. 10.—Depth of Chest; Growth Curves of Sows in Groups I, II, III, and IV. (See Table 4.)

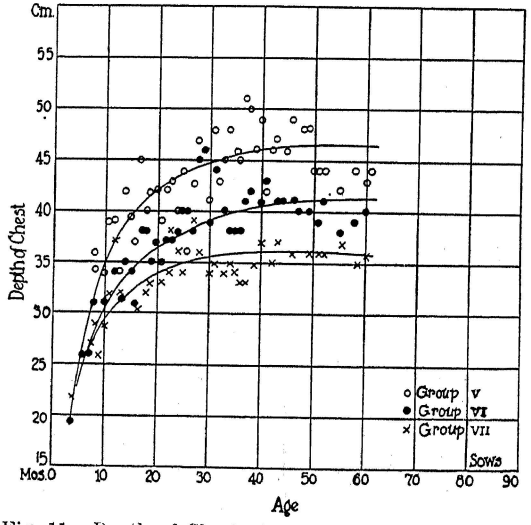

Fig. 11.—Depth of Chest; Growth Curves of Sows in Groups V, VI, and VII. (See Table 4.)

(2) Early bred sows (Groups III, IV) were very slightly smaller at 20 months of age than the later bred sows (Groups I, II).

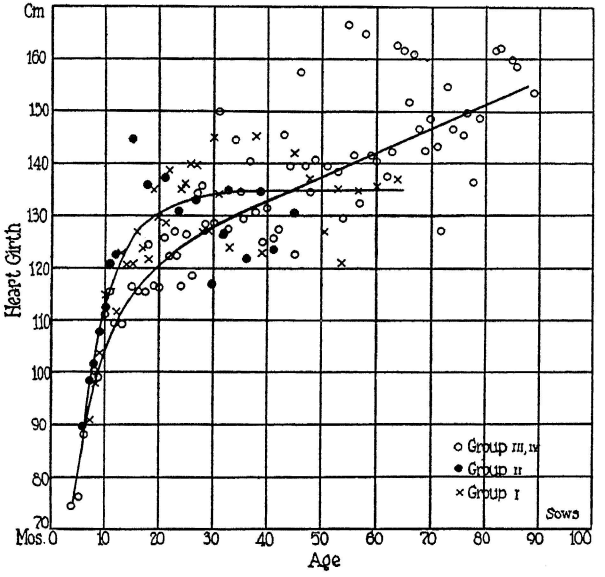

Fig. 12.—Heart Girth; Growth Curves of Sows in Groups I, II, III, and IV. (See Table 4.)

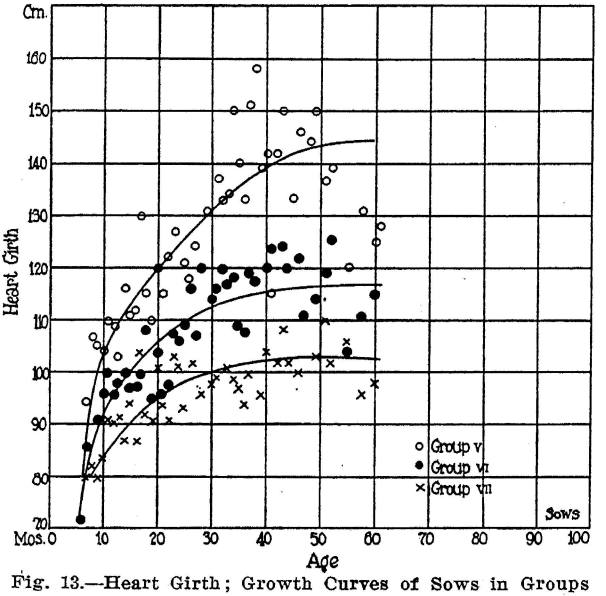

Fig. 13.—Heart Girth; Growth Curves of Sows in Groups V, VI, and VII. (See Table 4.)

(3) Early bred sows (Groups III, IV) grew ultimately to a greater size than did those of Groups I and II, certainly early breeding did not inhibit their growth. Thus Groups I and II were usually fully grown at 35-45 months. Groups III and IV continued to grow till 80-90 months.*

(4) Restricting the amount of feed given to Groups VI and VII produced marked effects on the rate of growth and the ultimate size of these sows, and the smaller the amount fed the slower the rate and the smaller the sow.

(5) The sows of Groups V, VI, and VII reached mature size when 40-50 months old.

DEGREE OF FATNESS AND BODY MEASUREMENTS

To study the effect that condition (or fatness) may have on body measurements the figures of Table 6 are included. Low and medium plane aged sows were weighed and measured and put in the fattening pen for 28 days, then again weighed and measured. There were six sows, three over 5 years, one 4 years old, and two 3 years, 8 months old.

TABLE 6.—EFFECT OF FATNESS ON BODY MEASUREMENTS*

	3 to 5 months before fattening (per month)	After fattening 28 days
	Centimeters	Centimeters
Gain in height at withers	—.1	5.0
Gain in height at croup	.17	2.5
Gain in depth of chest	.3	4.8
Gain in heart girth	1.13	21.4
Gain in weight	10.2 lbs.	97.2 lbs.

*Data on six aged sows, Groups VI and VII.

The sows were being carried along, a small gain in weight had been made, and the changes in size as determined by measurements were slight, but when put on full feed these sows made remarkable gains in weight and body measurements. The average daily gain in weight was 3.47 pounds. One sow gained as much as 7 pounds a day for a week. Heart girth showed a greater increase than the other measurements. Increases at depth of chest and height at withers were about the same, indicating that the fat is put on over the shoulders and not to any noticeable degree on the floor of the chest.

One sow of Group VI and one of Group VII were placed on full feed when they were 3½ years and 5 years of age, respectively. The measure-

*However, the point to be emphasized is the somewhat slower growth of the sows farrowing first when less than a year old, the ultimate size evidently not being affected. The influence of the boars and the difference in type of these boars in the latter years of the experiment no doubt had some influence on the mature size of these sows (the mature bred groups, I and II, were produced only in the early years of the experiment).

ments recorded are tabulated in Table 7. After the sows had reached a maximum, that is, failed to put on more weight or to grow in height, the feed was reduced in amount and the sows brought to approximately the same condition of fatness as they were when the feed was first increased.

TABLE 7.—RETARDED SOWS FATTENED, THEN REDUCED

Group VI Sow					
Age (months-days)	43 m. 18 d.	48 m. 10 d.	55 m. 0 d.	64 m. 5 d.	65 m. 4 d.
Weight (lbs.)	270	335	562	343	315
Heart Girth (cm.)	109.5	128	170.7	129.3	122.1
Height at Withers(cm.)	64.5	70	79.9	71.5	71.0
Depth of Chest (cm.)	38.5	43.2	53.	45.1	43.2
Width at Ham Points(cm.)	25.5	25.9	40.3	29.5	27.6
Condition	med.-poor	good	very high	medium	med.-poor
Group VII Sow					
Age (months-days)	60 m. 18 d.	61 m. 15 d.	67 m. 22 d.	73 m. 20 d.	79 m. 13 d.
Weight (lbs.)	250	320	623	497	297
Heart Girth (cm.)	108.0	123.5	179.2	152.7	121.9
Height at Withers (cm.)	64.4	69.	81.9	77.1	71.9
Depth of Chest (cm.)	38.0	41.	56.	49.3	43.3
Width at Ham Points(cm.)	20.9	26.	42.7	37.7	27.2
Condition	med.-good	good	very high	good to high	med.-poor

The Group VII sow weighed 250 pounds at 5 years, and after seven months on full feed reached her maximum of 623 pounds. During this time her height at withers increased 17.5 centimeters, her heart girth 71.2 centimeters, her depth of chest 18 centimeters, and width of ham points (really width of loin) 21.8 centimeters. When the feed was reduced the sow shrank or became smaller, till after a year of reduced feeding she weighed 297 pounds, was 1.6 centimeters smaller in heart girth than she was when she weighed 320 pounds when being fattened, in fact she had assumed almost the same size of body as she had had some 18 months previously.

The same holds for the Group VI sow. After a year of full feeding she had reached her maximum of 562 pounds, and when the feed was reduced she lost weight till 10 months later when she weighed 315 pounds When reduced she measured about the same as she had at 335 pounds 17 months previously when in the fattening stage.

Had these animals been still further reduced in weight they may or may not have become as small as they were when full feeding first began. Certainly when the fat was taken off them they came close to their original thin size. However, the Group VII sow appeared thinner at 297 pounds after her reducing period than she looked at 250 pounds when fattening started. And the Group VI sow looked thinner at 315 pounds when reduced than she did at 335 pounds when being fattened. So that there may have been a slight permanent increase due to the increased feed consumption, but there can be no certainty about this point judging from the data available.

It is true that both sows were somewhat above the average for their groups before the fattening period began. This great increase in size

when fattened and almost equal decrease thereafter may mean that the poorly fed sows actually attained their full growth of skeleton in spite of the limited amount of feed, and that there was retardation of growth in Groups VI and VII but really no inhibition in skeletal development. Certainly the degree of fatness has a marked influence on body measurements.

GESTATION AND ITS EFFECT ON BODY GROWTH

In Table 8 the body measurements and weight of young pregnant sows are compared with those of open sows of the same age and maintained under the same conditions, all liberally fed. The pregnant sows tended to put on weight more readily than the non-pregnant individuals and with the same amount of feed. There was little difference in the two groups of sows as regards body measurements. Pregnancy did not seem to retard growth certainly, nor could one conclude from Table 8 that the phenomenon of pregnancy particularly accelerated growth.

TABLE 8.—THE AVERAGE GAIN OF ELEVEN PREGNANT AND EIGHT NON-PREGNANT SOWS (114-DAY PERIOD)

	Pregnant Sows	Non-Pregnant Sows
Gain in weight (lbs.)	69.8	38.8
Height at Withers (cm.)	4.9	4.6
Height at Croup (cm.)	4.2	4.5
Length of Body (cm.)	7.4	7.7

From Missouri Agr. Exp. Sta., Res. Bul. 45, page 18.

The Period of Gestation.—It is conceivable that certain factors might influence the number of days a sow is pregnant. So Tables 9 and 10 and Figure 14 have been prepared. In Table 10 it is seen that the

TABLE 9.—THE RELATION OF THE LENGTH OF THE GESTATION PERIOD TO (A) AGE OF FIRST BREEDING, (B) AGE OF SOW, AND (C) PLANE OF NUTRITION

(Each group of figures shows number of litters in data and average length of gestation period in days

Litter Number	Group					
	I	II	III, IV, V	V	VI	VII
1st	5–113.6	4–113.5	28–114	7–113.1	5–113.4	9–114
2nd	2–114	3–114.3	23–113.5	5–114	3–113.3	3–113
3rd	2–115	2–114	20–112	5–112.6	4–113.5	4–113.7
4th	2–111	1–114	16–113.6	5–113.6	4–114.2	5–114
5th	2–114.5	1–113	21–113.2	5–113.8	3–114	4–13.17
6th	1–115	--------	16–113.1	3–113.3	2–113	1–118
7th	--------	--------	12–113.4	1–115	1–114	--------
8th	--------	--------	8–114.4	1–118	1–115	--------
9th	--------	--------	4–113.7	1–115	1–117	--------
10th	--------	--------	2–113	--------	--------	--------
11th	--------	--------	1–114	--------	--------	--------

great majority of the periods of gestation are 111 to 116 days in length, that is 91.8 per cent are of this length. And there are as many that fall

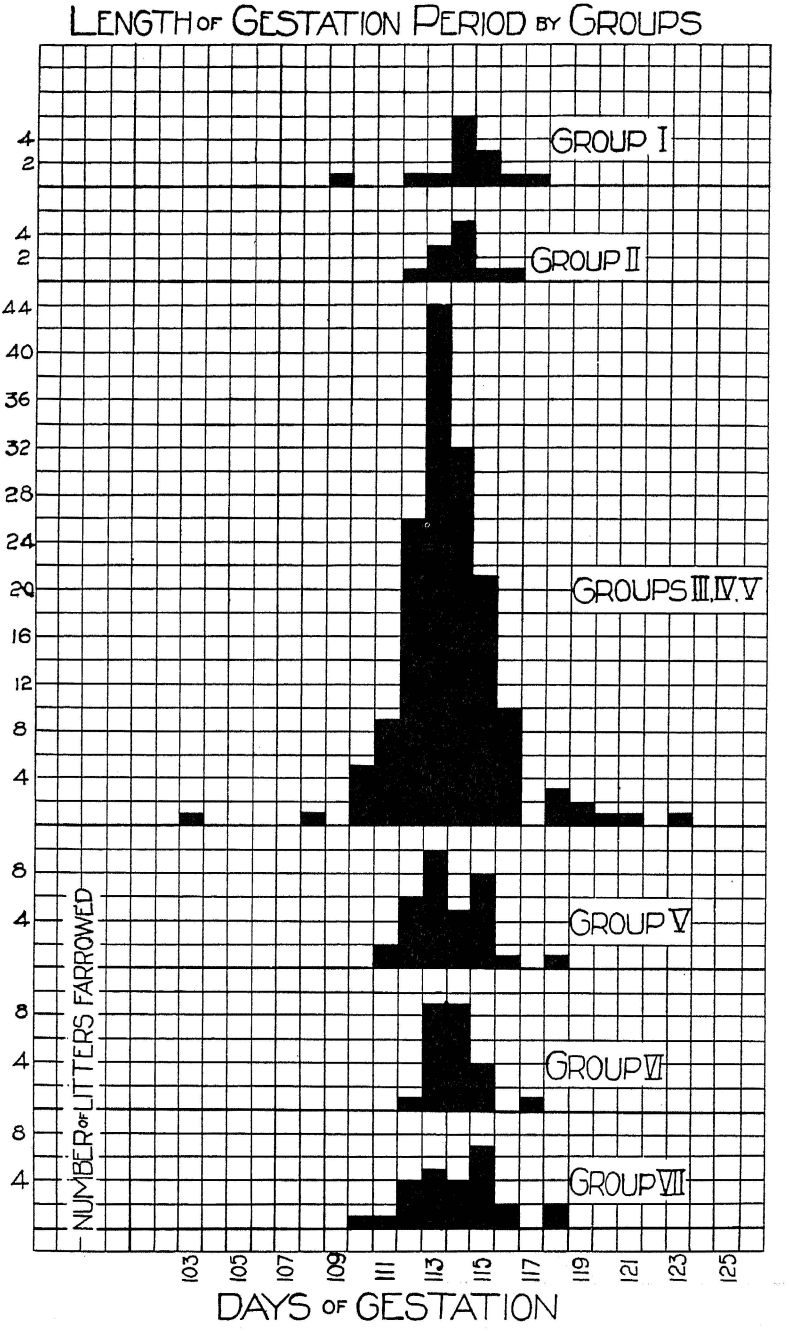

Fig. 14.—Average Length of the Gestation Period by Groups. (See Tables 9 and 10)

TABLE 10.—THE PERIOD OF GESTATION AND THE SIZE OF THE LITTER (ALL GROUPS)

Pigs born in litter	Gestation Period—days														Total
	103	105	108	110	111	112	113	114	115	116	117	118	119	120	
1	---	---	1	---	---	---	---	---	---	---	---	---	---	---	1
2	---	---	---	---	---	---	---	---	1	---	---	---	---	---	1
3	---	---	---	---	1	1	6	3	4	2	---	---	---	---	17
4	---	---	---	4	---	4	2	2	1	---	---	1	---	---	14
5	---	---	---	---	1	---	2	1	---	2	1	---	---	---	7
6	---	1	---	---	---	6	4	7	3	---	1	---	---	1	23
7	---	---	---	1	1	5	5	7	3	1	---	---	---	---	23
8	---	---	---	---	2	1	7	7	4	3	---	2	---	---	26
9	---	---	---	---	1	5	7	5	7	5	---	---	---	---	30
10	1	---	---	---	1	4	10	9	3	---	---	---	---	---	28
11	---	---	---	---	2	7	4	4	2	---	---	1	1	---	21
12	---	---	---	1	---	1	2	5	1	---	---	---	---	---	10
13	---	---	---	---	---	1	2	2	1	---	---	---	---	---	6
14	---	---	---	---	---	1	2	3	2	---	---	---	---	---	8
15	---	---	---	---	1	---	---	---	---	---	---	1	---	---	2
16	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	2	---	---	---	---	---	---	---	2
18	---	---	---	---	---	---	1	---	---	---	---	---	---	---	1
Total	1	1	1	6	10	36	56	55	32	13	2	5	1	1	220

Average length of the 220 gestation periods, 113.5 days.
111 of the 220 periods, or 50.45 % were for 113 or 114 days.

short of this period as exceed it, namely 4.1 per cent in each case. In the case of Groups VI and VII the distribution is the same as for that shown in Table 10 for all groups. From the data available there does not appear any difference in the length of the period of gestation between sows bred first at different ages, the later litters were carried on the average about the same length of time as earlier litters. Sows on one plane of nutrition were pregnant about the same length of time as those on other planes, neither did the size of the litter (that is the number of pigs born) seem to influence noticeably the gestation period. In fact the constancy of this period is remarkable.

LACTATION AND ITS EFFECTS

The Effect of Lactation on Height at Withers.—It is commonly felt that reproduction is a drain on the maternal organism, particularly on the immature mother, and that reproduction may materially influence the ultimate size of the individual so taxed. Table 8 was presented above to show how pregnancy affected the growth of young sows. No very marked effect was noted. In Table 11 and Figure 15 the period of lactation is studied. Sows that farrowed and weaned large litters have been included here, and sows that had weaned small litters have also been included for comparison. The various groups of sows are represented in this table as well. The one measurement of height at withers is used in this comparison. As indicated earlier in this paper measuring was done usually at three-month intervals.

TABLE 11.—THE EFFECT OF LACTATION ON GROWTH (AS INDICATED BY HEIGHT AT WITHERS, IN CENTIMETERS)

	NAME OF SOW											
	F. 90	F. 160	4th93	3rd91	2nd91	S-f 90	3rd96	4th94	2nd94	2nd96	F12A	F. 8
Age at Farrowing First Litter (days)	358	352	307	329	531*	327	361	621	435	439	663	1090
Group	III	IV	V	V	V	VI	VII	VII	VII	VII	II	I
Number of Pigs Weaned												
Litter No. 1	11	2	0	9	0*	7	0	4	6	6	3	3
Litter No. 2	11	0	3	0	9	10	0	0	0	3	8	3
Litter No. 3	3					6	4	4	0	5	10	7
Litter No. 4	8					7	2		0	7		
Litter No. 5	12					7	6		0	7		
Litter No. 6	9					7	2					
Litter No. 7	4					10	5					
Height at Withers cms.												
Age (months)												
6											50.	
7	56.5		49.5			47.	53.	39.5			52.	48.
8	57.					51.					52.	54.5
9	58.	53.5		66.		53.5		47.			54.	56.
10	61.		55.5			51.5 F	55.	48.			56.	
11	61. F		F	F							56.	
12	62.	64.5	60.5	56.	62.		F		54.	54.5	57.	58.5
13		F	57.5		Ab*	40.	55.	52.				
14	63.5				63.				F	F		60.
15		67.		64.					58.	56.5		
16			65. F			55.	51.	55.5				64.5
17					67.		F					
18	64. F	74.		65.	F	F			57.	56.	62.	
19		F	65.5	F		58.	52.5					66.5

20					67.			55.5				65.5
21	69.	76.		65.			54. F	F	57.	56. F	64.	66.5
22						59.	55.	54.			F	66.5
23												65.
24	74.	76.5							50.5	52.	65.	
25						64. F	58.	60.				
26	F								F			
27	76.							F	59.	F	66.	
28						63.	59.5	61.		56.5	F	
29												70.
30						F	F		58.	54.5	62.	
31	77.					62.	57.5	59. F	F			
32											64.	
33	F								56.5	54.5		71.
34	74.					63.	57.	61.5		F	F	
35									56. F	53.5		
36						F	F		58.	56.		F
37	76.					57.	62.					
38												70.
39	F								60.	59.5		
40	76.					54.	60.					
41										F		
42						F	F		63.5	59.5		71.
43	85.					63.	58.		F			
44									61.5	58.		F
45	F											72.
46	79.					65.	60.					
47												
48						F	F					72.
49	76.					58.						
50												F
51	F					57.5						69.
52	75.					60.5						
53												69.

*Aborted First Litter.

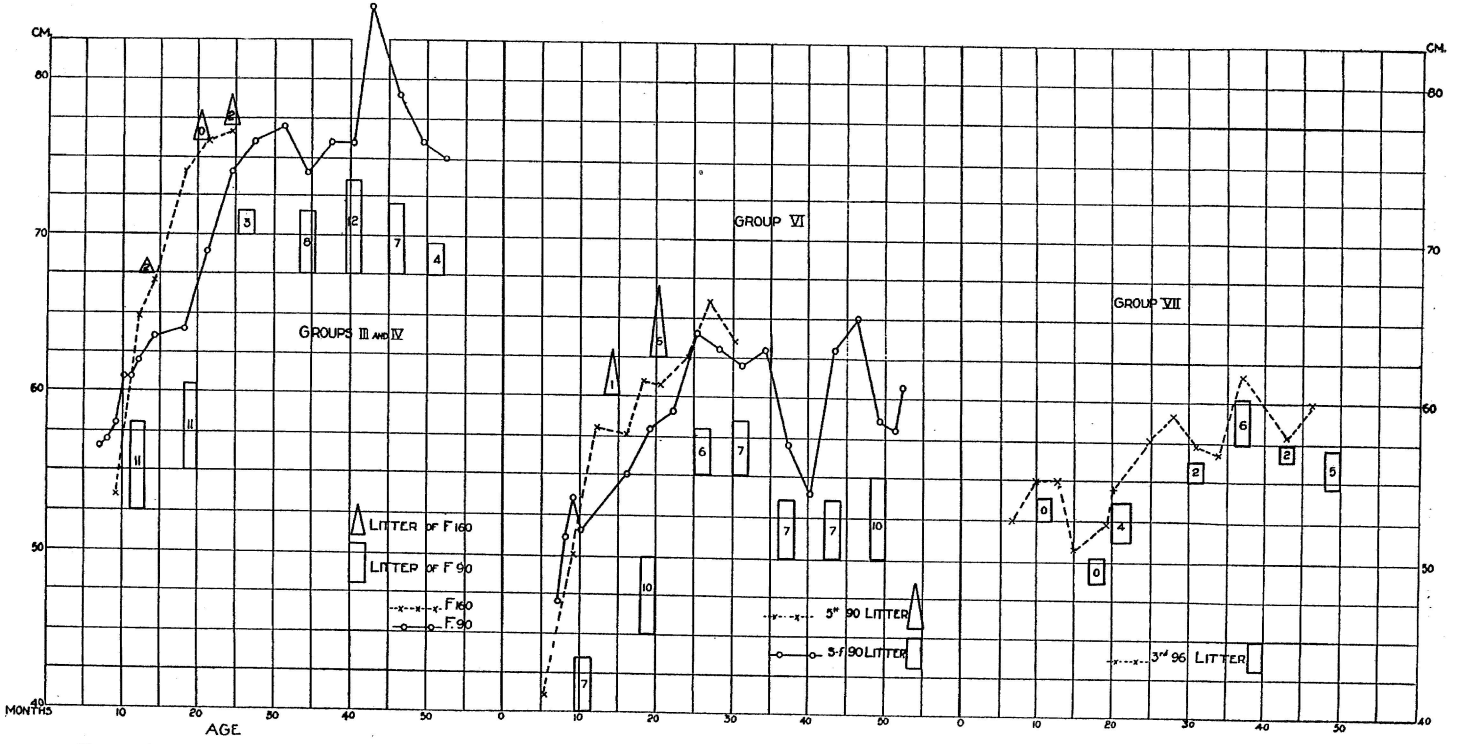

Figure 15.—The Effect of Lactation on Growth as Indicated by Height at Withers for Sows Suckling Large and Small Litters and on Different Planes of Nutrition (The number of pigs farrowed is indicated in the triangle or rectangle). (See Table 11).

Sow F.160 grew in height at withers fast and suffered no retardation at all, neither did she wean big litters. Sows F.90 and 3rd91 suckled and weaned large litters when each were young and immature and when each was growing rapidly. Sow F.90 grew 3 centimeters in the seven months following the birth of her first litter; sow 3rd91 seemed to shrink in height when she farrowed first, she did not increase in height at all before her second farrowing. These two instances afford a marked contrast to the growth in height of 9.5 centimeters in sow F.160 from a time shortly before farrowing her first litter till her second farrowing. Sows F.90 and 3rd91 suckled large first litters, F.160 a small litter.

Sow 2nd91 continued to grow rapidly after aborting her first litter, but the suckling of a large second litter was associated with a standstill in height at withers.

The sows of Groups I and II had their growth before lactating at all, consequently lactation proved no check to growth in these cases. Sow F.90, though evidently somewhat affected by suckling large first and second litters before she was 20 months of age, was not stunted, but rather the effect of heavy lactation was one of retardation and not inhibition.

When the feed was restricted in amount as it was in Groups VI and VII there was correlated with suckling periods a lack of growth, or a slowing up of growth in the immature individual, but most important, this combination of limited feeding together with lactation accompanied growth inhibition, or partial stunting, for the sows of Groups VI and VII failed to grow as large as those in other groups.

Sow S-f.90 suckled a litter of seven pigs when she was ten months old. This was a serious check on her growth. In the case of sow 2nd94 growth in height at withers was suspended for 9 to 10 months after the first litter was farrowed and suckled. But she finally grew out to medium size, her later litters being lost. The later litters of sow 2nd96 lived and were suckled, and this sow's height at 44 months was still not that of a normal mature sow.

Thus lactation proved a drain on rapidly growing sows and probably accounted for a difference in height at withers at the age of 18 months of 10 centimeters where the sows were liberally fed. Where lactating sows were maintained on scant rations growth was retarded in the young animals and the attainment of mature size postponed indefinitely (a difference in favor of better fed sows of 12 to 17 centimeters in height at withers).

Weight of Lactating Sow and Size of Litter.—Table 12 with Fig. 16 is an attempt to demonstrate the effect lactation had on the sow. Body weight is the criterion in this comparison, whereas height at withers was used in Table 11 and Figure 15. Only first litters are con-

TABLE 12.—THE RELATION OF THE SIZE OF THE LITTER TO THE WEIGHT OF THE SOW FROM BEFORE FARROWING TO A MONTH AFTER WEANING

(First Litters only)

Group	No. of Pigs Weaned	Weeks Before Farrowing		After Farrowing (weeks)														
		2	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I & II*		226 (9)				236				251				270				296
III, IV, V	7 or more	277 (7)	288	255	249	239	228	222	214	214	212	214	209	216	217	228	229	
III, IV, V	3 or less	256 (12)	258	244	245	245	247	250	256	252	252	256	265	267	271	278	281	
VI	7 or more	199 (4)	207	185	185	180	172	168	160	158	151	144	150	142	150	154	158	
VII	7 or more	180 (4)	180	160	154	149	144	149	142	141	138	138	137	138	142	139	145	
VII	3 or less	183 (3)	192	161	169	169	175	176	173	176	179	174	169	162	161	158	159	

*The weight curve of non-pregnant sows of the same average age is used here for sake of comparison; the sows are from Groups I and II. Number of sows included parenthesis. Weight of sows in pounds.

sidered here, and the weight curves of sows that suckled and weaned seven pigs or more compared with sows of the same and of other groups which suckled and weaned only three or less. Thus are compared groups of sows suckling relatively large litters and small litters. The average

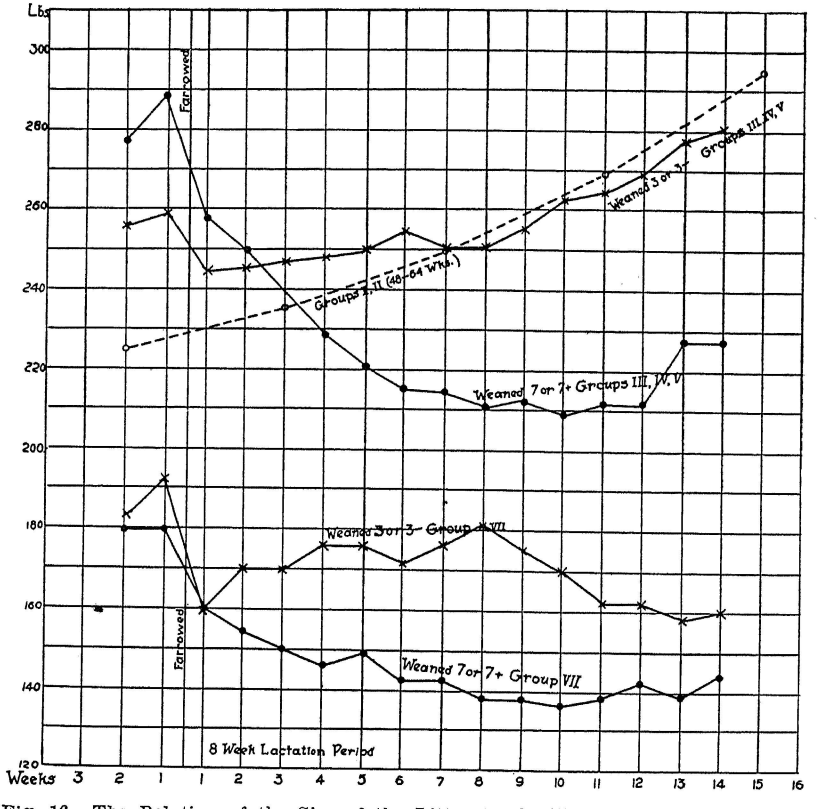

Fig. 16.—The Relation of the Size of the Litter to the Weight of the Sow from Before Farrowing to a Month After Weaning. (See Table 12.)

weights of nine sows of Groups I and II, at the same age as the sows of the other groups, are included so that comparison can be made with non-pregnant, non-lactating sows.

It is noted that following the loss at farrowing time those sows suckling small litters tended to gain in weight rather than lose throughout the eight-week lactation period. On the other hand, sows suckling relatively large litters lost weight rapidly each week of lactation and did not begin to gain till the third week after weaning. The losses were

greater and more rapid in the better fed groups, large litters considered, thus the well fed sows of Groups III, IV and V lost 46 pounds from the first week after farrowing till the tenth week, as compared with 35 pounds and 23 pounds respectively for the medium plane (Group VI) and low plane (Group VII) sows for the same period. And the losses at farrowing time are greatest for the well-fed sows, 33 pounds for Groups III, IV, and V, as compared with 22 and 20 pounds respectively for Groups VI and VII, for the particular sows used in this table. These relative losses during the suckling period bore a direct relationship to the weaning weights of the pigs (studied in Table 15 below), so that generous feeding to sows losing weight rapidly while suckling large litters produced the largest pigs at weaning. This is only reasonable for the good sow "milks down" and for the more feed given her while she is lactating (within limits) the more milk can she produce.

TABLE 13.—THE RELATION OF THE SIZE OF THE LITTER WEANED TO THE DAILY LOSSES OF THE SOW DURING LACTATION

Data on 217 litters

No. of Pigs Weaned	No. of Litters	Daily Losses in Lactation	
		1st Half lbs.	2nd Half lbs.
Groups I and II			
1	2	.385	.425
2	1	.74	.60
3	6	.238	.75
4	2	.14	1.69
5	2	.99	1.64
6	1	0.0	2.19
7	2	2.07	.995
8	5	1.83	1.19
9	1	3.53	.78
10	1	1.5	1.82
Groups III and IV			
1	2	.17	.20
2	5	.828	.418
3	13	.293	.236
4	13	.679	.513
5	17	1.177	.947
6	14	1.115	.785
7	16	.757	.615
8	11	1.59	.964
9	5	2.11	.234
10	1	1.92	—.14*†
11	2	1.62	1.255
12	2	1.065	.655
Groups V, VI and VII			
1	4	—0.833*	—0.27*
2	7	0.168	—0.01*
3	10	0.305	—0.102*
4	10	0.959	0.312
5	13	1.176	0.617
6	13	0.881	0.711
7	19	1.145	0.84
8	5	1.226	0.876
9	6	1.511	0.533
10—	5	1.234	0.786
11			
12—	1	1.92	1.14

†Raised by Middle Plane sows only.
*These are actual daily gains in weight. (or negative losses).
‡This represents a daily gain of .14 pound

Losses in weight during lactation and their relation to the number of pigs weaned are taken up in Table 13. All litters and all groups of sows are here considered. If it is lactation that influences growth rather than gestation then data dealing with the severity of lactation should be of interest. In Table 13 there appears a very definite relationship between small litters and small losses. And with an increased number of suckling pigs there is noted an appreciable increase in daily losses of the lactating sow; this daily loss ranges from 3.53 pounds maximum, where a litter of nine was weaned, down to an actual daily gain of 0.83 pounds where only one pig was weaned. Also, the losses during the second half of lactation were less than during the first half, except for Groups I and II where heavier losses occured in some cases in the latter half of lactation, but here very few litters and sows are included in the data.

TABLE 14.—FEED CONSUMED DURING LACTATION PERIOD AND DAILY LOSS IN WEIGHT DURING FIRST AND SECOND HALVES OF THIS PERIOD

	Feed (lbs.)	Daily Loss in Lactation	
		1st 4 weeks (lbs.)	2nd 4 weeks (lbs.)
Group III	435.7	0.93	0.61
Group IV	401.3	1.08	0.83
Group V	443.7	0.93	0.49
Group VI	296.3	1.04	0.66
Group VII	194.3	0.52	0.33

Feed Consumed and Losses in Weight by Lactating Sows.—In Table 14 the lactation period is divided into two equal parts, the first four weeks, and the second four weeks, and the losses in body weight for each period, are noted for all sows for all litters (Groups I and II excepted). The amount of feed consumed is indicated. The daily loss for all groups during the first half of lactation was practically the same except for Group VII where the feed was cut to an extremely low figure. Here it must be observed that Group VI sows weaned more pigs on the average than any other group (see Table 1) and no doubt this fact accounted for the high loss in weight. Group VII sows lost least in both halves of lactation. During the second half of the suckling period the sows did not lose as rapidly, only about two-thirds that of the losses in the first four-weeks, except for the Group V sows which lost only half as much daily as they did the first half, and here again it must be recalled (Table 1) that this group weaned the smallest litters on the average, and all suckling periods are here considered.

Were reliable data available to show the milk production of sows it would be expected that more milk is produced during the first half of

lactation, reasoning from the figures in Tables 13 and 14. However no one feels that to date a satisfactory method has been devised for measuring milk production in sows.*

THE RELATION OF WEANING WEIGHT TO THE PLANE OF NUTRITION AND AGE OF THE SOW

Table 15 gives the weaning weights of the pigs of the high, medium and low plane of nutrition sows, and the record on the first litters are tabulated separately.

TABLE 15.—RELATION OF WEANING WEIGHT TO PLANE OF NUTRITION

Group	No. of Pigs in Data	No. of Litters	Aver. Weaning Wt. per Pig for All Litters	No. of First Litter Pigs	No. of Litters	Aver. Weaning Wt. per Pig for First Litters Only
V	144	29	25.41	35	7	21.6
VI	131	21	22.27	37	6	19.78
VII	126	26	19.29	47	8	18.92

Litters of gilts did not weigh as heavy at weaning time as later litters. This applies to each group here. Again the plane of nutrition of the sow affected the weaning weights of the pigs. The sows liberally fed weaned pigs weighing 25.41 pounds, whereas sows in Groups VI and VII weaned pigs that averaged 22.27 and 19.29 pounds respectively. First-litter pigs weighed less but bore the same relationship in regard to feed consumed by the sows, thus Groups V, VI and VII weaned pigs that averaged 21.6, 19.78 and 18.92 pounds, respectively.

It may be justly contended that the pigs produced by the sows on the high plane of nutrition did not weigh especially heavy. The fact that the same pastures were used for several years and doubtless had some worm infestation may account for this, but at any rate the sows were kept under approximately the same conditions, and differences in weaning weights should be due to differences in age and plane of nutrition of the sows.

FEED CONSUMED BY THE SOW AND THE WEIGHT OF THE SUCKLING PIGS

The relation between the plane of nutrition of the sow and the growth of the suckling pig is set forth in Table 16 and Figure 17. These particular litters were included in this table for the reason that extra precautions had been taken to afford sanitary conditions and it was felt that these offered a fair comparison. The grain mixtures fed the sows were the same, but the Group VI and VII sows received only limited amounts. The average amount of feed consumed per day by each sow for the

*P. S. Chung states that sows gave the greatest milk yield during the third and fourth weeks of lactation, and the amount gradually declined from the fifth week.

TABLE 16.—THE RELATION BETWEEN THE PLANE OF NUTRITION OF THE SOW AND THE AVERAGE WEIGHTS BY LITTERS OF SUCKLING PIGS FROM BIRTH TO EIGHT WEEKS

Litter No. on Graph (Fig. 17)	I	II	III	IV	V	VI	VII
Dam	4th96L*	5th94L	3rd90M	4th90M	2nd91H	4th91H	3rd91H
No. of Pigs in Litter	8	9	10	9	9	8	4
Avg. daily Grain (lbs.) for sow for eight weeks	4.89	4.36	4.97	5.36	10.00	10.63	10.97
Age-days							
Birth	2.525	2.08	2.50	3.33	2.17	2.59	3.00
2	-----	-----	3.19	-----	-----	-----	-----
7	-----	3.67	-----	6.37	-----	-----	-----
8	4.05	-----	-----	-----	3.82	-----	-----
9	-----	-----	6.29	-----	-----	-----	-----
11	-----	-----	-----	-----	-----	5.125	9.10
15	5.25	-----	7.835	-----	8.00	-----	-----
18	-----	-----	-----	-----	-----	8.875	12.625
22	-----	7.50	-----	10.83	9.56	-----	-----
23	7.19	-----	-----	-----	-----	-----	-----
24	-----	-----	10.10	-----	-----	11.50	-----
26	-----	-----	-----	-----	-----	-----	17.875
29	-----	9.78	-----	13.17	12.22	-----	-----
30	8.25	-----	-----	-----	-----	-----	-----
32	-----	-----	-----	-----	-----	14.25	-----
33	-----	-----	-----	-----	-----	-----	22.75
36	-----	11.39	-----	14.55	14.56	-----	-----
38	-----	-----	13.10	-----	-----	-----	-----
43	-----	-----	-----	-----	16.78	-----	-----
44	10.31	-----	-----	-----	-----	-----	-----
45	-----	-----	14.65	-----	-----	-----	-----
46	-----	-----	-----	-----	-----	20.5	-----
47	-----	-----	-----	-----	-----	-----	33.50
48	-----	-----	-----	18.44	-----	-----	-----
50	-----	16.29	-----	-----	18.00	-----	-----
51	12.19	-----	-----	-----	-----	-----	-----
52	-----	-----	16.85	-----	-----	-----	-----
53	-----	-----	-----	-----	-----	25.00	-----
54	-----	-----	-----	20.11	-----	-----	37.50
56	-----	16.94	-----	-----	-----	-----	-----
57	-----	-----	-----	-----	23.33	-----	-----
58	12.875	-----	-----	-----	-----	-----	-----
60	-----	-----	19.05	-----	-----	27.25	-----
61	-----	-----	-----	22.67	-----	-----	-----

*L—Group VII: M—Group VI: H—Group V.
F. 150, Pigs Farrowed Feb. 1, 1926.
4th 96, Pigs Farrowed Feb. 3, 1926.

suckling period is given. Of course, in the case of the generously fed sows the major part of the feed was taken in the latter part of the period. The sows on limited feed during lactation were also on a limited amount of feed during the gestation period preceding. The number of pigs in each litter is given and this number did not vary throughout the period covered.

The pigs with the low plane sow were markedly below those with better fed sows throughout the suckling period in some cases weighing at weaning time 13 pounds or only half as much as those with the high plane sows. The amount of good feed a sow received during the gestation period affected greatly her condition, and it was these two factors, condition of the sow and amount of feed fed during lactation that influenced so greatly the growth of the pigs during the suckling period. Certainly it is very evident from the figures in Table 16 that materially restricting the feed of the sow that was lactating led to low weaning

weights on the pigs. The sows fed less than five pounds of grain daily for the eight-week period weaned pigs averaging less than twenty pounds. Sows fed more than five pounds daily during this time weaned pigs over twenty pounds. All the sows were run on bluegrass pasture.

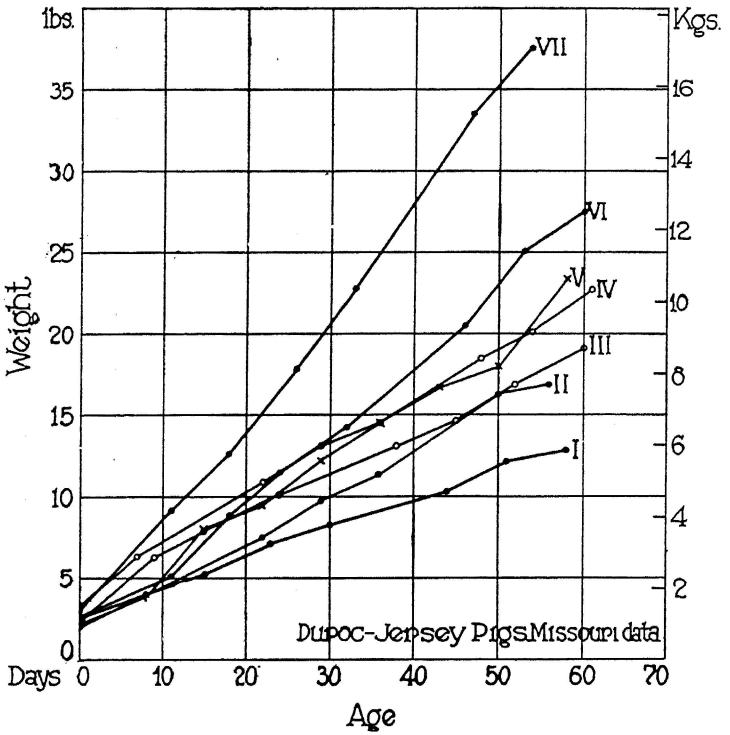

Fig. 17.—The Relation Between the Plane of Nutrition of the Sows and the Average Weights by Litters of Suckling Pigs from Birth to Eight Weeks. (The Roman numerals refer to litters in Table 16).

FEED CONSUMED BY SOW AND PIGS AND GROWTH OF PIGS TO MARKETABLE SIZE

The importance of having the pigs wean at fairly heavy weights is emphasized in Table 17 and Figure 18. Here the feed and body weight records of two litters from birth to the time they were ready to go to market are compared. One litter is out of a generously fed sow, F.150, of Group IV, the other litter is out of a low plane of nutrition sow, 4th96, of Group VII. The two sows were run on bluegrass pasture during the lactation period, in adjacent and similar lots. The sows were the

TABLE 17.—THE AVERAGE BODY WEIGHTS AND FEED CONSUMED DAILY OF TWO LITTERS FROM SOWS ON DIFFERENT PLANES OF NUTRITION, FROM BIRTH TO MARKETABLE SIZE

Age of Pigs (days)	Aver. daily Feed to the Sow (lbs.) Ration A	No. of Pigs	Aver. daily amt. of feed to each pig (lbs.)	Aver. body wt. of pigs (lbs.)
0 (birth)	0.	8	----------	2.77
10	2.64	7	----------	5.6
17	7.6	6	----------	8.1
25	9.2	6	----------	10.3
32	9.28	6	----------	14.0
46	10.4	6	----------	20.8
53	13.6	6	----------	24.5
60	13.6	6	----------	28.7
68	----	6	1.5 Ration A	31.8
75	----	6	1.63 Ration A	33.6[2]
82	----	6	1.75 Ration A	36.2
89	----	6	1.78 Ration A	41.3
96	----	6	2.43 Ration A	48.7
109	----	6	3.19 Ration A	60.0[3]
116	----	6	3.68 Ration A	68.5
123	----	6	4.87 Ration A	74.7
137	----	6	4.7 Ration A	96.7
143	----	6	4.7 Ration A	100.
150	----	6	6.37 Ration A	111.4
157	----	6	8. Ration A—1 day 6.03 Ration B—6 days	121.1[4]
164	----	6	7.0 Ration B	129.8
178	----	6	7.98 Ration B	155.7
192	----	6	7.92 Ration B	181.3
206	----	6	10.2 Ration B	212.2
220	----	6	12.5 Ration B	240.5
227	Shipped	6[5]	12.5 Ration B	253.7

[1] Weaned at 60 days.
[2] Dipped at 73 days and wormed at 75 days.
[3] Vaccinated at 103 days
[4] Photographed at 155 days
[5] Including 3 barrows, 3 sows.

Note.—Ration A consists of 5 parts shelled corn, 2.5 parts (shorts) wheat middlings, 1.5 parts wheat bran, 1.0 part tankage (by weight). Ration B consists of 8 parts shelled corn, 2 parts (shorts wheat middlings, 1 part tankage (by weight).

Age of Pigs (days)	Aver. daily Feed to the Sow (lbs.) Ration A	No. of Pigs	Aver. daily amt. of feed to each pig (lbs.)	Aver. body wt. of pigs (lbs.)
0 (birth)	0.	11	----------	2.28
8	1.94	8	----------	4.05
15	4.94	8	----------	5.25
23	5.0	8	----------	7.19
30	5.0	8	----------	8.25
44	5.07	8	----------	10.4
51	6.0	8	----------	12.2[1]
58	6.0	8	----------	12.25[2]
66	----	8	0.56 lb. Ration A	14.4
73	----	8	0.59 lb. Ration A	15.0[3]
80	----	8	0.56 lb. Ration A	19.6[4]
87	----	7	0.62 lb. Ration A	23.1
94	----	7	0.72 lb. Ration A	27.4
107	----	7	1.01 lb. Ration A	36.0
114	----	7	2.8 lb. Ration A	43.0
121	----	7	3.2 lb. Ration A	48.6
135	----	7	4.0 lb. Ration A	66.7
141	----	7	4.0 lb. Ration A	73.7
148	----	7	4.67 lb. Ration A	82.3
155	----	7	5.7 Ration A—1 day 4.85 Ration B—6 days	92.0[5]
162	----	7	5.5 Ration B	100.0[6]
176	----	7	5.05 Ration B	121.6
190	----	7	6.26 Ration B	143.4
204	----	7	6.99 Ration B	174.2
218	----	7	8.45 Ration B	205.4
225	----	7	8.47 Ration B	216.1
234	----	7	9.0 Ration B	229.1
239	Shipped	7[7]	10.0 Ration B	246.0

[1] Dipped Pigs at 47 days.
[2] Weaned at 59 days.
[3] Dipped at 71 days and wormed at 73 days.
[4] Rung, in cattle pastures 7 days.
[5] Photographed at 153 days.
[6] Boar pigs castrated at 162 days.
[7] Including 5 barrows, 2 sows.

same age, in each case the litter was the second for the sow, and the litters were farrowed just two days apart. The pigs were full-fed by hand twice daily from weaning till shipped to market. Instead of plotting on the graph (Figure 18) the actual amount of feed consumed, a seven-day moving average is used.

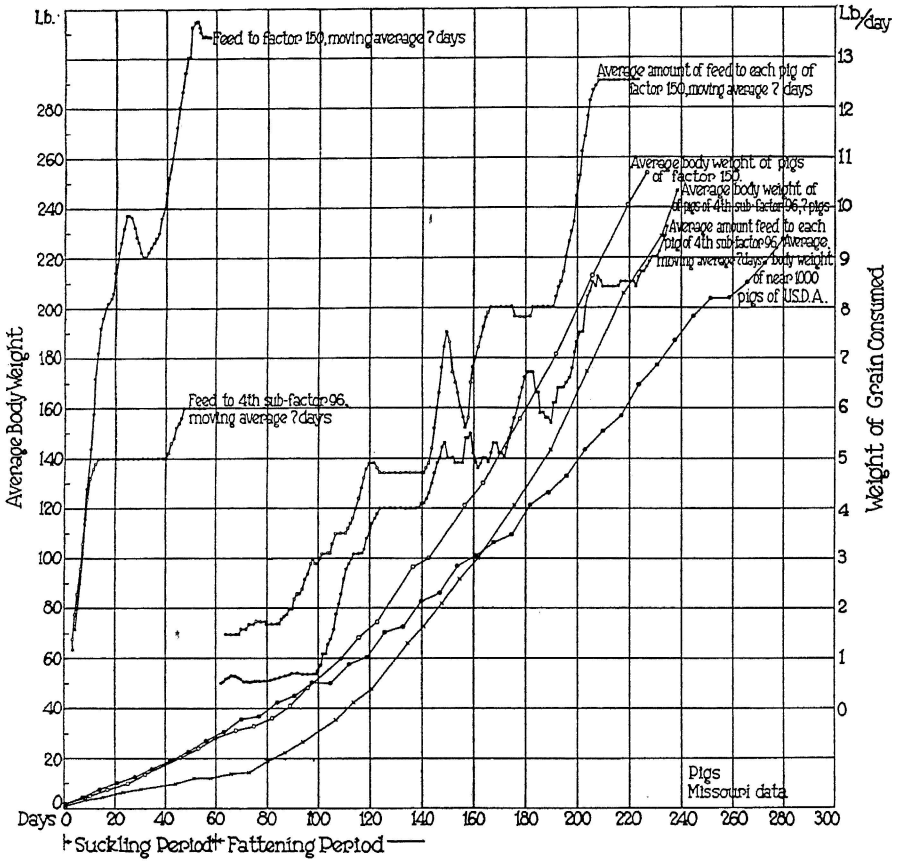

Fig. 18.—The Average Body Weights and Feed Consumed Daily of Two Litters from Sows on Different Planes of Nutrition, from Birth to Marketable Size. (See Table 17.).

The pigs of the better fed Group IV sow (F.150) were each able to eat almost a pound more grain the day they were weaned than the pigs of the Group VII sow. The Group IV sow was offered enough feed while she suckled her litter that the pigs learned to eat grain well before weaning (they were at thr trough regularly from the time they were 41 days old).

Increases in the amount of feed to the pigs of the Group IV sow were made soon after weaning, whereas about 40 days passed before the other litter could take an increase. However, when these pigs of the Group VII sow did get on feed they did well.

The divergence of the growth curves of the two litters during the suckling period was marked, but after weaning the curves were parallel, that of the Group VII sow's pigs lagging by some 20 days; this difference gradually diminished till at marketing time there was a difference of only 17 days.

The additional 17 days required to finish the pigs of the Group VII sow can be laid to the treatment given during the suckling period.

In Figure 19 the two upper views are photographs of the litter of the Group IV sow at 227 days, average weight 254 pounds, the lower views are of the litter of the Group VII sow at 225 days, average weight 216 pounds.

BIRTH WEIGHTS AND THE INFLUENCE OF SEX

The sex and weight of the pigs at birth, alive and dead, are indicated in Table 18. In Groups I, II and VII only were there more females than males born, and taking all pigs into consideration there were 1034 males farrowed and 977 females, including 90 dead males and 75 dead females.

The males averaged .09 pounds heavier than the females, every group of sows farrowing heavier males than females. Where the sows were on a restricted amount of feed the birth weights were reduced, thus the male pigs averaged 2.45, 2.36 and 2.18 pounds, and the female pigs 2.33, 2.27 and 2.08 pounds for Groups V, VI and VII respectively. Dead pigs weighed less on the average than live pigs though the difference was slight, dead males were heavier than dead females, 2.24 pounds for the dead males as against 2.13 pounds for the dead females.

TABLE 18.—BIRTH WEIGHTS OF MALE AND FEMALE PIGS

Group	No. of Males	Wt. per pig—male (lbs.)	No. of Females	Wt. per pig—female (lbs.)	Pigs Born Dead			
					No. of Males	Wt. per pig—male (lbs.)	No. of Females	Wt. per pig—female (lbs.)
I, II	76	2.51	88	2.46	1	1.7	3	1.67
III, IV	480	2.38	464	2.32	49	2.22	49	2.17
V	209	2.45	175	2.33	19	2.42	9	2.09
VI	121	2.36	141	2.27	4	2.32	9	2.35
VII	148	2.18	109	2.08	17	2.09	5	1.57
All Groups	1034	2.38	977	2.29	90	2.24	75	2.13

BIRTH WEIGHTS AND NUMBER OF PIGS BORN

The relation of the average birth weight to the number of pigs farrowed in a litter is considered in Table 19. Included here are 2,027 pigs in 242 litters, the pigs averaging 2.33 pounds at birth with an average of 8.38 pigs per litter.

TABLE 19.—RELATION OF AVERAGE BIRTH WEIGHT TO THE NUMBER OF PIGS FARROWED IN THE LITTER

No. of Pigs in Litter	No. of Litters Included in Data	Average Birth Weight (lbs.)
2	1	2.19
3	14	2.68
4	14	2.40
5	8	2.67
6	28	2.41
7	23	2.27
8	31	2.32
9	36	2.41
10	29	2.23
11	29	2.35
12	13	2.05
13	7	2.28
14	7	2.34
15	1	2.98
17	1	2.26

The total number of pigs was 2027 in 242 litters, pigs per litter 8.38, the average litter weight at birth was 19.51 pounds, and the average birth weight per pig was 2.33 pounds.

There does not appear to be any close correlation in these data between the number and weight of the pigs at birth, in fact the weight seems to vary only within narrow limits in most cases. The heaviest pigs, 2.98 pounds, were in a litter of 15 pigs. In litters of six pigs, or less, the pigs averaged 2.40 to 2.68 pounds for the most part while in larger litters most of the pigs weighed 2.05 to 2.41 pounds.

TOTAL WEIGHT OF LITTER AT BIRTH AND WEIGHT OF SOW

There would appear to be a definite relationship between the weight of the sow and the total weight of her litter at birth, as judged from Table 20. Sows weighing over 400 pounds at time of farrowing produced litters

TABLE 20.—THE RELATION OF THE WEIGHT OF THE SOW TO THE TOTAL BIRTH WEIGHT OF THE LITTER

Class (lbs.)	Aver. Wt. (lbs.)	Aver. Total Wt. of Litter (lbs.)	Litter Wt. in percentage of Sow's Wt.	Number of Litters Incl.
600 & over	641.	28.5	4.45	3
500-600	539.3	26.12	4.84	12
400-500	443.2	20.03	4.52	48
300-400	348.14	18.13	5.21	51
200-300	255.04	15.16	5.94	45
100-200	179.0	12.73	7.11	8
Grand Average	361.3	18.5	5.13	167—Total

whose weight at birth was less than five per cent of the body weight of the sow, 20.03 to 28.5 pounds per litter. Sows 200 to 400 pounds farrowed litters weighing 15.16 to 18.13 pounds, that is 5.21 to 5.94 per cent of their own weight. And thin sows, those under 200 pounds, farrowed 12.73-pound litters which weight was 7.11 per cent of the sow's weight. So that the smaller the sow the greater was the birth weight of the litter proportionately.

THE WEIGHT OF THE LITTER AT BIRTH AS AFFECTED BY FEED CONSUMED BY SOW

The care of the sow might conceivably influence the weight of the litter born. In Table 21 the amount of grain consumed by the sows and the gains made at critical points in the sow's life are set down. The

TABLE 21.—THE RELATION OF TOTAL WEIGHT OF LITTER AT BIRTH TO (A) FEED LAST HALF OF GESTATION, (B) AVERAGE DAILY GAIN TWO WEEKS PRIOR TO BREEDING, (C) AVERAGE DAILY GAIN FIRST FOUR WEEKS AFTER BREEDING, (D) AVERAGE DAILY GAIN IN GESTATION, AND (E) ACTUAL LOSS AT FARROWING TIME

Aver. Wt. of Litter at birth (lbs.)	Number of Litters	Amount of feed per sow last half of gestation (lbs.)	Daily Gains Made by Sow			Aver. loss by sow at parturition (lbs.)	Proportion litter wt. is to sow's loss per cent
			Two weeks prior to breeding (lbs.)	First four weeks after breeding (lbs.)	In gestation (lbs.)		
31.8	10	225.05	.069	.947	.816	43.20	71
26.6	14	257.11	.58	.98	.997	41.85	63
22.5	25	199.9	.018	.41	.65	25.92	86
18.2	28	207.26	−.085	.819	.76	26.46	68
13.6	20	154.31	.72	.341	.495	14.7	92
7.7	12	187.27	.096	.503	.596	21.83	35

lowest feed consumption for the two months prior to farrowing, 154 to 187 pounds of grain, and the lowest gains of the sows during pregnancy, .5 to .6 pounds daily, were associated with lowest litter weights, 7.7 to 13.6 pounds. The sow's loss in weight at parturition was greatest for the better fed sows, 42-43 pounds, which sows also farrowed the heaviest litters, 26.6 to 31.8 pounds. Weights were taken weekly and the difference between the loss in weight of the sow at farrowing and the total weight of the litter was no doubt influenced to some extent by an additional loss in some cases during the first few days of lactation (probably 3 to 6 days before weigh day) when it was the practice to withhold the feed and gradually increase the amount of grain to the sow over a period of two weeks.

The data here presented would not indicate that the gains made by these sows the two weeks prior to breeding had much influence on the

size of the litter, there is a more definite correlation indicated in the gains made the month following breeding. It may be that the prenatal death, which often is considerable in swine, is offset to some extent where sows are cared for and maintained in a thrifty, gaining condition during pregnancy.

RELATION OF GAINS OF SOW TO THE NUMBER OF PIGS FARROWED

In Table 22 the daily gains made by the sows (a) two weeks before they were bred, (b) the four weeks after breeding, and (c) throughout the gestation period, are tabulated to show what relation these gains may have had to the size of the litter resulting from this breeding. A

TABLE 22.—RELATION OF GAINS OF SOW TO NUMBER OF PIGS FARROWED

No. of pigs in litter	Daily Gains Made (pounds)			No. of litters in data
	Two weeks prior to breeding	Four weeks after breeding	Gestation period	
1	.28	—.89	.56	1
2	—1.02	.42	.56	2
3	.87	.66	.61	19
4	—.14	.62	.60	16
5	.44	.44	.66	8
6	.46	.62	.74	30
7	.18	.73	.58	26
8	.17	.74	.74	35
9	.06	.86	.67	34
10	.02	.97	.82	31
11	—.13	.83	.77	31
12	.20	.86	.87	12
13	.48	1.23	.97	8
14	.21	.90	1.25	8
15	—.13	1.15	.97	3
16	----	----	----	0
17	—.23	.95	1.05	2
18	1.64	.50	.90	1

severe loss in weight prior to breeding (1.02 pounds daily) was associated with litters of only two pigs each. A very marked gain (1.64 pounds daily) during this period was associated with the production of an 18-pig litter. For the most part, however, the gains during the period preceding breeding were small, in some cases slight losses being recorded.

A marked loss, .89 pounds daily, during the four-week period immediately following breeding, occurred only once and resulted in only one pig being farrowed. In these data gains during this post-breeding period, ranging from .42 to .66 pound daily, resulted in litters of one to six pigs (the one exception was the 18-pig litter, but here the sow gained 1.64 pounds daily the two weeks before breeding). Again .73 and .74 pound daily gains in this four-week post-breeding period

were associated with 7- and 8-pig litters, and greater gains than these with litters of more than eight pigs. In fact the relationship is very marked between daily gains made the four weeks after the sows settled and the number of pigs farrowed. This general relationship holds for the gains made throughout gestation, but is not so clear-cut as it is in the first month of pregnancy.

There is probably much significance that can be placed upon this finding, namely the relation of good gains and the maintenance of a real thrifty condition after breeding in swine. "Flushing" in sheep has been held as good practice for many years. This practice does probably not have the same great significance in swine on account of the possibility that sows in reasonably good thrift ovulate a sufficient number of eggs that if fertilized and developed to maturity should provide a good-sized litter. But it has been definitely proved that the prenatal mortality in swine is high. Corner[1] says only 66 per cent of the eggs ovulated develop to full-term foetuses. Warwick[2] found in 491 uteruses of sows that the size of the litter was found to decrease from 11.4 at the twentieth day to 6.8 at the 110th day. Hammond[3] found in pigs that of every 100 eggs shed only 67.4 developed to normal foetuses. This investigator concludes that in pigs the fertility is mainly influenced by those fctors which control the number of eggs which developed, whereas in sheep fertility is limited by the number of eggs shed at each heat period.

If sows can be handled so that this prenatal death may be prevented to an appreciable extent, increased size of litters is a reasonable result that may be expected. Maintaining the thrift of the sow, keeping her in a gaining condition throughout pregnancy, particularly the first stages, is a logical way to attack the problem. The data in Table 22 substantiate this belief.

THE MONTH OF THE YEAR AND PERCENTAGE OF PIGS WEANED

In Table 23 the season and its effect on the percentage of pigs weaned are considered. For those sows that were fed at all generously January was the only month that affected the pig crop in this respect very materially (only 29 to 50 per cent of pigs raised to weaning age). However, Group VII suffered in February also (36 per cent of pigs weaned). February to June for all groups, except Group VII, and March to June for these sows proved to be the most favorable farrowing season when from 59 to 92 per cent of all pigs farrowed were raised (over 70 per cent in most cases).

*See List of References.

TABLE 23.—THE RELATION OF THE MONTH IN WHICH PIGS ARE FARROWED TO THE PERCENTAGE WEANED

Month	Percentage Weaned			
	Groups I, II	Groups III, IV, V	Group VI	Group VII
	Per cent	*Per cent*	*Per cent*	*Per cent*
January	29	48	50	25
February	68	70	68	36
March	72	73	59	59
April	67	75	84	62
May	86	64	82	91
June	62	72	92	--
July	50	61	93	85
August	82	52	70	69
September	--	52	83	--
October	86	68	55	--
November	--	51	64	100
December	--	64	70	64

AUTOPSIES

Two gilts from low plane sows were maintained on the low plane of nutrition after they were weaned, and handled as low plane gilts were cared for when used for breeding. Number 51 was killed and her genitalia examined when she was 8 months, 18 days old. She had been carefully observed all her life and was never noticed in heat nor seen coming into heat. Table 24 summarizes the data and Figures 20 and 22 are photographs of the gilt at the time of killing, and of the genitalia.

TABLE 24.—DATA ON THE GENITALIA OF GILTS 51 AND 63

	Gilt 51	Gilt 63
Age of Gilt	8 mos. 18 days	13 mos. 17 days
Live weight	85 pounds	110 pounds
Total weight of genitals	106 grams	585 grams
Length of Uterine Horn	33.0 cm.	77.5 cm.
Weight of		
Left Ovary		7 grams
Right Ovary	3.5 grams	
Number of Follicles		
Right Ovary	15	20
Left Ovary	17	33 (plus many small follicles 1-3 mm.)
Diameter of Follicles (Average)		
Right Ovary	3.43 mm.	3.72 mm.
Left Ovary	2.7 mm.	2.76 mm.
Number of Corpora Lutea		
Right Ovary	None	5 large 4 small
Left Ovary	None	5 large 5 small
Diameter of Corpora Lutea		
Right Ovary		8.0 mm. 2.25 mm.
Left Ovary		8.8 mm. 2.0 mm.
Oestrus	Never	2 periods

Number 63 was not killed till she was 13 months, 17 days old, 5 months older than Number 51. She had been noticed to be coming in heat

10 days before death but was never seen actually in heat. Again for some two weeks she showed signs of approaching oestrus, this a month before killing; in other words, the only times at which Number 63 was observed to be in heat or nearly so was 10 days before death, and three weeks prior to this oestrus.

Table 24 summarizes the data obtained from Gilt Number 63, and Figures 21 and 23 are photographs of the gilt just before being killed, and of the genitalia.

A 15-centimeter ruler was glued to the live animal and appears in each photograph. Centimeter scales were also placed in focus beside the genital tissues in the photographs.

The data secured at autopsy provide a satisfactory explanation as to why the underfed animal did not breed as early as the well nourished individual. The low plane gilt that was retarded in growth of body was also retarded in the growth and development of her genital organs. The ovaries of the 8-month gilt were not even functional due to underdevelopment, hence oestrus or heat was impossible as long as this retarded condition continued, and conception of course was out of the question.

COMPARISON OF RESULTS WITH THOSE OF OTHER INVESTIGATORS

From Table 1 it is seen that pigs of first litters, that is pigs of gilts, averaged 2.04 to 2.25 pounds at birth, as against more than 2.30 pounds, the average of all the pigs. The Wisconsin Station[4] reports slightly heavier birth weights, namely, 2.35 pounds per pig for those of gilts, and 2.55 pounds for pigs of sows.

The number of pigs farrowed per litter was between seven and eight for first and second litters, and more than eight for third and later litters. Sinclair and Syrotuck[5] of Alberta, found 1.6 pigs difference between litters of yearling and two-year-old sows, thereafter the increase in size of litter was slight. This is practically the same result as found at the Missouri Station inasmuch as the first and second litters were usually farrowed before the sow was two years old.

The length of the period of gestation for the sows included in this paper is 113.5 days, data on 220 farrowings. It is shown that 50.45 per cent of the litters were born on the 113th or 114th day, 91.8 per cent of the periods were 111 to 116 days, 4.1 per cent were for less than 111 days, and 4.1 per cent for more than 116 days. The extremes were 103 and 120 days. Sinclair and Syrotuck[5] found the average period of gestation for 278 farrowings to be 114.6 days. Carmichael and Rice[6] found

the average length of gestation on 549 periods to be 114.58 days, of these 76.9 per cent were for 111 to 116 days, 4.4 per cent were less than 111 days, and 18.8 per cent were more than 116 days. Less than 20 per cent of the litters were farrowed on the 114th day, which was the day of greatest frequency of farrow. The extremes found by Carmichael and Rice were greater than here, namely 98 to 124 days.

The length of the gestation period did not seem to be influenced by the age of the sow and the size of the litter. Carmichael and Rice[6] observed similar results. Sinclair and Syrotuck[5] observed that fifteen of their 5-year old sows averaged 115.4 days as against the general average of 114.6 days.

Group V sows weaned first litters that averaged 3.8 pounds per pig less than the general average. Sinclair and Syrotuck found 7.6 pounds difference between the pigs from yearling sows and four-year-old sows. The Wisconsin[4] data indicate a difference of 4.08 pounds between the pigs in first litters and litters of aged sows.

There were 1034 male pigs and 977 female pigs farrowed, or 51 per cent males and 49 per cent females. The males averaged 2.38 pounds at birth and the females 2.29 pounds, a difference of .09 pound. Of the dead pigs farrowed 55 per cent were males, 45 per cent females. The dead pigs averaged 2.24 pounds for the males and 2.13 pounds for the females. The grand average birth weight of all pigs was 2.33 pounds in 242 litters of 8.38 pigs each. Litters of 6 pigs or less averaged 2.4-2.68 pounds per pig at birth, and larger litters 2.05-2.40 pounds per pig at birth. The Alberta[5] data are for 2533 pigs, 53.69 per cent male and 46.31 per cent female. The Illinois[6] data are for 5657 pigs of which 51.9 per cent were males and 48.1 per cent females. Of the dead pigs reported by the Illinois men 56 per cent were males and 44 per cent females. and the average weight was 2.17 pounds. 83 per cent of the dead pigs reported by the Wisconsin Station[4] weighed less than 2.3 pounds. The Illinois Station reports the average size of litters as 8.1 pigs, and those litters with fewer than the average weighed 2.67 pounds per pig, and litters larger than the average 2.47 pounds per pig, a grand average of 2.55 pounds. Males were consistently heavier than females. These findings are much in accord with each other. The birth weight is less for the Missouri pigs than for those of Illinois, but the size of litter is slightly larger for the former.

Griswold[7] and associates reported that five pregnant gilts gained 8 grams more daily than two open gilts of the same age. This represents two pounds greater gain in favor of the pregnant gilts for the whole period of gestation. The gain in body measurements on the average was in favor of the open gilts but normal variability was great enough to account for the difference observed. The data reported by the writer

is in general accord with Griswold's findings, though a much greater gain in weight (31 pounds) was found for pregnant gilts in this breeding project herein reported.

United States Department of Agriculture Farmers' Bulletin Number 1437 gives a growth curve for 1000 hogs. This curve is shown in Figure 18. These hogs gained more rapidly the first 100 days as compared with the Missouri data, but after this the two litters of the sows in Groups IV and VII made the more rapid gains.

SUMMARY AND CONCLUSIONS

This report has to do with the records on 60 sows and their litters. These sows were divided into seven groups, some were bred when immature, others not till the sows were half-mature, or mature. Three groups of early bred sows were fed on high, medium, and low planes of[8] nutrition. The sows were carried under similar conditions generation after generation. There were sixteen generations of the early bred group.

Sows representing the eleventh to the sixteenth generations of continued early breeding, all well fed, made the fastest growth and attained the greatest size of all the groups.*

Breeding a sow to farrow her first litter when she was eleven months old did not interfere with the mature weight of the sows as judged by comparison with sows handled similarly except bred later. However, withholding the feed did have a marked influence, on the weight curve, delaying mature weight indefinitely.

Differences between the growth of sows bred first when a year and a half old and those bred first at two years were slight or negligible.

When all sixteen generations of the well-fed, immature bred sows were considered, they were only slightly smaller at 20 months of age than the later bred sows. They grew ultimately to a greater size than later bred sows, the latter being fully grown at 35-45 months, the former continued to grow till 80-90 months.

The degree of fatness of a sow had a marked influence on body measurements, especially heart girth, width of loin, depth of chest, and height at withers.

There is some evidence that the immature bred sows maintained on the low plane of nutrition were retarded in growth but that there was no real inhibition in skeletal development.

Pregnancy did not retard nor accelerate growth.

The average period of gestation was 113.5 days, 91.8 per cent of all periods were 111 to 116 days in length. Gilts and sows carried their pigs about the same length of time. Neither size of litter nor the plane of nutrition seemed to affect the length of the gestation period.

*See footnote, page 29.

Lactation was a drain on rapidly growing sows and probably accounted for a difference in height at withers at the age of 18 months of 10 centimeters where the sows were liberally fed. The growth of lactating sows on limited feed was retarded and the attainment of mature size postponed indefinitely. There was a difference in favor of liberally fed sows of 12 to 17 centimeters in height at withers.

Well fed sows suckling small litters gained in weight throughout the lactation period. Sows suckling 7 pigs or more lost weight rapidly each week of lactation and did not begin to gain till the third week after weaning, and the better fed the sows were the greater the losses. Losses during the second half of lactation were about two-thirds of those during the first half.

Generous feeding to sows losing weight rapidly while suckling large litters produced the largest pigs at weaning.

The condition of the sow at farrowing time and the amount of feed consumed during lactation influenced greatly the growth of the pigs.

First litter pigs weighed less at weaning than those of later litters.

Where the lactating sow was well fed the pigs were eating almost a pound per head per day more grain at weaning than the pigs suckling the poorly fed sow.

The additional 17 days that were required to finish pigs that had suckled a sow on the low plane of nutrition can be laid to the treatment given during the suckling period.

Of all pigs farrowed 51 per cent were males, and 55 per cent of all pigs born dead were males. Males weighed .09 pound heavier at birth than females.

The plane of nutrition of the sows affected the birth weights of the pigs.

Dead pigs weighed less than live pigs. In litters of six pigs or less the average birth weight was 2.40 to 2.68 pounds per pig, and in larger litters 2.05 to 2.41 pounds.

There was a definite relationship between the weight of the sow and the proportionate weight of the litter at birth, that is, the smaller the sow the greater was the proportionate birth weight of the litter. The birth weight of the litter ranged from 5 per cent of the sow's weight for sows over 400 pounds to 7.11 per cent for sows under 200 pounds.

The lowest feed consumption for the latter half of gestation was associated with the lowest gains in weight during the period and with the lowest litter weights. The sow's loss in weight at parturition was greater for the better fed sows.

The data do not indicate that the gains made by sows the two weeks prior to breeding had much influence on the size of the litter (within limits). There is a very definite correlation indicated between the gains

made the month following breeding and the number of pigs farrowed. Attention is drawn to the high prenatal death rate in pigs and that size of litters in swine can be more properly controlled by care of the sow after breeding more particularly than before breeding (or in the flushing period).

January was the most unsatisfactory month in which to have sows farrow, and February was bad too if the sows had not been reasonably well fed.

Post morten data indicate that the gilt maintained on the low plane of nutrition was not only retarded in growth of body but in the development of her genital organs as well, so much so that sexual maturity was postponed till the animal was 11-12 months old.

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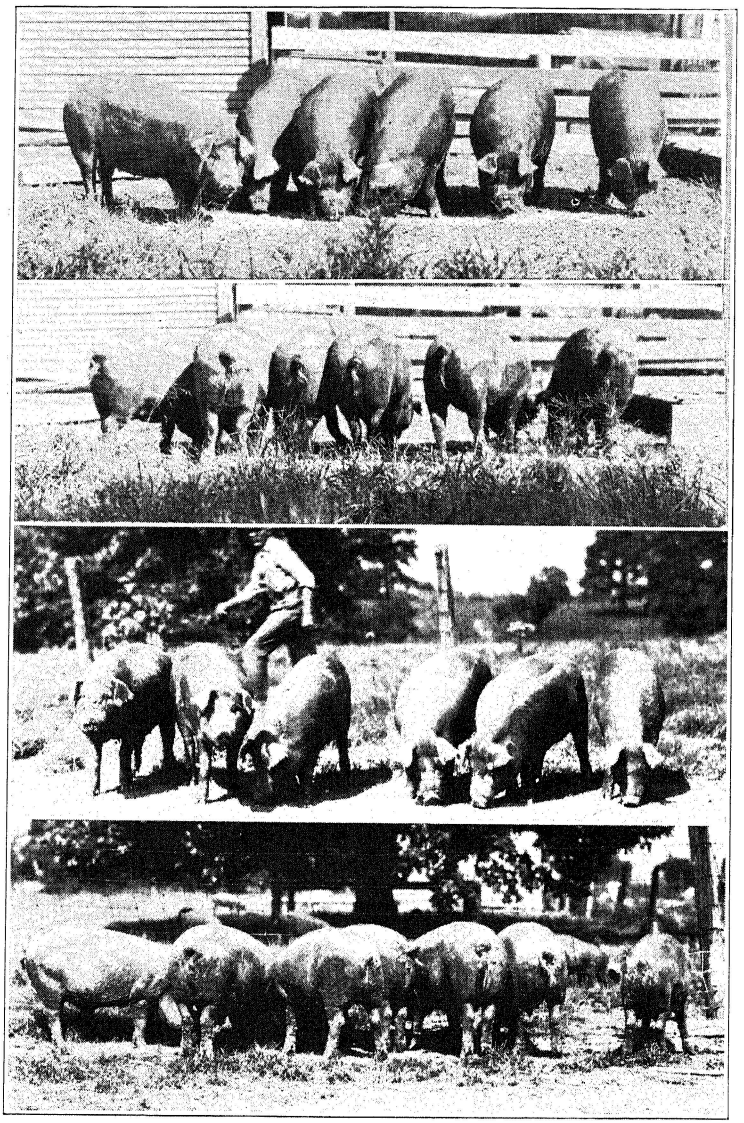

Fig. 19.—Two upper views: Litters of Group IV Sow (F. 150) at 227 days, Average Weight 254 Pounds. Two lower views: Litter of Group VII Sow (4th 96) at 225 days, Average Weight 216 Pounds. (See Table 17).

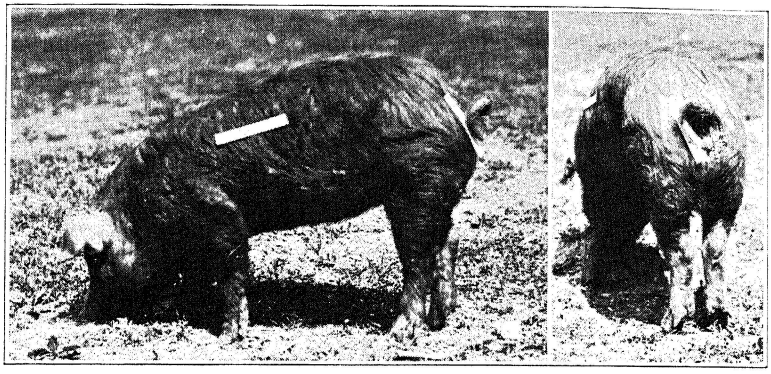

Fig. 20.—Gilt 51, at 8 Months 18 Days, just Before She Was Killed. Note the 15-centimeter ruler glued to her hip and side. (See Table 24).

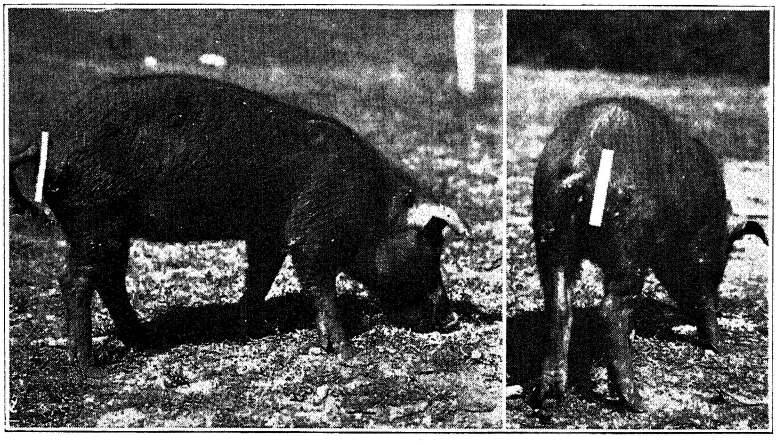

Fig. 21.—Gilt 63, at 13 Months 17 Days, Just Before She was Killed. Note the 15-centimeter ruler on her hip. (See Table 24).

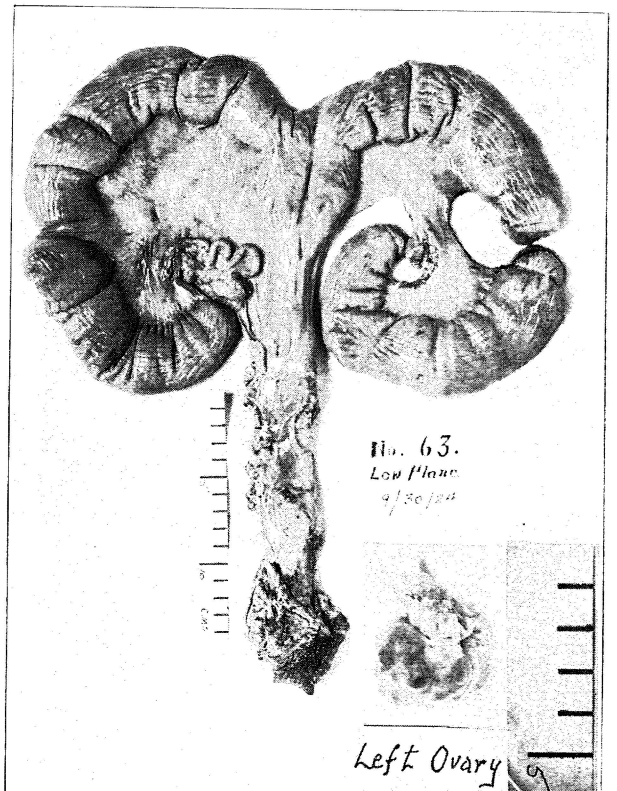

Fig. 23.—Genitalia of Gilt No. 63 (Group VII). A section has been removed from the right horn of the uterus for histological study. The gilt had experienced only two heat periods prior to death. The left ovary is shown, .57 of actual size. (See Table 24.)

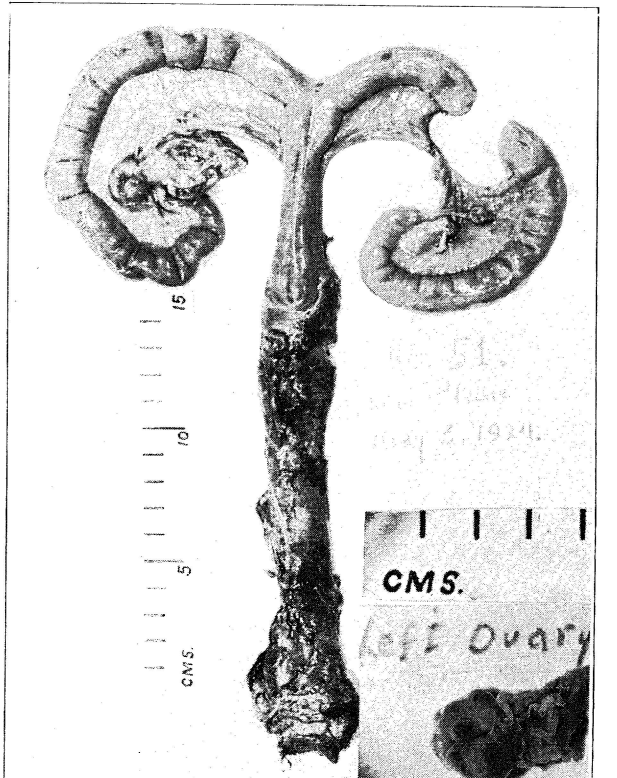

Fig. 22.—Genitalia of Gilt No. 51 (Group VII). Note the smaller size of these organs as compared with those of Gilt No. 63 in Figure 23. A section has been removed from the right horn of the uterus for histological study. The left ovary is shown, seven-tenths actual size. This gilt has never been in heat, the ovaries containing no corpora lutea. (See Table 24.)

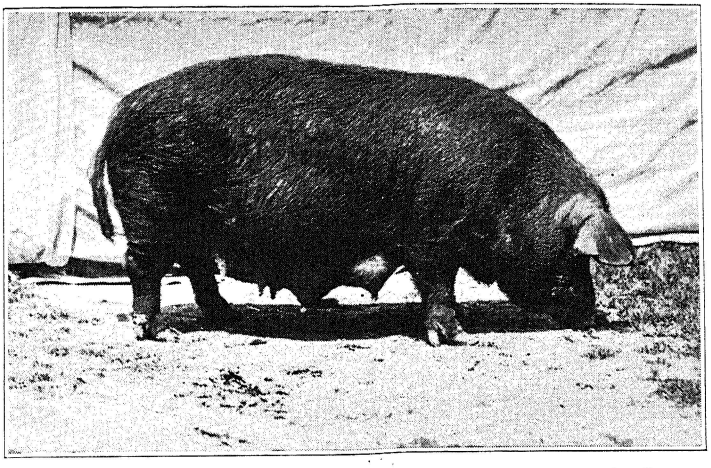

Fig. 24.—Group I Sow (F. 8) a Foundation Sow of This Group. At 4 years 8 months, 16 days, bred first at 976 days. Farrowed 29 pigs in 4 litters and is suckling her fourth litter, which will make 17 pigs (total) weaned.

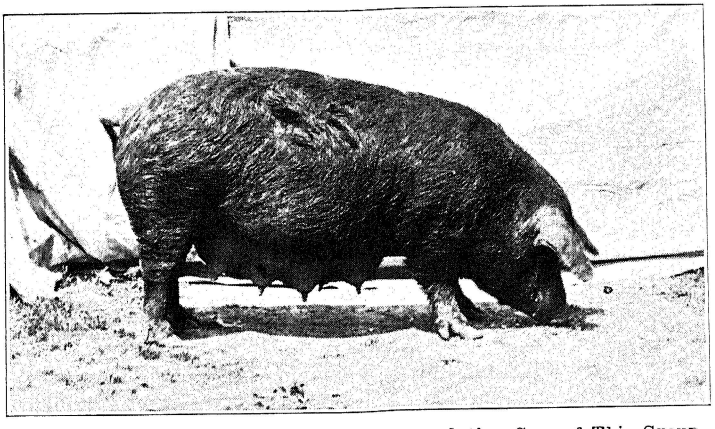

Fig. 25.—Group III Sow (F. 6) a Foundation Sow of This Group. At 4 years 8 months, 16 days; bred first at 4 months, 21 days and again at 5 months, 5 days to farrow first litter at 8 months, 29 days. Has farrowed 65 pigs in 8 litters and raised 49 pigs.

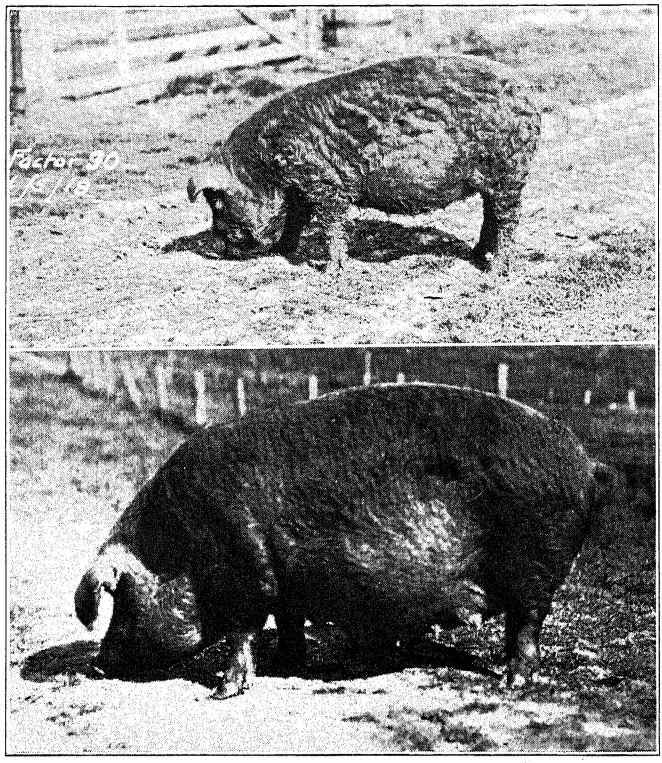

Fig. 26.—Group III Sow (F. 90) a Ninth Generation Sow. At 8 months, 4 days (pregnant a month) weight 212 pounds, and the same sow at 4 years, 2 months weighing 539 pounds. Has farrowed 6 litters of 70 pigs, and weaned 54 pigs.

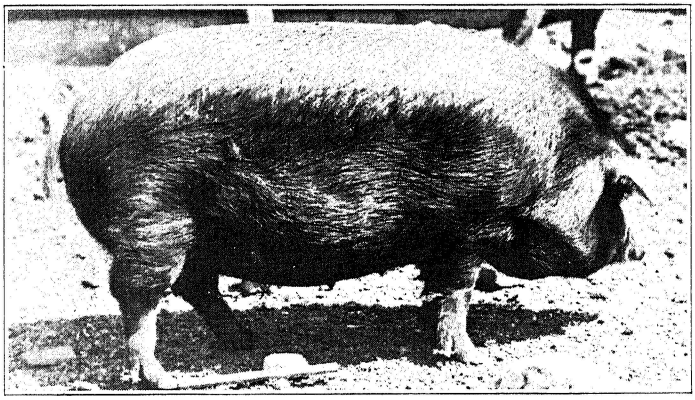

Fig. 27.—Group IV Sow (F. 160). A sixteenth-generation sow, bred when immature. Age, 1 year 10 months 10 days. The biggest sow at two years of age produced in the experiment.

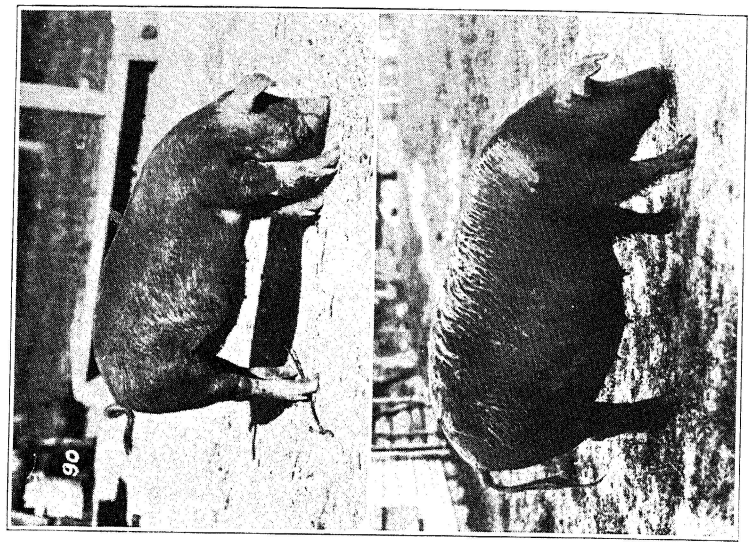

Fig. 29.—Group VI Sow (S-f. 90). At 7 months, 25 days, and again at 2 years, 4 months, 26 days.

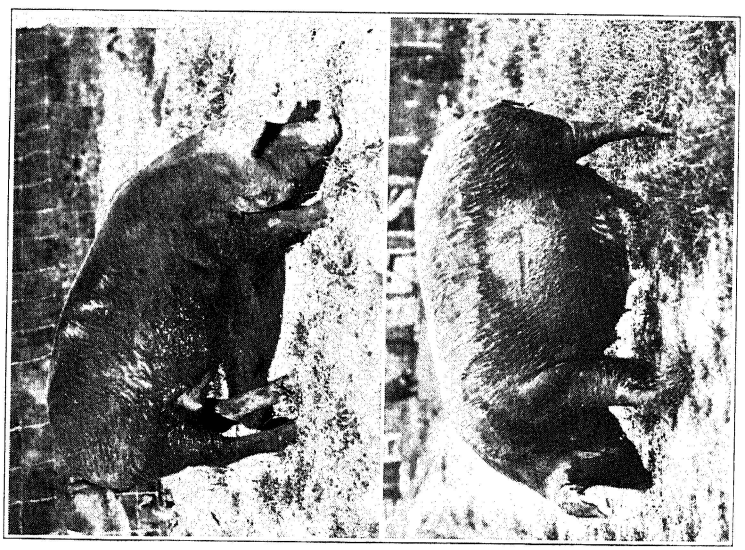

Fig. 28.—Group V Sow (S-f. 91). At 7 months 25 days and at 2 years, 14 months, 25 days.

Fig. 30.—Group VII Sows (2nd 94 left and 2nd 96 right). At seven months, and again at 2 years 4½ months

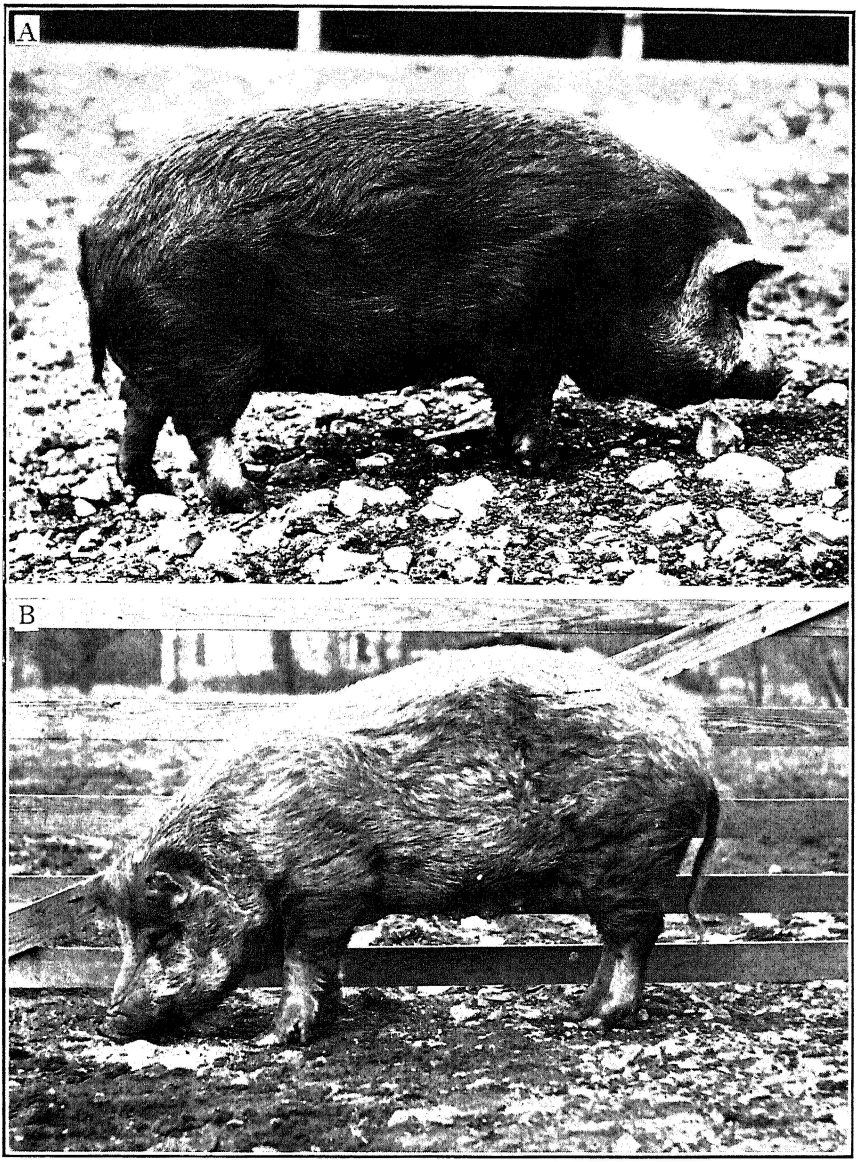

Fig. 31.—Group VI Sow (4th 90). (A). After fattening to 553 pounds, 78.4 cm. at height of withers, 1½ months before reaching the maximum of 562 pounds. (B). After being reduced to 315 pounds and 71.0 cm. at height of withers. (See Table 7).

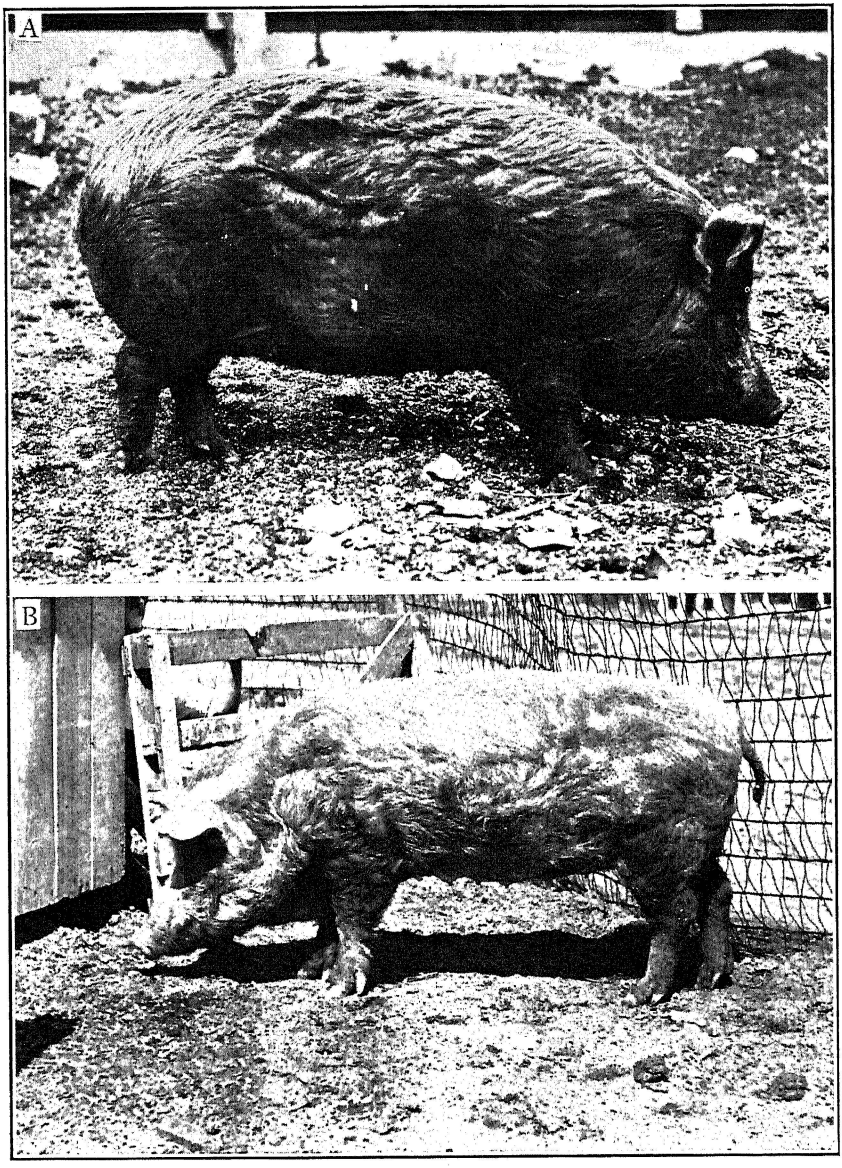

Fig. 32.—Group VII Sow (3rd 94). (A). After fattening to 577 pounds, 79.7 cm. at height of withers. Photograph taken 2 months before maximum of 623 pounds was reached. (B). After being reduced to 297 pounds, and 71.9 cm. at height of withers. (See Table 7.)