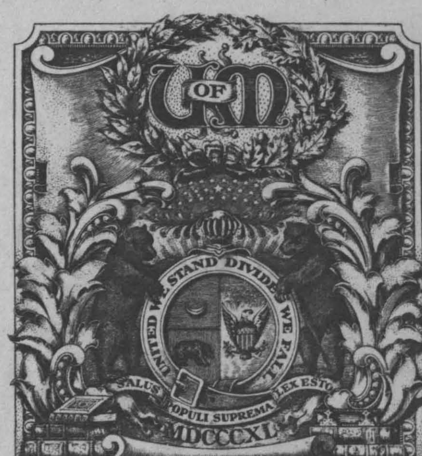

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Department of Animal Husbandry
Office of E. A. Trowbridge

AGE A S A FACTOR IN ANIMAL BREEDING

by

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GROWTH

Chapter 1.

A study of the effects of continued early breeding must necessarily be closely linked with the phenomena of growth. Different investigators have tried to define growth. As a result there are many definitions similar in some respects; yet differing in details and in regard to those external factors which are taken as indexes of growth. The views of only a few of the most prominent students of the problem will be taken up and discussed at this point.

Pfeffer[1] says, "That in general all formative processes which lead to a permanent change in form are to be regarded as growth." Huxley[1] has called growth an increase in size. Sachs[2] defines it as an increase in volume intimately bound up with change of form. Vines[2] says, "By growth we mean permanent change of form accompanied by an increase in bulk." Burlingham and Gillette[3] define growth as being the sum of the changes through which an animal must pass in its progress to maturity.

Thus we see the word "growth" bearing the ideas of increase of volume and differentiation, then of differentiation alone, and finally of increase in volume alone. Most authorities agree that the addition of material is the essential feature of growth. Increase in size may occur without appreciable change in form and change in form may occur without a marked increase in size. A study of

the various definitions leads to the belief that Mendel was probably right when he said, "There is no satisfactory definition of growth and it is probably impossible to define it."

To say that growth consists in permanent increase in volume or change of form, is to ignore entirely the phenomena of reduction so common in the lower forms of animal life, and yet appearing to some extent in all forms. The term growth has been used in so broad a sense that the many definitions are readily explainable when it is considered that some investigators may not differentiate between growth, regeneration, recuperation and other kindred terms. Each of these terms are related, yet cover distinct processes in the life of an individual animal. Growth as understood in the lower forms of life cannot be applied to the higher forms, and to our farm animals. In the latter it is understood that, "Growth is the result of an inherent impulse, which when combined with suitable external factors, usually manifests itself in an increase in stature, volume and weight".

Kinds of Growth.

Growth has been classified in several different ways, one classification is as follows:

(1) Passive growth - due to the imbibition of water.

(2) Active growth - resulting from the building up of the body tissues.

Growth may also be divided as to its permanency:

(1) Transitory - An enlarged organ may return to nor-

mal size.

(2) Permanent or developmental growth - a persisting enlargement.

Growth may be classified according to its distribution:

(1) Diffused growth - involving the entire individual.

(2) Localized - as in the case of tumors.

Processes of Growth.

Although growth is seen at every turn yet little is known regarding the processes involved. The impulse to grow is an inherent characteristic of all forms of life. The growth processes begin upon the fertilization of the egg by the sperm and continue as long as anabolism exceeds katabolism.

Davenport[2] says, "Organisms are composed of living matter and formed substance, and that growth may therefore result from the increased volume of either of these. The living matter in turn is composed of two principal substances, plasma and enchylema or cell sap, so growth may be due to the increase of either of these substances. It may result either from assimilation of more strictly from the excess of the constructive over the excretory processes of the plasma or the excreting of water."

In a general way, there are two distinct sources from which growth receives its impetus, the internal factor largely hereditary and the external factor, involving the environment and the food supply. The hereditary factor fixes

the final size that may be attained. The part which nutrition plays is secondary. "Nutrition,which is often looked[5] upon as a controlling factor,can do no more than give free scope to the inherent tendency to grow."

Mendel[5] says, "All growth, whether of the cells or the tissues or the organs is the result of no more than three processes, viz. multiplication of the cells, enlargement of the cells, and the deposition of intercellular substance, the first being the most potent of all".

The increase in the number of cells takes place to the largest extent during the development of the embryo. The increase in the size of the cells and the laying down of intercellular substances reaches its height in later life.

From observations on the gasteroped, Wilson[6] conclude that the body size may depend upon the total number of the cells rather than upon the size of the individual cells, and also that the same seems to be the case in plants. Just as periods of slow growth follow more rapid growth, so may pauses follow periods of rapid cell division.

Marshall[7] says, "Growth, like reproduction, involves cell division. As a mass of living substance increases the cells must multiply; for every cell has assigned to it a limit beyond which it cannot pass. Cell division goes on, though with gradually decreasing freqency throughout practically the whole of life; tissue formation continues, but from an early period of development onward, there is a progressive diminuation in the power of growth". The relation of the final size of the animal to the number and size of the cells is one of

long dispute. This relation probably differs for unlike species. The fact that ultimate size in the lower forms is related to the number of the cells will not hold for the higher forms where there are more complex factors such as the laying down of intercellular substances.

NORMAL GROWTH.

A study of the effect of an external factor on growth involves a knowledge of the normal growth of the individual. Growth by no means takes place in a regular curve. Environmental factors and hereditary characteristics cause the curve to fluctuate. It seems that in the life of the individual there are periods when growth is fairly rapid and such periods are usually followed by a marked decline in the rate of growth.

Minot[8] has calculated that over ninety eight per cent of the original growth power of the rabbit or the chick has been lost by the time of birth or hatching. The same has also been found true of man. Jackson[9] has found the maximum rate of growth of the human foetus to occur during the first month of intra uterine life. He has defined relative growth as the ratio of the gain during a given period to the weight at the beginning of that period. On this basis the ovum increases more than 10,000 times during the first month while the relative growth rate for the remainder of foetal life is expressed by the figures 74, 11, 1.75, .82, .67, .50, .47, .45.

Normal growth curves can be prepared only for given species and then only when a large number of observation are taken under given conditions. Normal growth curves have been established for different animals. C. H. Eckles of the Missouri Station has carried on work along this line for dairy cattle, while McCollum and others have plotted growth curves for rats. Such curves are merely graphic representations of periodic measurements of the continuous changes taking place within the animals. Of course such a curve may not correspond with a similar set of measurements taken for a single individu ual, yet it serves as an index of what is to be expected for an average of that specie when placed under certain conditions. The writer knows of no reliable growth curve for swine (10) McCollum has used such a curve; but the scarcity of data regarding the way in which this particular curve was obtained makes it almost worthless for comparison.

Limitations of Growth.

(4) Mendel says, "Variations in the growth of different individuals are for the most part inborn - inherited fundamental characteristics of the individual ------ nutrition which is often looked upon as the controlling factor can do no more than give free scope to the inherent tendency to grow". To quote from (11) Minot, "When the cell is in the young state it can grow rapidly; it can multiply freely; when it is in the old state it loses those capacities and its growth and multiplication are correspondingly impeded, and if the organization is

carried to an extreme the growth and multiplication of the cell cease altogether."

The answer seems to be a little more complicated than considered by Minot.[11] The growth of animals may be suppressed for long periods of time without limiting the size that the animal may attain when placed on a normal diet. As early as 1596 the tendency for the growth impulse to die out was observed and the fact still goes without adequate explanation. In speaking of this growth tendency Mendel[5] says, "What determines the limit is unknown, but the cause is perhaps in some way connected with the geometric principle that the volume of the cell increases as the cube of its diameter, whereas the surface by which it absorbs increases only as the sqmare of its diameter. Since activity is a function of the surface the larger the unit the smaller must be its activity. An organism can only attain a large size on this basis, by a multiplication of units, each presenting the same amount of surface as an individual organism, though it may be exposed to an internal rather than an external medium."

The cessation of growth may be correlated with the establishment of an equilibrium according to definite chemical laws. Kellicott[12] writes: "It seems quite likely that in organisms in general the normal growth of each tissue or organ is controlled separately by a specific internal secretion. These substances may regulate growth either through inhibition or acceleration and the effect produced may be due either to the presence or the withdrawal of the specific substance". Here we have another theory to account for the

cessation of growth, namely, the final triumph of the secretions of inhibition over those of acceleration. Morgan (13) believes the cessation of growth to be due to some such inhibiting factor while Minot (11) looks upon it as the result of a differentiation of the protoplasm.

These differences of opinion serve only to show how uncertain our knowledge is at present regarding the factors which limit growth, or the causes of its cessation. The problem is so intricate and so closely related to vital body processes that the problem may still go unsolved for years to come. There is great need of continued and detailed investigation of the chemistry of growth.

Environmental Factors Influencing Growth.

It is just as impossible to cite all of the external factors influencing growth as it is to determine the internal factors that control it to so marked a degree. Food - while it can in no way be regarded as the cause of growth - yet among the factors to be considered it occupies a preeminent position. When food is given in sufficient amounts the animal stores up a reserve that may be used in times of need. Skeletal growth may continue on a maintenance or even a submaintenance ration.

The uses to which a vigorous animal puts its food are: (a) maintenance, (b) growth and (c) production of fat. The requirements for maintenance must be met before production of any kind can occur. Waters (14) found an increase amounting to as much as 9 cm. in the height of a steer re-

ceiving a submaintenance ration.

The capacity to store food is necessary for maximum development under all circumstances. Without this capacity animals could not live over periods of sparse food supply; and hibernation so common during winter in some species would be impossible. Eckles (15) has found that a heavy ration resulted in a more rapid growth of the skeleton, especially while the animal was young or during the period of most rapid development. The animals receiving the lighter ration grew less rapidly, yet growth continued longer. The light fed group never quite reached the size of those receiving the heavier ration while young.

Morgan (13) says: "Not only the amount but the kind of food has an influence on growth". He carried on experiments in which he found that tadpoles fed on beef grew three times as fast as when fed on plant food. Lawes (16) and Gilbert have shown that growth increased proportionately to the amount of nitrogen in the food. With the idea in mind that the kind of food exerts an influence on the rate of of growth a brief discussion of proteins, carbohydrates and fats will be given here.

The term protein comes into its fullest meaning when the quality of the proteins is also considered. It is comparatively simple to secure the proper quantity of protein for rations; yet only when the variety of proteins which furnish the ammino acids needed in growth are brought together will the best results be secured from the ration.

Investigations in recent years by Hart and McCollum and Mendel and Osborne have thrown some light upon the importance of the different amino acids in growth. Most of the experiments have been carried on with rats; however, in later years farm animals havé been used. It will be interesting to see whether or not the results obtained with rats will also apply to the higher animals.

(17) Osborne and Mendel carried on experiments in which thy found that the amount of lysine and tryptophane in the ration may become the limiting factor for growth. They also established the fact that tryptophane was indispensable for maintenance and lysine for growth. Zein in corn fails to maintain animals adequately or to promote growth. When one fourth lactalbumin was added the curve of growth was almost normal. Cystein and a small amount of arginine have also been found to be necessary for growth.

(18) McCollum, when working with swine, found that milk proteins were superior to others for the production of growth. The pigs stored in their bodies over 60% of the protein when derived from this source. Proteins of the cereal grains had an efficiency of only 23.28 per cent, while those of linseed meal when fed alone were only 18 per cent efficient. However, when three fourths of the protein in the ration came from the corn and one fourth came from the linseed meal the efficiency was raised to 37 per cent. This may indicate that the deficiency of the protein in the one may balance that of the other.

Matthews[18] believes that glycine which is essential for growth can be synthesized in the animal body. McCollum[19] found, "that the rate of nitrogen retention in all cases where a sufficiently high plane of protein intake was fed, was limited by the chemical makeup of the food proteins and not by the physiological capacity of the animal to grow."

VITAMINES AND TOXIC SUBSTANCES

Recent investigations have shown the so-called "vitamines" to be of equal importance with the quality of the proteins in promoting growth and for maintenance. They are as yet unidentified dietary factors of which our knowledge is limited.[19] Plants evidently have the power of synthesizing these substances; since animals draw upon the plants for these growth accessories. McCollum[20] and his associates classify vitamines into fat soluble A and water Soluble B. The former is soluble in fats and oils and the latter in water. Fat soluble A is found in milk and milk products, eggs and meats and the leaves of plants. It is not to be found in extracted plant oils and fats such as those derived from linseed, corn and wheat. The water soluble B has its most common source in vegetable food stuffs as well as in meat and eggs and milk. It is not present in starches and sugars or in the plant fats.

With regard to the function of the vitamines very little is known. Some investigators have associated them with some unknown influence on the ductless glands. This

association has probably come about owing to the atrophy so noticeable in deficiency diseases and a marked recovery of the glands when vitamines are included in the food.

Toxic sbstances bear a direct relation to growth. Hart and McCollum[21], in feeding rations to heifers balanced from restricted resources, found that the animals fed a ration balanced from the wheat plant alone not only did not make a normal growth but showed all the symptoms of malnutrition, and failed to give birth to normal calves. This was later ascribed to the toxic effect of the wheat ration.

A consideration of the relation of carbohydrates to growth shows that they are the one great source of body heat and energy; and are therefore indispensable for growth. Experimental evidence is plentiful along the lines of the importance of carbohydrates in the ration; but it has not been determined which of the sugars are essential for growth and which are not.

As regards the importance of fats, Mendel[5] says; "A study of the role of fats and lipoids has given more conclusive results than in the case of the sugars. Owing to experimental difficulties it has so far been impossible to determine conclusively whether the true fats are essential requirements for maintenance of the healthy organism.------- The addition of the extracted fats and in some cases of the other fats usually initiated growth in the animals. But in the light of more recent observations these findings may be interpreted upon an entirely different basis--that of thelack

of vitamines in the food."

THE USE OF FOOD AND ITS RELATION TO GROWTH

Lusk (22) states that, "A definite percentage of the energy content of the food is retained for growth irrespective of the size of the individual." This has been calculated to be 34 percent for all of the mammals with the exception of man, only 5 per cent being retained in the latter case. Other authorities, however, have doubted the justification for establishing such a law.

Waters (14) has concluded that an animal may make a normal growth:

1. By growing steadily from birth to maturity as with an ample and uniform food supply.

2. By storing fat in a period of abundant food supply to assist in tiding over a limited period of sparse food supply without serious interruption of growth.

3. By prolonging the growth period.

4. By an increase in the rate of growth in a period of low nourishment and low gains. In other words, an animal that is below normal in size at a given age through poor nourishment apparently has the capacity when liberally fed to compensate for this loss in a measure at least, by an increased rate of gain.

5. By conserving the cost. Apparently the animal when kept for a long period of time on a low nutritive plane gets on a more economical basis than when liberally fed. Thus a ration that was insufficient to sustain live weight at first may later be capable of maintaining the animal at a stationary body weight and still later of causing an increase in weight

(23) Osborne and Mendel, in experimenting with rats in which maturity is generally reached at 300 days, when a normal ration is fed, found that a resumption and completion of growth were readily obtained at as late an age as of 550 days. From such experiments as these where growth has been retarded for long periods it seems reasonable to ask whether or not the capacity to grow is ever lost without being given an opportunity to manifest itself.

Growth is more than a mere energy problem. Insufficiency of food and individual food stuffs may be associated with certain problems in growth, yet these are at the best only external factors which are comparatively easy to explain as compared to the intricate internal factors, which are really the controlling agencies.

MINERALS

The importance of mineral elements in the ration is nearly always underemphasized. The mineral elements are absolutely essential in the animal body, as they control life processes. In the cells they are electrolytically active and will conduct a charge of electricity through the body. They are present in the bones, tissues and all of the liquids of the body.

Calcium is the most abundant with phosphorus second while the other minerals K, Na, Mg, Fe, S, Cl, and Si are found in lesser quantities. A large percent of the bones are made up of calcium compounded with phosphorus.

Calcium and sodium salts control the heart beat and are found abundantly in the blood. The power of the red blood cells to carry oxygen is due to the presence of iron in the haemoglobin. Sodium and potassium are found in the body fluids. Chlorine is found in combination with Na and K and also in the gastric juice as HCl, Iodine, Flourine and Silicon occur only in traces. Iodine is found in the thyroid,flourine in the teeth and Silicon in the hair. All too many compoundedrations have failed to consider that. Any one of the more important minerals may become the limiting factor in growth. It is a well known fact that an animal will draw on its body content to furnish minerals for the fetus or to keep constant the mineral content of the milk. All animals need a certain amount of mineral matter and in milk we find thosesalts needed by the young of that species. Especially in swine careful attention should be given to mineral matter, for their food is generally concentrated and apt to be low in minerals. A great field of investigation lies open to the one who would trace out the specific effects of the different minerals on growth.

HORMONES AND THE DUCTLESS GLANDS

The fact that the removal of certain glands exerts a marked influence on growth has led to their closer study. In some cases their removal has resulted in a

cessation of growth and frequently in death. The presence of hormones has often been cited as the means of control for certain important physiological functions.

One of the most important of these glands is the thyroid. The hypertropyhy of this gland brings about goitre and its atrophy during early years of life is the cause of cretinism. Although its complete function is not fully known, it has been associated with that of nutrition. The parathyroids lie in the vicinity of the thyroid and the function of the two may be correlated. The parathyroids probably function in the neutralization of toxic substances formed elsewhere in the body. Thyroidectomy, in which both thyroid and parathyroids are removed, has usually proven fatal, especially in carnivorous animals. Gudernatsch (24) found in feeding fresh beef thyroid to rats that large doses produced the same effects as hyperthyroidization. When the dose was so regulated as to keep the animals in good health they failed to breed.

The pituitary body consists of two lobes, anterior and posterior, each of which probably exercise separate functions. An overgrowth of the pituitary in childhood leads to gigantism, and in later life an enlargement causes an overgrowth of the bones "making a caricature of the human shape". Howell (25) says: "So far as our knowledge goes, the anterior lobe furnishes a secretion that stimulates the growth of the skeleton and possibly the connective tissues in general, and in addition exercises

some deeper influence on metabolism of an unknown but essential nature. The posterior lobe on the contrary secretes one or several hormones that have a stimulating effect on several processes ---- the tone of the plain muscle, the secretory activity of several glands and the process of glycogenolysis in the liver". It also may exert some influence on the development of the reproductive organs. Pearl (26) foünd that the feeding of pituitary substance to poultry did not affect the egg production either favorably or unfavorably.

The thymus gland is probably associated with growth, although nothing definite can be said as to its functions. Paton (27) found the thymus to be very closely associated with the testes, and that the removal of one of these organs may cause a compensating growth in the other. The removal of the thymus after puberty produced no evil effects, since it normally atrophies after this period.

The adrenal bodies are closely linked with the life processes, death following their removal in two or three days. The function of the pineal body is not well understood. It probably exerts an inhibitory influence over the reproductive organs.

Recent work indicates quite clearly that the reproductive glands control the development of the sexual characteristics through internal secretions in the blood stream. The sexual glands may also exert an influence over

body metabolism. The effect of castration and spaying are known to every stockman. Howell (25) cites an experiment where ovaries were transplanted to a castrated male, whereupon the male took on feminine characteristics. The growth of the horns in horned breeds of sheep has been found to cease immediately following castration.

OTHER FACTORS INFLUENCING GROWTH

The quantity of water taken into the body may become the limiting factor in growth. When growth is most rapid the body content of water is at the highest and there is a gradual decline in the amount of water and an increase in dry matter as the animal grows older.

Temperature is known to have some effect on the final size of the animal. For example, speies taken from a warm climate to a cold will not reach normal size. With our farm animals the temperature variesfrom the point where most of the food is used for body heat to the summer temperature which is so suitable for growth.

It is doubtful if such things as pressure, light gravity and electricity exert much influence on the growth of our farm animals. There arecertain stimulants which are supposed to incite or inhibit growth. Some writers have claimed that lecithin promotes grwth when injected intravenously. Robertson (28) found, on the other hand, a slight inhibition due to lecithin taken through the mouth.

Hatai[29] found that white rats which received lecithin by either injection or mouth gained in weight more rapidly than those which did not receive it.

SEX AND GROWTH

Minot[8] says, "At birth the male is slightly heavier than the female, 70.8 grams against 70.1 grams; but theefemale immediately makes a marked gain, owing to its having a less post natal retardation than the male." Robertson[30] concludes, "that post natal retardation is suffered by both males and females. However, subsequent compensatory acceleration is more pronounced in the case of the female than the male". Minot[8] mentions, further, "that it is not until the 29th day that the male, weighing 203.8 grams, catches up with the female, weighing 203.7 grams. After the end of the first month to the end of the first year the males are at every age heavier than the females". This difference is weight during growth is not so pronounced in farm animals, although at maturity the male is normally heavier than the female. Pregnancy and lactation and their effect on growth will be taken uplater, as they form a part of the major problem.

INDIVIDUA LITY AND GROWTH

In every experiment individuality may materially influence the growth. Two animals placed under identical

conditions may vary, both in respect to the rate of growth and the ultimate size. Such individuality is a troublesome factor in experimentation. It is only when a large number of animals are considered that fairly definite results can be obtained. The coefficient of variation is used to represent variability in animals. It is one hundred times the ratio which the standard bears to the mean.

Porter, Thomas and Boas (31) have all concluded that the variation is correlated with rapidity of growth, except in the case of newborns. Galton, (31) in 1894, found the average stature of man to be 68.2 inches. He found with brothers that the deviation was only 1.06 inches, or 63 per cent of the racial variation. Later calculations have set this figure at 87 per cent. Intra litter rats varied in body weght less than half as much as the general population. All results bring out the necessity for a careful consideration of individuality in connection with its relation to experiments on growth. In regard to his experiments on rats Minot (8) concludes: "That any irregularity in the grwwth of an individual tends to be followed by an opposite compensating irregularity and that the g variability diminishes with the age."

MEASUREMENTS OF GROWTH

Mendel (5) writes: "Insomuch as growth involves a more or lesscontinuous change, there is need of some

criterion thereof; some suitable method of ascertaining and measuring it". This is by no means as readily accomplished as might appear at the first glance. The fact that skeletal growth will take place even when the animal is losing weight has shown that body weights are not always reliable guides. However, weight hasfurnished us with the best measurement of the total body changes that the animal undergoes. Yet it gives no idea of the intricate changes that are taking place in the tissues. After the growth impulse has apparently died out, an increase in weight may take place, as in the fattening of aged steers, yet this cannot be called growth.

Weights carry with them either a positive or negative error. Positive due to the amount of food in the digestive tract and to the contents of the bladder; and negative due to minor ailments which cause b abnormal loss in weight. Burlingham and Gillette (3) have found that dairy cows may show a difference of as high as 50 pounds from day to day. This cannot be accounted for altogether by bladder and intestinal content and may be due to the amount of moisture in the cells. Conclusions based on weight alone should include considerable periods of time and numerous individuals.

The growth impulse is supposed to lie in the skeleton. Skeletal growth is not subject to fluctuation to so great an extent as body weight, and therefore is a more

accurate measurement. By taking measurements that mark the distance between skeletal prominences, a fair idea can be obtained as to the actual grwwth that has taken place.

Swett (32) says, "For satisfactory measurements of growth at least two things must be considered - weight and skeletal measurement. It is only by a consideration of these two measurements that a fairly accurate comparison of two animals can be made.

Chapter 2.

SWINE BREEDING EXPERIMENT
AT
THE MISSOURI AGRICULTURAL EXPERIMENT STATION

PLAN OF THE EXPERIMENT

The experiment furnishing the basis for this discussion was begun in 1909 by Director F. B. Mumford and has since been continued under his general direction. Swine were used in the experiment since they probably lend themselves more readily than any other type of livestock to experimental work of this nature. This investigation had for its object the determination of the effects of continued early breeding on the mother and her offspring. These effects were, of necessity, measured through variations from the normal in such characteristics as size, longevity, fecundity, prepotency and constitutional vigor.

The animals were so divided that two gilts, one from each litter, made up each of the three lots. This arrangement was adopted in order to make conditions at the outset as nearly comparable as possible. Every attempt was made to develop the gilts under normal conditions and maintain similar treatment for each lot.

One lot was bred at the time of the first heat period. A young boar of as near a the same age as possible was used. This practice was continued for the succeeding

generations, two of the offspring being bred and one re-tained as a check. The gilts in the second lot were not bred until 18 months of age. Breeding practices similar to those in the preceding lot were followed for these gilts and their offspring. The animals in the third lot were not bred until they were thirty months of age. Further treatment of this lot and later generations was the same as for those of the two previous lots.

The name "Factor" was given to the animals. Factors V and VI were the immature gilts, which were bred at the first heat period. Factors III and VII were the half-mature groupbred at 18 months of age. While Factors IV and VIII, or the mature group, consisted of those animals bred at thirty months of age. To designate the difference in treatment, the letter A was suffixed for the half mature group, while the letter B was used for the mature group.

The animals in the experiment were under critical observation at all times. Weights and measurements were taken at regular definite periods. The time of puberty was observed, complete farrowing records were kept and care-ful notes were made of any irregularities occuring throughout the experiment. Photographs of the hogs on experiment were taken from time to time, since they would serve to give further ideas of their condition.

Well recognized principles of better Swine Husbandry were followed. The hogs had the run of bluegrass

pasture and plenty of shade. Adequate housing facilities were provided for the winter months, and in later years wallows were added to the lots for summer use. The feed given was so balanced as to meet the needs of swine under such management.

The rations used from the beginning of the experiment until March 11, 1917, were as follows:

Ration No. 1 was used for sows suckling litters, and for pigs from weaning time until they reached 125 pounds.

		Dry Matter	Prot.	Carb.	Fat
Shorts	4 pounds	3.57	.536	1.848	.172
Corn	2 "	1.79	.15	1.356	.092
Bran	2 "	1.8	.25	.832	.060
Oilmeal	1 "	.90	.302	.326	.067
Total	9 pounds	8.06	1.238	4.362	.391
Nutrients per pound of feed		.895	.1375	.4846	.043

Total digestible nutrients per pound of feed - .7198

Nutritive ratio - 1 : 4.23

Ration No. II was fed to breeding animals over 150 pounds in weight on dry lot when not suckling pigs.

		Dry Matter	Prot.	Carb.	Fat
Corn	13 pounds	11.63	.975	8.814	.594
Shorts	10 "	8.93	1.340	4.620	.430
Bran	5 "	4.49	.625	2.08	.150
Alfalfa Meal	5 "	4.56	.510	1.935	.040
Total	33 pounds	29.61	3.450	17.449	1.218
Nutrients per pound of feed		.897	.1045	.5287	.0369

Total digestible nutrients per pound of feed - 7.162

Nutritive ratio - 1 : 5.88

Ration No. III - For dry sows on grass and for fattening hogs over 125 pounds in weight

		Dry Matter	Prot.	Carb.	Fat
Corn	6 pounds	5.37	.450	4.068	.276
Oil Meal	1 "	.90	.302	.326	.067
Total	7 pounds	6.27	.752	4.394	.343
Nutrients per pound of feed		.895	.107	.628	.049

Total digestible nutrients per pound of feed - .845

Nutritive ratio - 1 : 6.9

From March 11, 1917, the following rations were used.

Ration A - This ration was used for sows suckling pigs and for the growing pigs until 5 months old.

			Dry Matter	Prot.	Carb.	Fat
Corn	5	pounds	4.475	.375	3.39	.23
Shorts	2.5	"	2.24	.335	1.155	.107
Bran	1.5	"	1.34	.187	.624	.045
Tankage	1	"	.926	.587	-----	.126
Total	10	pounds	7.891	1.474	5.169	.508
Nutrients per pound of feed			.7891	.1474	.5169	.0508

Total digestible nutrients per pound of feed - .779

Nutritive ratio - 1 : 4.3

Ration B - This ration was used for fattening pigs over five months of age, and for dry sows on grass.

			Dry Matter	Prot.	Carb.	Fat
Corn	8	pounds	7.16	.6	5.424	.368
Shorts	2	"	1.792	.268	.924	.086
Tankage	1	"	.926	.587	----	.126
Total	11	pounds	9.878	1.455	6.348	.580
Nutrients per pound of feed			.898	.1322	.577	.0527

Total digestible nutrients per pound of feed - .8277

Nutritive ratio - 1 : 5.26

Ration C - This ration was used for dry sows not on pasture.

			Dry Matter	Prot.	Carb.	Fat
Corn	5	pounds	4.475	.375	3.39	.23
Shorts	2	"	1.792	.268	.924	.086
Bran	2.5	"	2.247	.312	.104	.075
Tankage	.5	"	.463	.293	----	.063
Total	10	pounds	8.977	1.248	4.418	.454
Nutrients per pound of feed			.897	.1248	.4418	.0454

Total digestible nutrients per pound of feed - .66875

Nutritive ratio - 1 : 4.35

The animals were fed liberally so that feed would not be the limiting factor in growth. After lactation the feed of the sow was increased so that she might recover the weight lost while suckling a litter. Careful records of feed consumed were taken and the hogs were weighed at the end of each week. The pigs were weaned at eight weeks of age and were fed until they reached the weight of 250 pounds.

A system of measurements was used whereby the actual skeletal growth of the animals could be compared. The original factors were measured every month until one year of age, and every three months thereafter. The litters were measured when they reached 125 pounds, and again when they were removed from the experiment. In order to have a basis of comparison for the factors in the different groups,

the following series of measurements were taken: height at withers, height at croup, width of shoulders, width at shoulder points, width of hams, width at ham points, depth of chest, length of body, girths at heart, paunch and flanks, circumference of shin and shank bones, distance from elbow to ground and the distance from shoulder point to the ground. All measurements were taken in centimeters by means of a tape, calipers and a measuring standard.

Of the series of measurements given abovem the height at withers, depth of chest, length of body and the circumference of the shin and the shank bones were probably the most accurate, since they are least affected by the condition of the animal and are the least subject to error due to a changes in position while the measurements were being taken.

Furthermore, these measurements are excellent indices of growth as has been shown by the work of Swett (31) in which he says: "The constancy of the relation of increases to the height at withers, the height at hip points, length of body and heart girth have led, on the whole, to the assumption that any of the fundamental measurements may be used with a fair degree of accuracy as an index of growth".

Chapter 3.

PREGNANCY

A study of the effects of early breeding must of necessity include a knowledge of the reproductive functions performed by the mother and the changes that take place in the maternal organism at those times. The nutrition of the fetus and the part played by the mother in fetal development have beencarefully investigated. The exact relation between the carrying of young and the body growth of the mother during pregnancy has not as yet been established.

Howell[25] says, "At the time of fertilization the ovum contains a small amount of nutriment in its cytoplasm. The amount, however, in the mammalian ovum is small and suffices probably only for the initial stages of growth. When the ovum becomes implanted in the decidual membrane of the uterus the new material for growth must be absorbed directly from the maternal blood of the uterus. Within a short time, however, the chorionic villi begin to burrow into the uterus membrane at the point of attachment, the decidua serotina, and the placenta gradually forms as a definite organ for the control of fetal nutrition. ---- For the purpose of understanding its general functions, it is sufficient to recall that the placenta consists essentially of vascular chorionic papillae from the fetus bathed in large blood spaces in the decidual membrane of the mother. The fetal and the maternal blood do not come into actual contact;

they are separated from each other by the walls of the fetal blood vessels and the epithelial layers of the chorionic villi, but an active diffusion relation is set up between them. Nutritive material, protein, fat and carbohydrates and oxygen pass from the maternal to the fetal blood, and the waste products of fetal metabolism - carbon dioxide, nitrogenous wastes, etc. - pass from the fetal to the maternal tissues. The nutrition of thefetal tissues is maintained, in fact, in much the same way as though it were an actual part of the maternal organism. That material passes from the maternal to the fetal blood is a necessary inference from the growth of the fetus. The fact has also been demonstrated repeatedly by direct experiment."

Marshall (7) states three theories which are an attempt to explain how fetal nutrition takes place.

1. The mechanical theory - which holds that all the processes occuring in the placenta are possible by the laws of filtration and osmosis.

2. Still others hold that it is not possible for haemoglobin to pass through in such a simple way. They hold that there is a vital action on the part of the cells, whereby the synctium selects the necessary material and alters it to a form capable of being transmitted to the fetal circulation.

3. A third theory seeks to explain the nutrition of the

fetus by a direct transmission of internal food-carrying leucocytes from the mother to the circulation of the fetus. This idea, however, meets a strong refutation in the fact that in many cases of leucocythaemia where the mother gave a high count of leucocytes the fetus failed to show any increase in this kind of blood cells.

FETAL NUTRITION

These theories neglect the possibility of the fetus itself elaborating some of its own material; and the question naturally arises as to whether or not the developing fetus may play some part in the preparation of the nutritive materials. Howell (25) states, "In general, it is evident that for a long period the maternal organism digests and prepares the food for the embryo, excretes the waste, regulates the conditions of temperature, etc., as it does for a portion of its own substance, but as the fetus approaches term its tissues and its organs begin to assume more of an independent activity, as indeed must be the case in preparation for the sudden change at birth".

Marshall (7) cites as evidence for the activity of the fetus, the fact that in the chick embryo the speial proteins and other tissue elements are not pre-formed but are elaborated by a series of anabolic processes which are carried b out by the ovum itself. There is no reason to believe that the mammalian ovum, after acquiring the properties of intra uterine development, has lost its metabolic activity. Marshall (7)

further says; "In addition, we possess positive evidence of metabolic activity in the mammalian ovum. The results of Bohr's e investigation on the respiratory exchange of the fetus mean nothing if they do not afford proof of this. As a large amount of energy is generated, while at the same time practically none is dissipated as heat evaporated or radiated from the surface or lungs, the unavoidable conclusion is that the fetus itself carries out the work of organization, and utilizes the energy for its fulfillment."

These theories do not explain that, in no order of mammals has the transmission of unaltered haemoglobin from the mother to the fetus been demonstrated. Even if it is absorbed as such by the trophoblast, it undergoes changes of such a nature that the iron containing part of the molecule is less firmly bound. In all mammals in which special investigations have been made, such loose organic compounds of iron have been observed. The carbohydrates undergo changes which appear to be the result of trophoblastic activity. Fats may also be transformed by the trophoblast.

Marshall (7) also remarks: "A consideration of these and similar facts lead us to believe that the new organism owes its development in large part to the energy in it and by it from the combustion of substances supplied by the mother, and to a series of active metabolic changes by means of which these substances ate transformed into living protoplasm. Whether the nutritive materials are derived from the food or

the tissues of the mother is of secondary importance. What is essential is that the fertilized ovum obtains certain organic and inorganic compounds and a supply of oxygen to carry out its work of organization, just as in the first period of extra uterine life the growth and the development of the new being progress by its own activities, so long as it is furnished with the proper materials".

Fat hasbeen found in the human fetus as early as in the second month, and according to Howell (25) begins to increase with some rapidity after the sixth month. Marshall (7) suggests it may be split up into fatty acids and glycerine before being absorbed and resynthesized by the fetal placenta. He also mentions that glycogen occurs in the placenta itself, and in all of the tissues of the embryo during the period of most active growth. It would appear, therefore, that glycogen represents one of the most important materials for the growth of the embryo, and that in the beginning, at least, the tissuesgenerally have a glycogenetic power. The sugar brought to the placenta in the maternal blood passes over into the fetal blood and the excess beyond that immediately consumed is deposited in the tissues as glycogen".

Marshall (7) describes iron as appearing in the fetus at a very early stage. Iron is stored in the liver and other fetal organs and rapidly diminishes after birth.

According to physical principles colloid substances with large molecules like protein would require a preliminary transformation before they could be taken up by the fetal ectoderm. But actual observations are against such a

statement. There is no evidence of a placental digestion of proteins before their absorption by the trophoblast. Marshall(7) says: "It is probable that the normal proteins of the serum are also transformed by the trophoblast into a form suitable for the fetus. The exact nature of the transformation is unknown, but it is not comparable with the hydrolytic processes which occur in the intestine".

CHANGES IN THE MATERNAL ORGANISM

Probably the two most distinct changes resulting are the growth of the uterus and the development of the mammary glands. The agencies bringing about these and other changes in the maternal body due to pregnancy, are as yet unknown. Marshall(7) concludes that these changes are brought about by "chemical stimuli" or hormones, which probably arise from the Corpus Luteum. This organ has been found necessary for the progress of pregnancy in at least the early stages.

Regardless as to whether or not the mother prepares the food for the fetus, it is quite certain that she must furnish it and build up an organ of nutrition for the new born young. Does such action on the part of the mother cause a depletion of her own tissues? Marshall(7) states that: "in insufficient nutrition the mother certainly gives up organized tissue products, and, even with a plentiful diet, a period is usually observed during which the mother must draw on her own tissues to account for the loss of nitrogen.

On the other hand, it is also probable that unorganized substances are utilized by the trophoblast, since variations in diet are apparently capable of producing changes in the fetus. To illustrate, cows given a ration low in calcium have been known to abort, when the animals would not react to a test for abortion.

Paton (33) found that the size of the offspring of the guinea pig depends directly upon the diet and the nutrition of the mother during pregnancy. Other investigators have obtained similar results. The nourishment of the mother's tissues may at times take precedence over the needs of the fetus. Yet it is doubtful if the size of the offspring is seriously limited unlessthe restriction of the food has been so great as to jeopardize the life of the mother.

Experimental results have led to many different opinions as to protein metabolism in the pregnant mother. This may be largely due to the fact that, in a great many cases, the quantity and not the quality of the proteins has been considered. Even on a comparatively rich protein diet, it is generally accepted that a negative balance occurs for a considerable period, that it then disappears, and is replaced by a positive balance lasting to the end of pregnancy. The growth of an animal with a negative nitrogen balance is contrary to all the cases of physiological growth that have so far been considered.

Ferroni[7] claims that the absorption of fats from the intestines is increased during pregnancy. He has shown that the end products in fat metabolism are decreased in the faeces toward the end of pregnancy. This is the time when the subcutaneous tissues of the fetus are receiving an abundant supply.

Marshall[7] says: "Little is known regarding the metabolism of the individual metals and salts. The fixation of mineral elements is slight at the beginning but becomes active toward the end of pregnancy. ----- With a few exceptions, the mineral salts are approximately in the same proportion throughout pregnancy". Kruger[34] found the iron content of the liver and spleen of the bovine fetus to be about ten times that of the mature animal. The addition of a high calcium food to a ration low in this mineral was found by Evvard[35] to give a marked increase in both the size and vigor of the pigs at birth.

At times pregnancy has been associated with an inhibition in growth and has been referred to as a drain on the mother. Still others have thought of it as furnishing an impetus to the growth of the mother. A progressive increase in weight greater than that of the fetus has also been observed. Marshall[7] states that this increase in weight is due to an increase in other parts of the maternal organism as a result of the inactivity and good dietetic conditions

during pregnancy. A review of some of the experimental wprk on pregnancy having a bearing on the problem at hand, will be taken up and discussed.

Gassner[(7)] observed a progressive increase in the weight of the mother, greater than the increase in the weight of the fetus and the generative organs together. The increase in the latter amounts to about 1.125 kilos per month. Baumm[(7)] confirmed these results by bobservations on pregnant women. He found that a diet necessary to maintain the body weight in a woman of the same size gave an increase in weight of a pregnant woman amounting on an average to 1.777 kilos, in the last month of which, .650 kilograms represented increase outside the fetus and generative organs. Zacharjewsky[(7)] observed an increase in weight running parallell to the increased weight of the fetus and the uterus.

Minot[(8)] found the average weight of 66 guinea pigs which were bred at about 90 days of age, to be 405 grams. The average weight of these same pregnant mothers just previous to delivery was found to be 830.2, while the animals not bred weighed, on the average, only 532.1 grams. Accordingly, the period of gestation seems to have added 300 grams or more to theweight of the mother. Weighings of the same 66 mothers, taken within three days after delivery, gave for 62 observations an average weight of 588 grams.

Now the corresponding weight of females not pregnant was 532.1 grams, hence there was an excess of 55.9 grams in favor of the gestating animals.

The following table will give some idea of the changes taking place in the body weight of the mothers during pregnancy.

Days before delivery	Total weight	No. of Obs.	Average	Increase	Average daily increase	Daily per cent increase
70 - 76	37891	89	425.7			
65 - 61	60302	147	410.2	-15.5	-3.1	- .7
60 - 56	51459	131	392.8	-17.4	-3.5	- .8
55 - 51	63406	143	44.1	51.3	10.3	2.6
50 - 45	68193	147	463.9	19.8	4.0	0.9
45 - 41	79725	155	514.4	50.5	10.1	2.2
40 - 36	73419	140	524.4	10.0	2.0	0.4
35 - 31	68324	127	538.0	13.6	2.7	0.5
30 - 26	76281	132	577.9	39.9	8.0	1.5
25 - 21	76654	124	618.2	40.3	8.1	1.4
20 - 16	86738	131	662.1	43.9	8.8	1.4
15 - 11	101412	143	709.2	47.1	9.4	1.4
10 - 6	92000	123	748.0	38.8	7.8	1.1
5 - 1	85969	108	796.0	48.0	9.6	1.3
3 - 0	33207	40	830.2	34.2	11.4	1.4

Minot (8) says: "So far, then, as we can judge at present, gestation does not represent a tax upon the parent but a stimulus - it does not impede growth but on the contrary favors it".

Minot used only body weight as an index of growth. There is a question as to whether body weight under such circumstances represents physiological growth.

It at least gives us no idea of the skeletal growth made by the mother. during pregnancy.

Watson (36) compared the growth made by rats performing normal reproductive functions with those not bred and found that immediately after the birth of the young, the mated rats were much heavier than the unmated ones. During pregnancy there seemed to be an accumulation and a marked increase in weight over that of the unmated rats. Watson (36) concludes that: "The group of mated rats grew to be somewhat heavier than the unmated ones. This was found to be true in four out of five groups The mated rats which had been allowed to raise three litters were, on the average, 9 per cent heavier than the unmated individuals".

At Wisconsin (34) it was found that cows practically produced the fetus and maintained their weight on the same amount of feed that they had previously used for maintenance.

Musser (37) concludes from work with cows, that there is a gradual increase in the mother's weight from the time of breeding to the latter part of the eighth month. The nutrients required to develop the fetus in dairy cows and the tax on the maternal organism are too small to be measured by changes in the mother's weight. For cases of practical feeding, when an animal is in a thrifty condition and is receiving a maintenance ration, there is little danger of having an insufficient amount of nutrients for fetal development.

Griswold (38) carried on an experiment at the Missouri Experiment Station to determine the effect of

gestation and lactation on the growth and composition of swine. Ten gilts were used, seven being bred, and three being reserved as checks. A digestion trial was run in order to compare the digestion coefficient of open, pregnant and suckling gilts.

Weights showed no particular difference between the pregnant and the open groups. Measurements seemed to favor a greater growth of the open group, but this may all have been due to individuality. The digestion g trial indicated that the digestion coefficient of the pregnant group was enough higher than that of the open group to provide the nutrients required to develop the fetus. Slaughter house date seemed to indicate that pregnancy may possibly have caused an increase in the amount of blood and a retardation of skeletal growth. The percentage composition would indicate a lowering of the per cent of ash in the skeleton more than is to be accounted for by the ash content of the litter.

(39)

A At the Missouri Experiment Station, Eckles carried on experiments to determine the nutrients required to develop the bovine fetus. In Research Bulletin 26 of that station, he presents the following material: "Results from carefully controlled experiments lead to the conclusion that the amount of nutrients necessary to develop the bovine fetus is so small that it cannot be measured by the ordinary methods of experimentation".

Four cows were kept during the entire period of gestation on a ration, found by six months trial to be only sufficient to maintain them at uniform weight when neither pregnant nor producing milk. These cows developed calves of normal size for the breed, and one cow weighed 48 pounds more after the calf was dropped than when bred, and the other weighed only 14 pounds less.

This result was confirmed by two additional cows, the feeding of which was regulated during the gestation period by the amount required to maintain a dry farrow cow at uniform weight. One of the Jersey cows developed a normal fetus while receiving during gestation a ration even less than was found necessary to maintain her weight while dry and farrow during the same months of the year.

Accmrding to the bulletin, these results may be due to one or more of three possible factors - (1) A better use of feed during gestation (2) Decreased maintenance requirement during pregnancy and (3) The small amount of dry matter in the fetus. Four Jersey calves analyzed at birth contained on an average 73.09 per cent water.

(39)
"While the data taken are not very satisfactory the indications are that the coefficient of digestibility is not changed by pregnancy.

"The data do not make it possible to conclude definitely that the maintenance of the animals is decreased

by pregnancy, but it is thought that this is probable, and could be accounted for by the animal being quieter when in this condition.

"All of the data available indicate that the weight of the calf at birth is not ordinarily influenced by the ration received by the mother during gestation. This is especially true with reference to the energy value of the ration, but may not hold good when the ration has been decidedly deficient in some constituent for a long period".

RESULTS OF THE SWINE BREEDING EXPERIMENT AT THE MISSOURI STATION

This experiment furnishes some data that should be of value in determining the effect of pregnancy on growth. Measurements of the original factors were taken every month. In such cases, it was comparatively easy to find pregnant factors that could be compared with non pregnant gilts. In the later generations where the measurements were taken less frequently, few comparisons could be made.

In preparing tables like those following, three variable factors must be kept in mind, namely, amount of feed consumed, age, and the time of year during which the periods were taken. When these were considered, the data afforded by this experiment offered few opportunities for comparisons of the gains made by pregnant and non pregnant factors. In several cases the animals were fed together, and under such circumstances the pregnant sow might consume more of the feed than the non pregnant factor.

Group I gives a comparison between the growth made by pregnant and non pregnant factors during certain periods. The idea borne in mind was to determine whether or not there was a marked stimulation or retardation of growth due to pregnancy. The treatment was fairly uniform

in every case for each of the two animals compared. When the feed was the same, no mention is made of the amount fed, the digestible nutrients were determined according to the tables given in the plan of the experiment. All weights are expressed in pounds and all measurements in centimeters.

Group I - Table I

Table Comparing Growth of Factor VI during Her First Pregnant Period with Non-Pregnant Factor VII. Age of Both 6 months, 18 days to 7 months, 29 days.

	Factor VI		Factor VII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	VI	VII	VI	VII
Weight	124	172	132	177	48	45	1.17	1.099
Height at Withers	49.5	54	50	55.5	4.5	4.5	.1099	.1099
Height at Croup	54.5	57.5	55	60.5	3.0	5.5	.0732	.1341
Breadth of Shoulders	26.5	29.5	27	29.0	3.0	2.0	.0732	.0488
Breadth at Sh. Pts.	24.0	27.5	25.5	26.0	3.5	.5	.0537	.0121
Breadth of Hams	24.0	26.0	24.5	26.0	2.0	1.5	.0488	.0366
Breadth at Hip Pts.	22.0	24.0	21.5	24.0	2.0	2.5	.0488	.0610
Heart Girth	93.0	103.0	92.0	100.0	10.0	8.0	.2439	.1951
Paunch Girth	104.0	117.0	105.0	110.0	13.0	5.0	.3171	.1217
Flank Girth	91.0	100.0	92.0	102.0	9.0	10.0	.2195	.2439
Depth of Chest	27.5	32.0	29.0	33.5	4.5	4.5	11097	.1099
Length of Body	72.0	74.0	73.0	83.0	2.0	10.0	.0488	.2439
Width of Head	11.0	11.5	10.5	11.25	.5	.75	.0122	.0183
Cir. of Shank Bone	13.5	14.5	13.0	14.5	1.0	1.5	.2439	.0366
Cir. of Shin Bone	14.0	15.0	13.5	14.5	1.0	1.0	.2439	.2439
Dist. Elbow Pt. Down	26.0	27.0	25.0	28.0	1.0	3.0	.2439	.0732
Dist. Sh. Pt. Down	27.0	29.0	26.5	29.0	2.0	2.5	.0488	.0610

Amt. of Feed Consumed Same for Both

Factor VI made the greater daily gain in body weight. The table shows little difference in skeletal growth for either of the Factors.

Periods:

Factor VI - 3/19/09 to 4/30/09.
Factor VII- 3/19/09 to 4/30/09.

Group I - Table II

Table Comparing Growth of Factor V during Her First Pregnant Period, Age 6 mo. 20 das. to 10 mo. 7 das. with Pregnant Factor VIII, Age 6 mo. 18 days to 9 mo. 9 days.

	Factor V		Factor VIII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	V	VIII	V	VIII
Weight	129	173	124	172	44	48	.556	.5783
Height at Withers	51.5	55.5	48	56	4	8	.0506	.0963
Height at Croup	57.5	61.0	55.5	62	3.5	6.5	.0443	.0783
Breadth of Shoulders	27.0	29.0	26.0	30	2.0	4.0	.0253	.0481
Breadth at Sh. Pts.	24.0	27.0	23.5	27	3.0	3.5	.0379	.0421
Breadth of Hams	24.5	27.0	24.0	28	2.5	4.0	.0316	.0481
Breadth at Hip Pts.	20.0	24.0	22.0	25	4.0	3.0	.0506	.0361
Heart Girth	91.0	103.0	90.0	100	12.0	10.0	.1518	.1204
Paunch Girth	100.0	122.0	106.0	111	22.0	5.0	.2784	.0602
Flank Girth	93.0	100.0	90.0	101	7.0	11.0	.0886	.1325
Depth of Chest	29.0	32.5	28.5	32.5	3.5	4.0	.0443	.0481
Length of Body	73.5	80.0	71.0	82.0	6.5	11.0	.0822	.1325
Width of Head	10.5	12.0	10.75	12.5	1.5	1.7	.0189	.0210
Cir. of Shank Bone	13.5	14.0	14.0	15.5	.5	1.5	.0063	.0180
Cir. of Shin Bone	14.0	14.5	14.0	15.0	.5	1.0	.0063	.0120
Dist. Elbow Pt. Down	27.0	88.0	25.0	30.0	1.0	5.0	.0126	.0602
Dist. Sh. Pt. Down	28.5	31.0	26.0	31.0	2.5	5.0	.0316	.0602

Amt. of Feed Consumed Same for Both

Factor V made slightly smaller gains in body weight and practically all measurements. This may indicate a slight retardation of growth due to pregnancy.

Periods:

Factor V - 3/22/09 to 6/9/09.
Factor VIII-3/19/09 to 6/10/09.

Group I - Table III

Table Comparing Growth of Factor III during Period of Pregnancy with Dry Factor IV. Age of Both 9 months 8 days to 11 months 19 days.

	Factor III		Factor IV		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	III	IV	III	IV
Weight	161	195	167	179	34	12	.4722	.168
Height at Withers	53	56.5	55	58	3.5	3	.0486	.0422
Height at Croup	60	65.0	62	67	5.0	5.0	.0694	.0704
Breadth of Shoulders	28.5	29.0	30	31	.5	1.0	.0069	.014
Breadth at Sh. Pts.	24.5	27.0	27	27	2.5	0.0	.0000	.0000
Breadth of Hams	26.0	28.0	28	25.5	2.0	-2.5	.0276	-.0352
Breadth at Hip Pts.	23.0	24.0	26.	24.0	1.0	-2.0	.0138	-.028
Heart Girth	100.0	105.0	103	106.0	5.0	3.0	.0486	.0422
Paunch Girth	110.0	126.0	109	111.0	16.0	2.0	.2222	.028
Flank Girth	100.0	110.0	104	105.0	10.0	1.0	.1388	.014
Depth of Chest	31.0	33.5	33	36.0	2.5	3.0	.0486	.0422
Length of Body	85.0	84.0	82	87.0	-1.0	5.0	-.0138	.0704
Width of Head	12.0	11.5	11.5	12.0	- .5	.5	-.0069	.007
Cir. of Shank Bone	14.5	14.5	15.0	15.0	0.0	0.0	.0000	.0000
Cir. of Shin Bone	14.5	14.5	14.5	16.0	0.0	1.5	.0000	.0208
Dist. Elbow Pt. Down	29.0	28.0	29.0	29.0	-1.0	0.0	-.0138	.0000
Dist. Sh. Pt. Down	31.0	30.0	31.5	31.0	-1.0	- .5	-.0138	-.007

Amt. of Feed Consumed   Same for Both

Factor III shows a greater gain in weight, height at withers, all girth measurements and depth of chest. Here pregnancy may have caused a marked increase in body weight; and at least did not retard skeletal growth.

Periods:

Factor III - 6/9/09 to 8/20/09.
Factor IV - 6/10/09 to 8/20/09.

Group I - Table IV

Table Comparing Factor VII during Pregnancy, Age 22 months 14 days, to 26 months 11 days, with Dry Factor VIII, Age 22 months 14 days to 23 months 12 days.

	Factor VII		Factor VIII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	VII	VIII	VII	VIII
Weight	355	415	348	361	60	13	.5	.4482
Height at Withers	65	69	66.5	65	4.0	- 1.5	.0333	-.0517
Height at Croup	73	76	73.5	73.5	3.0	0.0	.025	.0000
Breadth of Shoulders	41	42	40.0	38.5	1.0	-1.5	.0083	-.0517
Breadth at Sh. Pts	35	33	37.0	35.0	-2.0	-2.0	-.0166	-.0689
Breadth of Hams	37	40	37.0	35.0	3.0	-2.0	.025	-.0689
Breadth at Hip Pts.	32.5	28	33.0	31.0	-4.5	-2.0	-.0375	-.0689
Heart Girth	145.0	141	138.0	130.0	-4.0	-8.0	-.0333	-.2759
Paunch Girth	162.0	159	150.0	150.0	-3.0	0.0	-.025	.0000
Flank Girth	146.0	151	145.0	130.0	5.0	-15.0	.0417	-.517
Depth of Chest	42.5	44.	43.0	43.5	1.5	.5	.0125	.0172
Length of Body	106.0	110	107.0	110.0	4.0	3.0	.0333	.1034
Width of Head	13.5	18	14.0	15.5	4.5	1.5	.0375	.0517
Cir. of Shank Bone	16.5	19	20.0	17.0	2.5	-3.0	.0208	-.1034
Cir. of Shin Bone	16.5	19	18.5	18.0	2.5	- .5	.0208	-.0172
Dist. Elbow Pt. Down	31.5	33	34.0	37.0	1.5	3.0	.0125	.1034
Dist. Sh. Pt. Down	34.0	36	36.5	39.0	2.0	2.5	.0166	.0862
Amt. of Feed Consumed	366.3		109.74				3.05	3.78
Dig. Nutrients	263.36		78.9				2.19	2.72

Although receiving less feed Factor VII shows the greater gain in body weight. Factor VIII made the larger gain in skeletal growth.

Periods:

Factor VII - 7/15/10 to 11/12/10.
Factor VIII - 7/15/10 to 8/13/10.

Group I - Table V

Table Comparing the Growth of Factor XIII during Her First Pregnant Period, Age 7 mo. 15 days, to 9 mo. 5 days, with Dry Factor 10A, Age 8 mo. 3 days to 9 mo. 29 days.

	Factor XIII		Factor 10A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XIII	10A	XIII	10A
Weight	120	171	136	169	51	33	1.04	.6000
Height at Withers	46.5	53	49	49	6.5	0	.0132	.0000
Height at Croup	52	57.5	56	58	5.5	2	.0112	.0363
Breadth of Shoulders	26	31.0	30	31	5.0	1.0	.102	.0181
Breadth at Sh. Pts.	23	27.0	23	24	4.0	1.0	.0816	.0181
Breadth of Hams	25	27.0	28	30	2.0	2.0	.0408	.0363
Breadth at Hip Pts.	21	24.0	19	20	3.0	1.0	.0612	.0181
Heart Girth	88	100.0	98	107	12.0	9.0	.2311	.1636
Paunch Girth	101	120.0	113	131	19.0	18.0	.3673	.3272
Flank Girth	88	100.0	98	115	12.0	17.0	.2311	.3070
Depth of Chest	28	31.5	30	33	3.5	3.0	.0711	.0545
Length of Body	69	87.0	70	75	18.0	5.0	.3673	.0909
Width of Head	9.5	10.5	15	16	1.0	1.0	.0211	.0181
Cir. of Shank Bone	13.0	14.0	13.5	13.5	1.0	0.0	.0211	.0000
Cir. of Shin Bone	13.5	14.5	14.0	14.0	1.0	0.0	.0211	.0000
Dist. Elbow Pt. Down	27.0	27.0	25.0	27.0	0.0	2.0	.0000	.0363
Dist. Sh. Pt. Down	28.0	29.0	27.0	29.0	1.0	2.0	.0211	.0363
Amt. of Feed Consumed	228.75		287.0				4.66	5.21
Dig. Nutrients	164.47		206.35				3.35	3.75

Factor XIII made a greater daily gain in body weight by .44 pounds than did the dry Factor. Skeletal measurements also favor the pregnant Factor.

Periods:

Factor XIII - 1/15/10 to 3/15/10
Factor 10 A - 1/20/12 to 3/16/12.

Group I - Table VI

Table Comparing the Growth of Pregnant Factor XI, Age 6 mo. 4 days to 9 mo. 5 days, with Dry Factor 11A, Age 6 mo. 1 day to 9 mo.

	Factor XI		Factor 11A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XI	11 A	XI	11A
Weight	96	186	120	177	90	57	.989	.626
Height at Withers	44.5	52.5	48	56	8.0	9.0	.0879	.0989
Height at Croup	50.0	57.5	57	63	7.5	6.0	.0824	.0659
Breadth of Shoulders	24.0	32.5	26	30	8.5	4.0	.0934	.0439
Breadth at Sh. Pts.	22.0	29.0	20	23	7.0	3.0	.0769	.0329
Breadth of Hams	23.0	28.0	26	28	5.0	2.0	.0549	.0219
Breadth at Hip Pts.	20.0	25.0	19	21	5.0	2.0	.0549	.0219
Heart Girth	86.0	109.0	88	102	23.0	14.0	.2527	.1538
Paunch Girth	97.0	123.0	107	122	26.0	15.0	.2857	.1648
Flank Girth	87.0	104.0	98	106	17.0	8.0	.1868	.0879
Depth of Chest	25.5	34.0	29	33	8.5	4.0	.0934	.0439
Length of Body	65.0	88.0	79	24	23.0	5.0	.2527	.0549
Width of Head	9.75	11.5	13.5	16	1.75	2.5	.0192	.0274
Cir. of Shank Bone	13.0	15.0	13.0	14	2.0	1.0	.0219	.0109
Cir. of Shin Bone	13.5	15.5	13.0	14	2.0	1.0	.0219	.0109
Dist. Elbow Pt. Down	23.5	28.0	24.0	29	4.5	5.0	.0494	.0549
Dist. Sh. Pt. Down	25.0	29.0	27.0	32	4.0	5.0	.0438	.0549
Amt. of Feed Consumed	386.75		427.0				4.25	4.68
Dig. Nutrients	278.0		307.0				3.05	3.37

Factor XI shows a greater gain in body weight, all breadth and girth measurements, depth of chest, length of body and circumference of shin bone. Pregnancy afforded a stimulus for gain in weight and possibly skeletal growth.

Periods:

Factor XI - 12/4/09 to 3/5/10
Factor 11A - 11/18/11 to 2/17/12.

Group I - Table VII

Table Comparing Factor XXI during Her First Pregnant Period, Age 7 mo. 1 day, to 7 mo. 29 days, with Dry Factor XXXI, Age 7 mo. 3 days to 8 mo. 7 days.

	Factor XXI		Factor XXXI		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XXI	XXXI	XXI	XXXI
Weight	160	188	190	211	28	21	1.000	.636
Height at Withers	47	49	53	54	2	1	.0714	.0303
Height at Croup	57	59	60	62	2	2	.0714	.0606
Breadth of Shoulders	30	33	33	33	3	0	.1071	.0000
Breadth at Sh. Pts.	25	26	22	25	1	3	.0357	.0909
Breadth of Hams	28	30	30	29	2	-1	.0714	-.0303
Breadth at Hip Pts.	21	24	21	20	3	-1	.1071	-.0303
Heart Girth	102	108	112	110	6	-2	.2142	-.0606
Paunch Girth	117	132	120	126	15	6	.5357	.1818
Flank Girth	104	111	107	113	7.0	6.0	.2500	.1818
Depth of Chest	31	33	34	34	2.0	0.0	.0714	.0000
Length of Body	82	84	82	85	2.0	3.0	.0714	.0909
Width of Head	15	15.5	16.5	16.5	.5	0.0	.0178	.0000
Cir. of Shank Bone	15	15.5	17.0	16.0	.5	-1.0	.0178	-.0303
Cir. of Shin Bone	15	16.5	16.5	16.0	1.5	- .5	.0535	-.015
Dist. Elbow Pt. Down	25	25.0	28.0	29.0	0.0	1.0	.0000	.0303
Dist. Sh. Pt. Down	29	28.0	31.0	30.0	-1.0	-1.0	-.0357	-.0303
Amt. of Feed Consumed	126		163.6				4.4	4.96
Diges. Nutrients	90.59		117.62				3.23	3.56

Factor XXI on less feed shows a greater gain in body weight. The pregnant Factor made a greater gain in height and girth measurements and depth of chest. Pregnancy evidently did not retard skeletal growth.

Periods:

Factor XXI - 11/19/10 to 12/17/10.
Factor XXXI - 11/4 /12 to 12/ 7/12.

Group I - Table VIII

Table Comparing Factor XXII during Her First Pregnant Period, Age 6 mo. 22 days to 9 mo 21 days, with Dry Factor XX, Age 6 mo. 22 days to 9 mo. 21 days.

	Factor XXII		Factor XX		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XXII	XX	XXII	XX
Weight	170	217	168	208	47	40	.5222	.4444
Height at Withers	47	52	47	56	5	9	.0555	1.0000
Height at Croup	55	59	55.5	63	4	7.5	.04444	.0833
Breadth of Shoulders	29	34	28.5	32	5	3.5	.0555	.0388
Breadth at Sh. Pts.	23	27	22.0	25	4	3.3	.0444	.0333
Breadth of Hams	26	32	27.0	31	6	4.0	.0666	.0444
Breadth at Hip Pts.	18	25	17.0	25	7.	8.0	.0777	.0888
Heart Girth	92	117	90.0	112	25	22.0	.2777	.2444
Paunch Girth	117	138	110.0	132	21	22.0	.2333	.2444
Flank Girth	100	120	100.0	119	20	19.0	.2222	.2111
Depth of Chest	29	35	29.0	33	6	4.0	.0666	.0444
Length of Body	85	93	80.0	90	8	10.0	.0888	.1111
Width of Head	11	16.5	11.0	17	5.5	6.0	.0611	.0666
Cir. of Shank Bone	15	16.5	16.0	16.5	1.5	.5	.0166	.0055
Cir. of Shin Bone	15	17.0	16.0	17.0	2.0	1.0	.0222	.0111
Dist. Elbow Pt. Down	26	26.0	25.0	27.0	0.0	2.0	.0000	.0222
Dist. Sh. Pt. Down	24	28.0	24.0	29.0	4.0	5.0	.0444	.0555
Amt. of Feed Consumed	410.3		412.3				4.52	4.52
Dig. Nutrients	295.0		296.4				3.25	3.24

Factor XXII made the greater gain in body weight. Yet dry Factor XX excelled in most of the skeletal gains. This may indicate a slight retardation of skeletal growth due to pregnancy.

Periods:

Factor XXII - 10/22/10 to 1/21/11.
Factor XX - 10/22/10 to 1/21/11.

Group I - Table IX

Table Comparing Factor L during Her First Pregnant Period, Age 7 mo. 6 days to 10 mo. 2 days, with Dry Factor 12A, Age 7 mo. 6 days to 10 mo. 2 days.

	Factor L		Factor 12A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	L	12A	L	12A
Weight	175	254	152	195	79	43	.8977	.5119
Height at Withers	52	59	52	56	7	4	.0795	.0476
Height at Croup	59	64	58	61	5	3	.0868	.0357
Breadth of Shoulders	30	36	28	30	6	2	.0686	.0238
Breadth at Sh. Pts.	20	25	20	24	5	4	.0868	.0476
Breadth of Hams	27	33	27	28	6	1	.0272	.0119
Breadth at Hip Pts.	22	25	19	21	3	2	.0686	.0238
Heart Girth	106	122	96	104	16	8	.1818	.09523
Paunch Girth	123	134	113	118	11	5	.125	.0595
Flank Girth	110	125	95	108	15	13	.1704	.1547
Depth of Chest	32	35	32	33	3	1	.0272	.0119
Length of Body	86	92	76	91	6	15	.0544	.1785
Width of Head	14.5	16.5	14.5	17	2	2.5	.0227	.0287
Cir. of Shank Bone	14.0	15.5	14.0	15	1.5	1.0	.017	.0119
Cir. of Shin Bone	13.5	15.0	14.0	15	1.5	1.0	.017	.0119
Dist. Elbow Pt. Down	27.0	26.0	25.0	29	-1.0	4.0	-.0113	.0476
Dist. Sh. Pt. Down	29.0	29.0	29.0	31	0.0	2.0	.0000	.0238

	Factor L	Factor 12A	Daily L	Daily 12A
Amt. of Feed Consumed	542.46	495.0	6.1	5.9
Dig. Nutrients	389.7	355.9	4.43	4.24

On only slightly more feed Factor L made a greater gain in body weight; and showed a greater increase in height, breadth and girth measurements, length of body and circumference of shin and shank bones. Here pregnancy seems to have favored growth.

Periods:

Factor L - 10/24/14 to 1/20/15.
Factor 12A- 12/7/12 to 3/1/13.

Group I - Table X

Table Comparing Factor LI during Her First Period of Pregnancy, Age 10 mo. 2 days to 11 mo. 2 days, with Factor 20A, Age 10 mo. 2 days to 11 mo. 2 days.

	Factor LI		Factor 20A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end.	LI	20A	LI	20A
Weight	184	222	251	263	38	12	1.225	.387
Height at Withers	53	54	57	57	1	0	.0322	.0000
Height at Croup	59	61	65	66	2	1	.0645	.0322
Breadth of Shoulders	31	32	35	36	1	1	.0322	.0322
Breadth at Sh. Pts.	23	22	26	26	-1	0	.0322	.0000
Breadth of Hams	29-	31	32	33	2	1	.0645	.0322
Breadth at Hip Pts.	23	23	26	26	0	0	.0000	.0000
Heart Girth	103	111	120	123	8	3	.2571	.0967
Paunch Girth	110	128	132	130	18	-2	.5806	.0644
Flank Girth	99	116	121	120	17	-1	.5161	-.0322
Depth of Chest	32	35	36	39	3	3	.2571	.0967
Length of Body	87	90	94	98	3	4	.1290	.129
Width of Head	14.5	14.5	15	15	0	0	.0000	.0000
Cir. of Shank Bone	15.0	15.0	16	16	0	0	..0000	.0000
Cir. of Shin Bone	15.0	15.0	16	16	0	0	.0000	.0000
Dist. Elbow Pt. Down	25.0	27.0	27	28	2	1	.0645	.0322
Dist. Sh. Pt. Down	28.0	30.0	29	30	2	1	.0645	.0322

Amt. of Feed Consumed   Same for Both

Factor LI exceeds in daily gain in body weight by .938 pounds. Skeletal measurements such as height at withers and croup, heart and flank girths, and circumference of shin bone do not show any marked retardation of skeletal growth during pregnancy.

Periods:

Factor LI - 1/20/15 to 2/20/15.
Factor 20A - 1/20/15 to 2/20/15.

Group I - Table XI

Table Comparing Factor LX during Pregnancy, Age 8 mo. 24 days to 11 mo. 14 days, with Dry Factor 13A, Age 7 mo. 11 days to 10 mo. 2 days.

	Factor LX		Factor 13A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	LX	13A	LX	13A
Weight	177	237	177	252	60	75	1.17	.9146
Height at Withers	55	59	55	58	4	3	.0784	.0365
Height at Croup	61	64	64	69	4	5	.0784	.0365
Breadth of Shoulders	28	33	31	36	5	5	.098	.0609
Breadth at Sh. Pts.	20	25	22	27	5	5	.098	.0609
Breadth of Hams	26	31.5	27	33	5.5	6	.1078	.0730
Breadth at Hip Pts.	19.5	21.5	20	24	2.0	4	.0392	.0487
Heart Girth	102.0	112.0	102	114	10.0	12	.196	.1463
Paunch Girth	118.0	125.0	122	138	7.0	16	.1372	.1951
Flank Girth	103.0	100.0	109	129	-3.0	20	-.0588	.2439
Depth of Chest	33.5	37.0	33	38	3.5	5	.0686	.0609
Length of Body	87.0	90.0	86	98	3.0	12	.0588	.1463
Width of Head	15.5	20.0	15	16	4.5	1	.0882	.0122
Cir. of Shank Bone	15.0	17.0	15	16.5	2.0	1.5	.0392	.0182
Cir. of Shin Bone	14.0	16.0	14.5	16.0	2.0	1.5	.0392	.0182
Dist. Elbow Pt. Down	26.0	30.0	28.0	30.0	4.0	2.0	.0784	.0243
Dist. Sh. Pt. Down	28.0	32.0	31.0	32.0	4.0	1.0	.0784	.0122
Amt. of Feed Consumed	508.9		485.0				9.97	5.914
Dig. Nutrients	365.9		348.7				7.17	4.25

Considering the difference in feed it still seems justifiable to conclude that pregnant Factor LX equaled Dry Factor 13A in increase in body weight and skeletal growth.

Periods:

Factor LX - 11/6/15 to 1/27/16.
Factor 13A - 12/9/12 to 3/1/13.

A comparison of pregnant and non pregnant animals during periods ranging in length from 28 days to 112 days, gives the following results.

With one exception, the pregnant factors made the greater gains in body weight, the gains varying from .08 pounds to .838 pounds daily. The exception was in the case of Factor V, table II, and the difference here amounted to only .022 pounds daily. In one of the tables, however, the pregnant factor received 2.9 pounds more feed daily than did the non pregnant factor. In eight of the eleven tables there was a slight increase in the skeletal growth of the pregnant animals over that of the non pregnant ones. It is very difficult to take accurate measurements of swine, and due consideration must be given to the fact that a large per cent of the differences noted in the preceding tables are probably within the range of error, yet it seems that where a sufficient amount of feed is given and the animals are cared for normally as was the case in this experiment, pregnancy does not retard skeletal growth.

The increase in weight of the pregnant sows can possibly be explained as follows:

An animal generally acquires a quieter disposition after conception, and this may lead to a lower maintenance requirement. It has been a common practice for feeders to breed heifers before placing them in the feedlot, and this is also done when fattening sows.

Thus the losses in weight that might occur during the period of sexual excitement are avoided.

Another probable explanation is that better dietetic conditions may prevail during the period of gestation. This point needs further investigation before any analogies can be drawn between pregnancy and a more economical use of food by the mother.

It has been shown that the mother will deplete her own tissues to nourish the fetus. Where the animal is liberally fed, this drain cannot be very great. The nutrients required by the developing fetus, the aminiotic fluid, and the placenta, are probably too small to be measured by any experimental methods used at the present time. Such requirements are probably offset by the saving due to decreased maintenance.

The swine in this experiment manifested no retardation in growth during pregnancy. On the contrary there is evidence to show that, as was the case with Minot's[(8)] guinea pigs, pregnancy favored body growth. It seems safe to conclude that any ill effects arising from early breeding are not due to an early pregnant period.

According to the data in the previous table, sowswhich have been bred but never suckled a litter would possibly be larger at a given age than those gilts that had never been pregnant. Perhaps good dietetic conditions

established during pregnancy still prevail throughout a following dry period.

Due to measurements having been taken at threemonth periods, there are few instances where such comparisons as those mentioned above could be made. In the following tables three sows which had lost their litters at birth were compared with gilts that had never been pregnant. The comparisons were made in the same way as those in group I. Age, time of year and feed consumed were comparable for each animal. All weights are expressed in pounds and all measurements in centimeters.

Group II - Table I

Table Comparing Factor XXI, Age 11 mo. to 12 mo., during Dry Period Follwoing Pregnancy and Loss of Litter with Dry Factor XX, Never Pregnant and of the Same Age.

	Factor XXI		Factor XX		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end	XXI	XX	XXI	XX
Weight	212	210	230	224	- 2	-6	- .0666	-.1998
Height at Withers	55	55	57	58	0	1	.0000	.0333
Height at Croup	62	64	65	64	2	-1	.0666	.0333
Breadth of Shoulders	35	35	34	34	0	0	.0000	.0000
Breadth at Sh. Pts.	27	27	27	27	0	0	.0000	.0000
Breadth of Hams	31	31	31	31	0	0	.0000	.0000
Breadth at Hip Pts.	24	23	23	24	-1	1	-.0333	.0333
Heart Girth	112	112	111	112	0	1	.0000	.0333
Paunch Girth	131	132	126	127	1	1	.0333	.0333
Flank Girth	112	113	115	118	1	3	.0333	.1111
Depth of Chest	34	36	35	35	2	0	.0666	.0000
Length of Body	93	94	92	93	1	1	.0333	.0333
Width of Head	17	17	17	17.5	0	.5	.0000	.0166
Cir. of Shank Bone	17	16.5	17.5	16.5	- .5	-1.0	-.0166	-.0333
Cir. of Shin Bone	17	16.5	18.0	17.0	- .5	-1.0	-.0166	-.0333
Dist. Elbow Pt. Down	28	28.0	30.0	30.0	0.0	0.0	.0000	.0000
Dist. Sh. Pt. Down	31	31.0	33.0	33.0	0.0	0.0	.0000	.0000

Amt. of Feed Consumed Same for Both

Both Factors lost in weight, yet Factor XX never pregnant, lost the most in weight. There was little difference in size of the animals at the time of taking final measurements. The difference in skeletal growth is too small to allow for comparison.

Periods:

Factor XXI - 3/18/11 to 4/17/11.
Factor XX - 3/18/11 to 4/17/11.

Group II - Table II

Table Comparing Factor XXX, Age 10 mo. 6 days to 12 mo. 5 days, during Dry Period after Loss of Litter, with Factor 11A, Age 9 mo. 29 days to 12 mo. 1 day.

	Factor XXX		Factor 11A		Gain-		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end.	XXX	11A	XXX	11A
Weight	259	302	196	262	43	66	.7143	1.04
Height at Withers	55	58	56	59	3	3	.0517	.0476
Height at Croup	65	66	65	68	1	3	.0172	.0476
Breadth of Shoulders	39	39	32	38	0	6.6	.0000	.0952
Breadth at Sh. Pts.	30	28	24	28	-2	4.0	-.0344	.0634
Breadth of Hams	32	35	29	39	3	10.0	.0517	.1589
Breadth at Hip Pts.	23	24	21	24	1	3.0	.0172	.0476
Heart Girth	118	121	108	124	3	16.0	.0517	.2536
Paunch Girth	136	143	127	144	7	17.0	.1207	.2698
Flank Girth	118	123	114	121	5	7.0	.0862	.1111
Depth of Chest	35	37	36	39	2	3.0	.0343	.0476
Length of Body	96	100	87	89	4	2.0	.0689	.0316
Width of Head	17	18	16.5	18	1	1.5	.0172	.0238
Cir. of Shank Bone	15	16.5	14.5	15.5	1.5	1.0	.0259	.0158
Cir. of Shin Bone	16	17.0	14.5	15.5	1.0	1.0	.0172	.0158
Dist. Elbow Pt. Dwon	29	30.0	29.0	31.0	1.0	2.0	.0172	.0316
Dist. Sh. Pt. Down	31	32.0	31.0	34.0	1.0	3.0	.0172	.0476
Amt. Feed Consumed	270.0		311.7				4.65	4.94
Dig. Nutrients	194.3		223.8				3.35	3.55

Although making a smaller gain in body weight and perhaps in skeletal growth Factor XXX was the larger at the time of final measurement as shown by body weight and skeletal measurement.

Periods:

Factor XXX - 2/6/13 to 4/5/13.
Factor 11A - 3/16/12 to 5/18/12.

Group II - Table III

Table Comparing Factor XXII, Age 10 mo. 18 days to 11 mo. 18 days, Following Loss of Litter, with Factor XX, Age 10 mo. 18 days to 11 mo. 18 days, Never Pregnant.

	Factor XXII		Factor XX		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XXII	XX	XXII	XX
Weight	195	193	216	230	- 2.0	14	-.0714	.500
Height at Withers	53	54	55.5	57	1.0	1.5	.0352	.0535
Height at Croup	63	64	64.0	65	1.0	1.0	.0352	.0352
Breadth of Shoulders	33	35	33.0	34	2.0	1.0	.0714	.0352
Breadth at Sh. Pts.	28	27	26.0	27	- 1.0	1.0	-.0352	.0352
Breadth of Hams	29	29	31.0	31	0.0	0.0	.0000	.0000
Breadth at Hip Pts.	24	23	24.5	23	- 1.0	-1.5	-.0352	-.0535
Heart Girth	110	108	112.0	111	- 2.0	-1.0	-.0714	-.0352
Paunch Girth	123	118	129.0	126	- 5.0	-3.0	-.1789	-.107
Flank Girth	111	110	120.0	115	- 1.0	-5.0	-.0352	-.1789
Depth of Chest	33	34	36.0	35	1.0	-1.0	.0352	-.0352
Length of Body	90	94	90.0	92	4.0	-2.0	.1428	-.0714
Width of Head	16.5	16.5	17.5	17	0.0	- .5	.0000	-.0178
Cir. of Shank Bone	16.0	16.5	16.5	17.5	.5	1.0	.0178	.0352
Cir. of Shin Bone	16.0	17.0	17.0	18.0	1.0	1.0	.0352	.0352
Dist. Elbow Pt. Down	27.0	28.0	29.0	30.0	1.0	1.0	.0352	.0352
Dist. Sh. Pt. Down	29.0	30.0	30.0	33.0	1.0	3.0	.0352	.107
Amt. of Feed Consumed	109		112				3.89	4.00
Dig. Nutrients	78.37		80.52				2.79	2.87

Factor XX made the greater gain in body weight and generally speaking may show a slightly greater skeletal development. Here the Factor that had never been pregnant was larger than the animal that had been bred.

Periods:

Factor XXII - 2/18/11 to 3/18/11.
Factor XX - 2/18/11 to 3/18/11.

Table I - shows that both of the sows lost in weight, yet the loss was most marked for the gilt that had never been pregnant. There was practically no difference in the size of the animals as shown by the final measurements. The differences in skeletal growth were very small.

Table II - The sow that had been pregnant was found to bethe larger at the time of final measurements, as shown by both body weight and skeletal measurements. However, the gilt that had never been pregnant excelled during the period of comparison, in both body weight and body measurements. There was a small difference in the amount of feed consumed, this, however, favoring the factor that had never been pregnant.

Table III - Factor XX, never pregnant, made the greatest gain in body weight and generally speaking also in skeletal measurements. Length of body excepted, Factor XX was the larger at the time of final measurements.

Comparisons of sows bred for several periods yet not allowed to suckle a litter, with animals that had never been pregnant would be necessary in order to substantiate any difference in the rate of growth due to previous treatment.

A COMPARISON OF THE GAINS MADE DURING THE DIFFERENT STAGES OF A SINGLE GESTATION PERIOD

A close study of pregnancy gives rise to the question, whether or not the gains are made consistently throughout the period.

In some instances measurements were frequently taken during the gestation period, and in such cases data was available on the point mentioned above. Feed, age and time of year were carefully considered, and weights are expressed in pounds and all measurements in centimeters.

Group III - Table I

Table Comparing Gains Made by Factor VII during Different Stages of Her First Pregnant Period, Age 22 mo. 14 days to 26 mo. 11 days.

	1st Period		2d Period	Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at end.	1st Period	2d Period	1st Per.	2d Per.
Weight	355	364	415	9.0	51	.3448	.561
Height at Withers	65	66.5	69	1.5	2.5	.0517	.0274
Height at Croup	73	75.0	76	2.0	1.0	.0688	.0109
Breadth of Shoulders	41	40.5	42	- .5	1.5	-.0172	.0164
Breadth at Sh. Pts.	35	35.5	33	.5	-2.5	.0172	-.0274
Breadth of Hams	37	36.5	40	- .5	3.5	-.0172	.0384
Breadth at Hip Pts.	32.5	34.0	28	1.5	-6.0	.0517	-.0656
Heart Girth	145.0	148.0	141	3.0	-7.0	.1034	-.0768
Paunch Girth	162.0	152.0	159	-10.0	7.0	-.344	.0768
Flank Girth	146.0	146.0	151	0.0	5.0	.0000	.0549
Depth of Chest	42.5	43.5	44	1.0	.5	.0344	.0054
Length of Body	106.0	108.0	110	2.0	2.0	.0688	.0218
Width of Head	13.5	14.0	18	.5	4.0	.0172	.0436
Cir. of Shank Bone	16.5	17.0	19	.5	2.0	.0172	.0218
Cir. of Shin Bone	16.5	17.0	19	.5	2.0	.0172	.0218
Dist. Elbow Pt. Down	31.5	32.0	33	.5	1.0	.0172	.0109
Dist. Sh. Pt. Down	34.0	34.0	36	0.0	2.0	.0000	.0218
Amt. Feed Consumed		38.9	266.6			1.1	2.92
Dig. Nutrients		27.99	191.6			.989	2.1

Although the amount of feed consumed is unequal for the two periods and the latter period is of greater length, it seems safe to conclude that the greater gains in body weight were made in the latter stage of the pregnant period.

Periods:

1st period- 6/15/10 to 8/13/10 -Pregnant only the last 21 days.
2d period- 8/13/10 to 11/12/10.

Group III - Table II

Table Comparing Gains Made by Factor XXI during Different Stages of Her First Pregnant Period, Age 6 mo. 3 days to 9 mo. 2 days.

	1st Period		2d Period	3d Period	Gain			Daily Gain		
	Meas. at Beg.	Meas. at end	Meas. at end	Meas. at end	1st Per.	2d Per.	3d Per.	1st Per.	2d Per.	3d Per.
Weight	159	160	188	209	1.0	28	21	.035	1.0	.6
Height at Withers	49	47	49	52	-2.0	2.0	3.0	-.071	.071	.085
Height at Croup	57	57	59	62	0.0	2.0	3.0	.000	.071	.085
Breadth of Shoulders	30	30	33	35	0.0	3.0	2.0	.000	.107	.057
Breadth at Sh. Pts.	24	25	26	25	1.0	1.0	0.0	.035	.035	.000
Breadth of Hams	26	28	30	31	2.0	2.0	1.0	.071	.071	.028
Breadth at Hip Pts.	18	21	24	25	3.0	3.0	1.0	.107	.107	.028
Heart Girth	93	102	108	110	9.0	6.0	2.0	.321	.214	.057
Paunch Girth	116	117	132	136	1.0	15.0	4.0	.035	.535	.114
Flank Girth	101	104	111	122	3.0	7.0	11.0	.107	.250	.314
Depth of Chest	31	31	33	34	0.0	2.0	1.0	.000	.071	.028
Length of Body	80	82	84	91	2.0	2.0	7.0	.071	.071	.200
Width of Head	13	15	15.5	17	2.0	.5	1.5	.107	.017	.042
Cir. of Shank Bone	15	15	15.5	16	1.0	.5	.5	.000	.017	.014
Cir. of Shin Bone	15	15.5	16.0	17	.5	.5	1.0	.017	.017	.028
Dist. Elbow Pt. Down	25	25.0	25.0	28	0.0	0.0	3.0	.000	.000	.085
Dist. Sh. Pt. Down	26	29.0	28.0	30	3.0	-1.0	2.0	.107	-.035	.057
Amt. of Feed Consumed	127		112.5	156.8				4.53	4.01	4.48
Dig. Nutrients	91.3		80.0	112.6				3.26	2.88	3.21

During the second period on less feed a greater gain was made in body weight, a smaller gain was made during the third month yet this was greater than for the 1st month.

Periods:

1st Period - 10/22/10 to 11/19/10
2d Period - 11/19/10 to 12/17/10
3d Period - 12/17/10 to 1/21/11.

Group III - Table III

Table Comparing Gains Made by Factor XXII During Different Stages of Her First Pregnant Period. Age 6 mo. 22 days to 9 mo. 21 days.

	1st Period		2d Period	3d Period	Gain			Daily Gain		
	Meas. at Beg.	Meas. at end	Meas. at end	Meas. at end	1st Per.	2d Per.	3d Per.	1st Per.	2d Per.	3d Per.
Weight	170	165	192	217	-5.0	27	25	-.178	.964	.714
Height at Withers	47	50	49	52	3.0	- 1.0	3.0	.107	-.035	.085
Height at Croup	55	58	59	59	3.0	1.0	0.0	.107	.035	.000
Breadth of Shoulders	29	29	33	34	0.0	4.0	1.0	.000	.142	.028
Breadth at Sh. Pts.	23	24	26	27	1.0	2.0	1.0	.035	.071	.028
Breadth of Hams	26	27	29	32	1.0	2.0	3.0	.035	.071	.085
Breadth at Hip Pts.	18	21	24	25	3.0	3.0	1.0	.107	.107	.028
Heart Girth	92	98	108	117	6.0	10.0	9.0	.214	.356	.257
Paunch Girth	117	116	135	138	-1.0	19.0	3.0	-.035	.678	.085
Flank Girth	100	109	114	120	9.0	5.0	6.0	.321	.178	.171
Depth of Chest	29	32	32	35	3.0	0.0	3.0	.107	.000	.085
Length of Body	85	83	85	93	-2.0	2.0	8.0	-.071	.035	.228
Width of Head	11	16	16	16.5	5.0	0.0	.5	.178	.000	.014
Cir. of Shank Bone	15	15	15	16.5	0.0	0.0	1.5	.000	.000	.042
Cir. of Shin Bone	15	15	15.5	17.0	0.0	.5	1.5	.000	.017	.042
Dist. Elbow Pt. Down	26	25	26.0	26.0	-1.0	1.0	0.0	-.035	.035	.000
Dist. Sh. Pt. Down	24	27	27.0	28.0	3.0	0.0	1.0	.107	.000	.028
Amt. of Feed Consumed	127		112.5	156.8				4.53	4.01	4.48
Dig. Nutrients	91.3		80.8	112.6				3.25	2.87	3.21

The gain in body weight was greater during the second period by .78 ponds during the second period. The third period exceeds the first in gains in body weight.

Periods:

1st Period - 10/22/10 to 11/19/ 10
2d Period - 11/19/10 to 12/17/10
3d Period - 12/17/10 to 1/21/10.

Group III - Table IV

Table Comparing Gains Made by Factor L during Different Stages of Her First Pregnant Period. Age 7 mo. 6 days to 10 mo. 2 days.

	1st Period		2d Period	3d Period	Gain			Daily Gain		
	Meas. at Beg.	Meas. at end.	Meas. at end.	Meas. at end	1st Per.	2d Per.	3d Per.	1st Per.	2d Per.	3d Per.
Weight	175	192	235	254	17	43	19	.653	1.48	.593
Height at Withers	52	53	56	59	1	3.0	3.0	.003	.103	.093
Height at Croup	59	61	61	64	2.0	0.0	3.0	.007	.000	.093
Breadth of Shoulders	30	32	33	36	2.0	1.0	3.0	.007	.034	.093
Breadth at Sh. Pts.	20	22	24	25	2.0	2.0	1.0	.007	.068	.003
Breadth of Hams	27	30	31	33	3.0	1.0	2.0	.115	.034	.062
Breadth at Hip Pts.	22	23	23	25	1.0	0.0	2.0	.003	.000	.062
Heart Girth	106	106	113	122	0.0	7.0	9.0	.000	.241	.281
Paunch Girth	123	119	131	134	-4.0	12.0	3.0	-.015	.413	.093
Flank Girth	110	106	115	125	-4.0	9.0	10.0	-.015	.310	.310
Depth of Chest	32	33	35	35	1.0	2.0	0.0	.003	.068	.000
Length of Body	86	91	94	92	5.0	3.0	-2.0	.192	.103	-.062
Width of Head	14.5	15.5	15.5	16.5	1.0	0.0	1.0	.003	.000	.031
Cir. of Shank Bone	14.0	14.5	15.0	15.5	.5	.5	.5	.192	.172	.015
Cir. of Shin Bone	13.5	14.5	14.5	15.0	1.0	0.0	.5	.003	.000	.015
Dist. Elbow Pt. Down	27.0	25.0	27.0	26.0	-2.0	2.0	-1.0	-.007	.068	-.031
Dist. Sh. Pt. Down	29.0	27.0	30.0	29.0	-2.0	3.0	-1.0	-.007	.103	-.031
Amt. of Feed Consumed	182.9		161.6	192				6.77	5.57	6.00
Dig. Nutrients	131.5		116.1	138.04				4.87	4.00	4.31

During the second month the gain in body weight was greater by .8 pounds and generally speaking Factor L seems to have made a greater gain in skeletal growth during the second month. The lowest gains in this case were made during the third month.

Periods:

1st Period - 10/24/14 to 11/20/14
2d Period - 11/20/14 to 12/19/14
3d Period - 12/19/14 to 1/20/15.

Group III - Table V

Table Comparing Gains Made by Factor LX during Different Stages of Her First Pregnant Period, Age 8 mo. 24 days to 9 mo. 14 days, to 10 mo. 13 days.

	1st Period		2d Period	Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at end.	1st Period	2d Period	1st Period	2d Period
Weight	177	186	231	9	45	.4285	1.506
Height at Withers	55	56	60	1	4	.0476	.125
Height at Croup	61	62	64.5	1	2.5	.0476	.0781
Breadth of Shoulders	28	28	33.0	0	5.0	.0000	.1562
Breadth at Sh. Pts.	20	20.5	24.0	.5	3.5	.0238	.1093
Breadth of Hams	26	26.5	31.0	.5	4.5	.0238	.1406
Breadth at Hip Pts.	19.5	21.0	24.0	1.5	3.0	.0714	.0937
Heart Girth	98.0	102.0	113.0	4.0	11.0	.1819	.3437
Paunch Girth	120.0	118.0	125.0	-2.0	7.0	-.0909	.2187
Flank Girth	107.0	103.0	106.0	-4.0	3.0	-.1819	.0937
Depth of Chest	31.5	33.5	37.5	2.0	2.0	.0909	.0625
Length of Body	86.0	87.0	91.0	1.0	4.0	.047	.125
Width of Head	14.5	15.5	16.0	1.0	.5	.047	.0156
Cir. of Shank Bone	14.5	15.0	16.0	.5	1.0	.0238	.0031
Cir. of Shin Bone	14.0	14.0	15.0	0.0	1.0	.0000	.0031
Dist. Elbow Pt. Down	30.0	26.0	31.0	-4.0	5.0	-.1819	.1562
Dist. Sh. Pt. Down	32.0	28.0	32.0	-4.0	4.0	-.1819	.125
Amt. of Feed Consumed	111		239.5			5.3	8.2
Dig. Nutrients	79.88		172.2			3.8	5.9

During the second month of pregnancy, Factor LX made a greater gain in body weight by 1.1 pounds daily. She also made greater gains in a few of the more important skeletal measurements. The difference in the amount of feed consumed may serve to account for the greater gain during the second period.

Periods:

1st Period - 11/6/15 to 11/27/15

2d Period - 11/27/15 to 12/26/15.

In every case, greater gains, varying from .22 pounds to 1.08 pounds, were made during the second month.

In most cases the differences in body growth as shown by skeletal measurements, were too small to allow for comparison. Gains during the third month are considered in only three tables; yet in two of these greater gains were made during the third month than the first month.

From the tables presented, it seems justifiable to conclude that greater gains in body weight, at least, are made during the second month when compared with the first. These results, however, have a limited application and need further investigation.

A COMPARISON OF THE FEED CONSUMED BY PREGNANT AND OPEN FACTORS.

Some investigators have concluded that animals when pregnant make a more economical use of their feed, due either to increased metabolism ; or to the more sluggish condition acquired by a pregnant animal.

The following table gives twenty-one comparisons that should have some bearing on this point. The feed consumed was calculated from the weekly feed records, and the average weight was obtained by averaging the weekly weights throughout the period. The gain in weight was obtained by subtracting the weight nearest to the beginning of the period, from the weight nearest the end of the period,and just previous to farrowing.

An effort was made to secure comparisons between animals of about the same age and during the same time of year. With a few exceptions the animals were comparable in respect to the factors mentioned above.

GROUP IV-TABLE I

TABLE COMPARING FEED CONSUMED BY PREGNANT AND OPEN FACTORS

PREGNANT FACTORS									OPEN FACTORS							
Factor	Date	Period	Ave. Wt.	Feed	Dig. Nut.	Dig. Nut. per M. #	Per M. # per da.	Per. Gain	Factor	Date	Ave. Wt.	Feed	Dig. Nut.	Dig. Nut. per M. #	Per M. # per da.	Per. Gain
V	11/24/09-3/18/10	2nd	265	530	381.1	1438.1	12.61	60	VIII	11/24/09-3/18/10	287	557.3	382.5	1332.7	11.68	48
V	6/1/10 -9/10/10	3rd	293	258.4	193	658.7	5.82	85	VIII	6/1/10 -9/10/10	363	208.8	150.2	414.2	4.1	69
V	12/9/10 -3/31/11	4th	318	495	355.9	1119.1	9.99	59	VIII	12/9/10 -4/3/11	431	501	360.2	835.7	7.26	24
VI	11/3/09 -2/24/10	2nd	226	473	340.1	1504.8	13.32	70	IV	11/13/09-2/24/10	265	448	322.15	1214.7	10.74	65
VI	6/2/10 -9/25/10	3rd	247	460	330.7	1338.8	11.64	104	IV	6/2/10 -9/25/10	327	261.9	188.35	575.9	4.96	16
XI	12/26/09-4/18/10	1st	172	478	343.7	199.8	17.68	86	XIA	12/17/11-4/8/12	171	586	421.4	2470.2	22.05	70
XIII	1/22/10-5/14/10	1st	176	480	345.1	1960.8	17.51	87	XIIIA	12/20/12-4/12/13	238	655	471	1979	17.51	93
XIV	12/7/09 -3/31/10	1st	155	451	324.3	2092	18.35	107	XIIA	11/4/12 -2/26/13	164	645	463.7	2827.4	24.8	82
XIV	6/22/10-10/12/10	2nd	242	523	376	1553.6	13.87	97	XIIA	5/20/13-9/9/13	254	371	266.7	1050	9.37	29
XXII	10/11/10-2/3/11	1st	180	488.3	350.9	1949	17.09	77	XXA	1/15/14-5/10/14	191	783	563	2947.6	25.63	120
XXII	3/17/11-7/6/11	2nd	202	352	253.1	1253	11.28	16	XXA	6/21/14-10/10/14	308	591	425	1379.8	11.89	88
XXX	10/1/12 -1/25/13	1st	226	514.8	370.2	1637.8	14.11	132	XXIA	1/4/14 -4/29/14	226	767.2	551.4	2439.8	21.4	148
XXX	4/21/13-8/9/13	2nd	333	345	24[illegible].05	744.7	6.77	72	XXIA	6/25/14-10/13/14	312	585.2	420.7	2367.4	21.52	71
XXXI	11/16/12-3/10/13	1st	244	517	371.75	1523.5	13.35	97	XXIIB	3/26/12-7/18/12	189	625	449.4	1348.4	11.83	107
XXXI	5/15/13-9/7/13	2nd	251	585	420.7	1675.8	14.57	60	XXIIB	9/23/12-1/16/13	263	445	317.8	1207	10.49	11
XXXI	2/16/14-6/10/14	3rd	348	819.9	589.5	1694.5	14.86	66	XXIIB	6/26/13-10/18/13	353	358.7	257.9	730.2	6.4	-9
XL	11/22/12-3/18/14	1st	247	750	539.9	2186	18.84	117	XIIIB	5/9/12 -9/2/12	219	630	452.9	2068	17.82	78
XL	11/2/14 -2/25/15	2nd	349	513.7	369.4	1058.8	9.2	-12	XIIIB	4/19/13-8/12/13	347	399	286.9	826.8	7.18	51
L	10/20/14-2/13/15	1st	221	705	506.9	2293.6	19.77	115	VII	10/19/09-2/16/10	281	467.6	336.2	1198.6	9.98	86
LX	11/4/15 -2/25/16	1st	234	624.4	448.65	1917.3	16.96	[illegible]0	III	11/9/09 -2/23/10	245	453	325.7	1329.4	12.54	32
LXX	9/3/16 -12/25/16	1st	204	632	454.45	2227.5	19.71	79	III	9/7/09 -12/22/09	210	290.2	208.65	993.3	9.37	78
	Total		5133	10995.5	7905.8	32027	297.3	1644			5644	10608.5	7621.2	31536.1	278.52	1357
	Average		244.4	523.5	376.4	1525.1	14.15	78.2			268.7	505.1	362.9	1501.7	13.26	64.6

A table of this kind lends itself only to a study of averages. The pregnant factors made the larger gains; yet on the average, consumed more feed. The difference amounted to .39 pounds, when expressed in terms of digestible nutrients per thousand pounds per day. However, when the digestible nutrients consumed per pound gain are considered, we find that the pregnant factors required only 19.4 pounds to make a pound gain, while the non-pregnant ones required 22.5 pounds.

Individual feed records were not kept in all cases; and only with such records along with digestion trials during the different periods would it be possible to determine whether or not the pregnant animals actually made a more economical use of their feed.

THE EFFECT OF LACTATION ON GROWTH

By lactation is meant the process of milk secretion. The mammary glands, or the organs of secretion, have been described as modified sebaceous glands. Their growth is small during the early years of life, and it is not until the time of puberty that a marked development of these organs occurs. The glands proper are made up of lobes, which are subdivided into lobules. Each lobule contains a number of glands which arise from the secretery alveoli, these uniting to form the lactiferous ducts. The alveoli are responsible for the secretion of milk.

The glands undergo a marked development during pregnancy, and by the end of the period are fully developed. The growth of the glands is not due to nervous stimuli from the reproductive organs. This has been shown by the severance of nerve connections between the two;and the development of transplanted mammary tissue during pregnancy. Many investigators now believe that hormones, or "chemical stimuli" control mammary development.

Marshall (7) says: "It is quite evident, therefore, that though the ovaries may represent the original source

of the stimulus necessary for mammary hypertrophy, they are not necessary forthe continuance of the process and exercise no control over the final stages which precede the secretion of milk". Experimental studies have led some investigators to think that the growth of the mammary glands is due to a specific hormone arising in the fetus. Miss Lane-Claypon (7) and Starling tried injecting ovarian extracts from pregnant rabbits into non pregnant ones and failed to secure any development of the glands. When extracts prepared from any part of the fetus were injected into non pregnant female rabbits there was a genuine development of the mammary glands, which simulated growth during pregnancy.

The physiological processes involved in milk secretion are not clearly understood. Marshall's (7) hypotheses is perhaps the most satisfactory. He says:; "The anabolic changes associated with the mammary glands are due to the assimilatory effect of a hormone elaborated in the fetus and carried thence through the placenta by the fetal and the maternal circulations. The removal of this stimulus produces those katabolic changes which are involved in the breaking down of the built up tissues and the consequent formation of milk".

Marshall describes three theories relating to the process of milk secretion. According to one view, the cells themselves break loose and become disintegrated, setting free their contents in the alveoli of the gland. Other authorities account for this process on the theory that the

cells simply excrete the substances into the alveolar lumina without becoming detached or destroyed themselves.

According to the third hypothesis, the mammary gland in its mode of activity occupies a position midway between the sebaceous and the submaxillary glands. Some of the cells simply discharge their contents into the lumina, while with others, the central parts of the cell containing a daughter nucleus break away and become disintegrated, leaving the basal portion still in position.

COMPOSITION OF SOW'S MILK

Lusk (40) says: "The milk of one race is specifically adapted to the growth of the offspring of that particular race. For example, the ash of the dog's milk has the same composition as the ash of the new born pup. The percentage or quantity of constituents in milk is dependent upon the rapidity of growth of the organism".

The following gives a comparison between sow's and cow's milk.

	Total solids	Fat	Casein and albumen	Milk sugar	Ash	Sp.Gravity
Sow's	19.49	6.80	6.06	5.64	.98	1.0412
Cow's	13.47	4.14	3.20	5.43	.70	1.0316
Difference	7.02	2.75	2.86	.21	.28	.0096

The sow's milk is richer in total solids, fat,

protein, milk sugar and ash content. Coburn[41] says: "On a comparative basis of 1000 pounds live weight, a cow giving 3 gallons of milk a day will give in the milk one pound of fat and .77 pounds of protein daily, while the sow's milk will yield 1.26 pounds of fat and 1.1 pounds of protein a day on an average". This comparison shows that proportionately the demands for milk production are as great in the sow as in the cow, and therefore she should be given a ration that will stimulate and sustain an abundant milk flow. Henry and Morrison[42] give the milk yield of a sow as varying from 4.9 pounds to 6.3 pounds of milk daily, and the total for an 84-day period as ranging from 429 pounds to 532 pounds.

GROWTH AND LACTATION COMPARED

The processes of growth and lactation, in some respects, show striking similarities. Both are dependent upon reproductive activities for their initial stimulus. The size that an animal will finally reach under favorable circumstances is limited by heredity. This same factor has been found to largely control the amount of milk that a cow is capable of giving. The suckling of young seems to be carried on at the expense of body growth, and when cows use their feed to lay on flesh, body growth seems to be at the expense of milk production.

REVIEW OF EXPERIMENTAL WORK

Minot[8], in working with guinea pigs, found a

very rapid loss in the weight of the mother immediately following delivery and continuing for several days. He also noted, subsequently, a continued loss in weight going on at a somewhat slower rate for about three weeks, after which a period of recovery began. He concluded that during gestation there is an accumulation of material in the mother's body which afterwards is exhausted for the production of milk. This may account for the overgain in weight before delivery, and the loss of weight shortly following.

The following table gives some idea of the changes taking place.

Days after delivery	Total weight	No. of Obs.	Average	Increase	Average daily increase	Daily per cen increas
0	14726	24	613.6			
1 - 5	60974	110	554.3	-59.3	-11.9	-1.9
6 - 10	57256	104	550.5	- 3.8	- 0.8	0.1
11 - 15	49134	87	564.8	14.3	2.9	0.5
16 - 20	55832	99	564.0	10.8	0.2	0.03
21 - 25	46864	85	551.3	12.7	- 2.5	-0.4
26 - 30	39993	71	563.3	12.0	2.4	0.4
31 - 35	24543	43	570.8	7.5	1.5	0.3

Although the number of observations is not sufficient to give a regular series of averages, yet it can be seen that the animals lost for the first ten days after birth and from this time on began to make slight gains.

Eckles (15) says: "Milk production is a severe tax upon the cow and checks the growth to a marked degree". Regan (43), from experimental work carried on at the Missouri Station,

concluded that lactation affects growth and that growth affects lactation, and that the relative amount of the effect of each depended upon the length of time that had elapsed since the beginning of each. He also found the more immature the animal at the term of lactation, the greater the check on growth; and the more tendency there is for the check to be a permanent one.

Mangels (45) found that a lactating gilt may have a lower digestive ability. Due to an insufficient number of trials, no conclusions can be drawn from his work. An explanation for the lower coefficient of digestibility may be that the gilt was in an emaciated condition from suckling the litter and not able to make as economical use of her food as she would normally.

In Hageman's (46) work with dogs, the nitrogen retention was found to be less than what was secreted in the milk. The bitch lost nitrogen from her body while the puppies increased in size. On the other hand, Jageros (46) showed that the mother retained more nitrogen from the food than she gave out to the puppies, and therefore protein was stored in her tissues. Both of these investigators, however, found a period of increased protein retention after the removal of the young.

A COMPARISON OF LACTATING AND OPEN FACTORS

Since pregnancy was found to cause no marked retardation of growth, it would be interesting to make similar comparisons between lactating and open factors. Breeders have commonly observed that lactation caused a serious check in the growth of an animal. Their method of observation in most cases has been the changes apparent to the eye as the period of lactation progressed. Other methods of comparison would be by means of body weights and measurements, taken at the beginning and the end of the period. Skeletal measurements will vary, due to the falling off in flesh of the animal and cannot be expected to show an actual gain or loss in the skeleton itself.

The small number of comparisons here considered was due to the fact that there were very few cases where two measurements were taken of the animal while lactating. Each table gives a comparison between a suckling sow and a dry animal. The age, time of year and previous treatment in each table are comparable for both animals. The dry gilts had never been bred. In most cases the lactating animals received the most feed. The weights are expressed in pounds and all measurements are given in centimeters.

Group V - Table I

Table Comparing the Growth of Factor VI during Her First Lactation Period, Age 9 mo. 18 days to 11 mo. 18 days, with Dry Factor VII, Age 9 mo. 18 days to 11 mo. 18 days.

	Factor VI		Factor VII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end	VI	VII	VI	VII
Weight	150	120	172	190	-30	18	-.428	.2535
Height at Withers	54	51	54.5	55	- 3.0	.5	-.0428	.0071
Height at Croup	58.5	56.5	62.5	67	- 2.0	4.5	-.0285	.0633
Breadth of Shoulders	25.5	22.0	29.5	32	- 3.5	2.5	-.050	.0352
Breadth at Sh. Pts.	23.0	21.0	27.0	28	-2.0	1.0	-.0285	.014
Breadth of Hams	24.0	21.0	27.0	27	- 3.0	0.0	-.0428	.0000
Breadth at Hip.Pts.	22.0	20.5	24.5	24	- 1.5	- .5	-.0214	-.0071
Heart Girth	101.0	85.0	105.0	106	-16.0	1.0	-.228	.014
Paunch Girth	110.0	100.0	115.0	120	-10.0	5.0	-.142	.071
Flank Girth	107.0	95.0	109.0	115	-12.0	6.0	-.1714	.0845
Depth of Chest	32.0	29.5	35.5	34	- 2.5	-1.5	-.0357	-.0211
Length of Body	76.0	72.0	80.0	85	- 4.0	5.0	-.0571	.071
Width of Head	11.5	11.0	13.5	12.5	- .5	-1.0	-.0071	-.0140
Cir. of Shank Bone	13.5	13.5	14.0	14.5	0.0	.5	.0000	.0071
Cir. of Shin Bone	14.5	14.0	14.0	14.5	- .5	.5	-.0071	.0071
Dist. Elbow Pt. Down	28.0	28.0	29.0	27.0	0.0	-2.0	.0000	-.0281
Dist. Sh. Pt. Down	30.0	29.5	30.0	29.0	- .5	-1.0	-.0071	-.0140
Amt. of Feed Consumed	452.2		179.5				6.46	2.52
Dig. Nutrients	325.1		129.06				4.64	1.81

Factor VI lost daily in weight and in practically all skeletal measurements. On much less feed Dry Factor VII shows an increase in weight and measurements. Here lactation seems to have checked increases in body weight and skeletal measurements.

Periods:

Factor VI - 6/10/09 to 8/19/09
Factor VII - 6/10/09 to 8/20/09.

Group V - Table II

Table Comparing Factor V during Her Second Lactation Period, Age 19 mo. 4 days to 20 mo. 19 days, with Open Factor IV, Age 19 mo. 1 day to 20 mo. 13 days.

	Factor V		Factor IV		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	V	IV	V	IV
Weight	259	248	320	321	-11	1	-.2444	.0238
Height at Withers	60.5	60	67.5	66.5	- .5	-1	-.0111	-.0238
Height at Croup	67.5	66.5	73.5	74.0	- 1.0	.5	-.0222	.0119
Breadth of Shoulders	36.5	31.0	40.0	38.0	- 5.5	-2.0	-.1222	-.0476
Breadth at Sh. Pts.	32.5	29.0	36.5	35.5	-3.5	-1.0	-.0777	-.0238
Breadth of Hams	31.0	29.5	37.0	35.5	- 1.5	-1.5	-.0333	-.0357
Breadth at Hip Pts.	27.5	25.0	32.5	32.0	- 2.5	- .5	-.0555	-.0119
Heart Girth	118.0	111.0	136.0	138.0	- 7.0	-2.0	-.1555	-.0476
Paunch Girth	139.0	140.0	146.0	144.0	+ 1.0	-2.0	.0222	-.0476
Flank Girth	123.0	110.0	134.0	134.0	-13.0	0.0	-.2888	.0000
Depth of Chest	39.0	38.0	43.0	44.0	- 1.0	1.0	-.0222	.0238
Length of Body	93.0	95.0	103.0	106.0	2.0	3.0	.0444	.0714
Width of Head	12.5	12.5	13.0	13.0	0.0	0.0	.0000	.0000
Cir. of Shank Bone	17.0	17.5	15.5	16.5	.5	1.0	.0111	.0238
Cir. of Shin Bone	16.5	17.0	17.0	16.0	.5	-1.0	.0111	-.0238
Dist. Elbow Pt. Down	30.0	31.0	33.5	33.0	1.0	- .5	.0222	.0119
Dist. Sh. Pt. Down	33.0	34.0	35.5	36.0	1.0	.5	.0222	.0119

	Factor V	Factor IV	Daily V	Daily IV
Amt. of Feed Consumed	280	103.4	5.11	2.46
Dig. Nutrients	201.3	74.34	4.47	1.77

Factor V shows a greater loss in body weight and most of the body measurements. Lactation may have inhibited growth.

Periods:

Factor V - 4/6/10 to 5/21/10
Factor IV - 4/2/10 to 5/14/10.

<u>Group V - Table III</u>

Table Comparing Factor XI during Her First Lactation Period, Age 11 mo. 21 days to 12 mo. 15 days, with Factor 11A Never Pregnant, Age 11 mo. 1 day to 12 mo. 1 day.

	Factor XI		Factor 11A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XI	11A	XI	IIA
Weight	188	187	237	262	- 1.0	25	-.04	.8927
Height at Withers	51	52	61	59	1.0	- 2	.04	-.0714
Height at Croup	59	60.5	69	68	1.5	- 1	.06	-.0356
Breadth of Shoulders	30	30.0	34	38	0.0	4	.000	.1428
Breadth at Sh. Pts.	27.5	26.5	25	28	- 1.0	3	-.04	.1071
Breadth of Hams	29.0	27.5	34	39	- 1.5	5	-.06	.178
Breadth at Hip Pts.	25.0	23.0	23	24	- 2.0	1	-.08	.0356
Heart Girth	107.0	105.0	124	124	- 2.0	0	-.08	.0000
Paunch Girth	135.0	130.0	140	144	- 5.0	4	-.2	.1428
Flank Girth	108.0	110.0	120.0	121.	2.0	1	-.08	.0356
Depth of Chest	33.0	33.5	38.0	39	.5	1	-.02	.0356
Length of Body	90.0	82.0	90.0	89	- 8.0	- 1	-.32	-.0356
Width of Head	11.5	11.5	17.0	18	0.0	1	.0000	.0356
Cir. of Shank Bone	15.0	15.0	15.0	15.5	0.0	.5	.0000	.0178
Cir. of Shin Bone	15.0	15.0	15.0	15.5	0.0	.5	.0000	.0178
Dist. Elbow Pt. Down	28.0	29.0	31.0	31.0	1.0	0.0	.04	.0000
Dist. Sh. Pt. Down	29.0	31.5	33.0	34.0	1.5	.06	.1	.0356
Amt. of Feed Consumed	117		145.3				4.68	5.18
Diges. Nutrients	84.1		104.4				3.36	3.72

Factor XI shows a daily loss in weight and in several body measurements. Gains were made by the dry Factor. Lactation here seems to have retarded growth.

Periods:

Factor XI - 5/21/10 to 6/15/10.

Factor 11A - 4/20/12 to 5/18/12.

Group V - Table IV

Table Comparing Factor XIII during Her First Lactation Period, Age 11 mo. 21 days to 12 mo. 15 days, with Factor 12A Never Pregnant, Age 11 mo. 4 days to 12 mo. 4 days.

	Factor XIII		Factor 12A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	XIII	12A	XIII	12A
Weight	182	153	220	231	-29	11	-1.16	.3666
Height at Withers	54.5	53	56	57	- 1.5	1	- .06	.0333
Height at Croup	61.5	60	64	66	- 1.5	2	- .06	.0666
Breadth of Shoulders	30.5	26.5	32	35	- 4.0	3	- .16	.1000
Breadth at Sh. Pts.	27.5	23.5	24	25	- 4.0	1	- .16	.0333
Breadth of Hams	28.0	23.5	29	32	- 4.5	3	- .12	.1000
Breadth at Hip Pts.	24.5	20.5	21	22	- 4.0	1	- .16	.0333
Heart Girth	105.0	101.0	113	116	- 4.0	3	- .16	.1000
Paunch Girth	123.0	121.0	124	128	- 2.0	4	- .08	.1332
Flank Girth	108.0	115.0	112	115	7.0	3	.28	.1000
Depth of Chest	33.5	31.0	35	37	- 2.5	2	- .1000	.0666
Length of Body	96.0	81.0	94	94	-15.0	0	- .6	.0000
Width of Head	11.0	11.0	17	16.5	0.0	- .5	.000	.0166
Cir. of Shank Bone	15.0	14.0	15.5	16.0	1.0	.5	.04	.0166
Cir. of Shin Bone	15.0	14.0	16.0	16.0	1.0	0.0	.04	.0000
Dist. Elbow Pt. Down	30.0	29.0	29.0	30.0	1.0	1.0	.04	.0333
Dist. Sh. Pt. Down	32.5	31.0	31.0	32.0	- 1.5	1.0	- .06	.0333
Amt. of Feed Consumed	128		136				5.12	4.53
Diges. Nutrients	92		97.7				3.68	3.25

Factor XIII shows a daily loss in weight of 1.16 pounds and a loss in most of the body measurements. Here lactation may have inhibited growth.

Periods:

Factor XIII - 5/21/10 to 6/15/10.
Factor 12A - 4/ 3/13 to 5/ 3/13.

Group V - Table V

Table Comparing the Growth Made by Factor XXII during Her First Lactation Period, Age 10 mo. 18 days to 11 mo. 18 days, with Open Factor 20A, Age 10 mo. 2 days to 11 mo. 2 days.

	Factor XXII		Factor 20A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	XXII	20A	XXII	20A
Weight	195	193	251	263	- 2	12	-.0714	.3871
Height at Withers	53	54	57	57	1	0	.0357	.0000
Height at Croup	63	64	65	66	1	1	.0357	.0322
Breadth of Shoulders	33	35	35	36	2	1	.0714	.0322
Breadth at Sh. Pts.	28	27	26	26	- 1	0	-.0357	.0000
Breadth of Hams	29	29	32	33	0	1	.0000	.0322
Breadth at Hip Pts.	24	23	26	26	- 1	0	-.0357	.0000
Heart Girth	110	108	120	123	- 2	3	-.0714	.0966
Paunch Girth	123	118	132	130	- 5	-2	-.1785	-.0644
Flank Girth	111	110	121	120	- 1	-1	-.0357	-.0322
Depth of Chest	33	34	36	38	1	2	.0357	.0644
Length of Body	90	94	94	98	4	4	.1428	.1288
Width of Head	16.5	16.5	15	15	0	0	.0000	.0000
Cir. of Shank Bone	16.0	16.5	16	16	.5	0	-.0178	.0000
Cir. of Shin Bone	16.0	17.0	16	16	1.0	0	.0357	.0000
Dist. Elbow Pt. Down	27.0	28.0	27	28	1.0	1	.0357	.0322
Dist. Sh. Pt. Down	29.0	30.0	29	30	1.0	1	.0357	.0322

	XXII	20A	Daily XXII	Daily 20A
Amt. of Feed Consumed	109	219.48	3.89	7.08
Dig. Nutrients	78.37	157.8	2.79	5.09

Lactating Factor XXII lost daily in body weight yet suffered no marked loss in skeletal measurements. Dry Factor 20A made greater daily gains.

Periods:
- Factor XXII - 2/18/11 to 3/18/11.
- Factor XXA - 5/ 6/14 to 6/ 6/14.

Group V - Table VI

Table Comparing Factor LX during Her First Lactation Period, Age 12 mo. 13 days to 14 mo. 9 days, with Factor 20A, Age 12 mo. 2 days to 15 mo. 2 days.

	Factor LX		Factor 20A		Gain		Daily Gain	
	Meas. At Beg.	Meas. at end.	Meas. at Beg.	Meas. at end.	LX	20A	LX	20A
Weight	226	247	285	340	21	55	.3818	.597
Height at Withers	61.5	60	59	63	- 1.5	4	.0272	.0434
Height at Croup	63.5	66	67	70	2.5	3	.0454	.0326
Breadth of Shoulders	33.5	30	36	40	- 3.5	4	-.0636	.0434
Breadth at Sh. Pts.	24.0	21	27	28	- 3.0	1	-.0545	.0108
Breadth of Hams	31.0	28.5	35	37	- 2.5	2	-.0454	.0217
Breadth at Hip Pts.	23.5	23.5	27	29	0.0	2	.0000	.0217
Heart Girth	111.0	114.0	126	143	3.0	17	.0545	.1847
Paunch Girth	125.0	133.0	138	150	8.0	12	.1454	.1304
Flank Girth	100.0	112.0	125	133	12.0	8	.2181	.0869
Depth of Chest	37.0	37.5	38	42	.5	4	.009	.0434
Length of Body	90.0	97.0	98	105	7.0	7	.1272	.076
Width of Head	20.0	17.5	16	17	-2.5	1	-.0454	.0108
Cir. of Shank Bone	17.0	19.0	16.5	18	2.0	1.5	.0363	.016
Cir. of Shin Bone	16.0	17.0	16.0	17	1.0	1.0	.0181	.0108
Dist. Elbow Pt. Down	30.0	31.0	27.0	26	-1.0	-1.0	-.0181	-.0108
Dist. Sh. Pt. Down	32.0	31.5	30.0	28	- .5	-2	.009	-.0217
Amt. of Feed Consumed	383.5		423				6.97	4.59
Dig. Nutrients	275.73		304.1				5.01	3.3

The greater gain in weight was made by dry Factor 20A. There are no marked differences between the two Factors as evidenced by skeletal measurements.

Periods:

Factor LX - 2/26/16 to 4/22/16.
Factor 20A - 7/6/14 to 10/6/14.

Group V - Table VII

Table Comparing Factor LXX during Her First Lactation Period , Age 10 mo. 5 days to 11 mo. 2 days, with Factor XX, Age 10 mo. 18 days to 11 mo. 18 days, Never Pregnant.

	Factor LXX		Factor XX		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	LXX	XX	LXX	XX
Weight	224	239	216	230	15	14	.5356	.5
Height at Withers	60.5	61	55.5	57	.5	1.5	.0178	.05356
Height at Croup	64.0	64.	64.0	65	0.0	1.0	.0000	.0356
Breadth of Shoulders	31.0	32	33.0	34	1.0	1.0	.0356	.0356
Breadth at Sh. Pts.	21.0	23	26.0	27	2.0	1.0	.0714	.0356
Breadth of Hams	29.0	31	31.0	31	2.0	0.0	.0714	.0000
Breadth at Hip Pts.	25.0	26	24.5	23	1.0	-1.5	.0356	-.0535
Heart Girth	110.0	112	112.0	111	2.0	-1.0	.0714	-.0356
Paunch Girth	132.0	130	129.0	126	-2.0	-3.0	-.0714	-.1071
Flank Girth	107.0	110	120.0	115	3.0	-5.0	.1071	-.178
Depth of Chest	37.0	37.5	36.0	35	.5	-1.0	.0178	-.0356
Length of Body	90.0	90.0	90.0	92	0.0	2.0	.0000	.0714
Width of Head	18.0	19.0	17.5	17	1.0	- .5	.0356	-.0178
Cir. of Shank Bone	15.0	15.5	16.5	17.5	.5	1.0	.0178	.0356
Cir. of Shin Bone	15.0	15.5	17.0	18.0	.5	1.0	.0178	.0356
Dist. Elbow Pt. Down	30.0	30.5	29.0	30.0	.5	-1.0	.0178	-.0356
Dist. Sh. Pt. Down	31.0	32.0	30.0	33.0	1.0	3.0	.0356	.1071
Amt. of Feed Consumed	154		112				5.5	4
Dig. Nutrients	110.7		80.5				3.95	2.85

Factor LXX made a slightly greater daily gain in weight, yet received more feed and suckled only one pig.

Periods:

Factor LXX - 12/30/16 to 1/27/17.
Factor XX - 2/18/11 to 3/18/11.

A summary of the tables shows that in only one case was a greater gain made by a lactating sow than a dry gilt, and this amounted to only .03 pounds daily. The exception, Factor 70, Table VII, suckled only one pig and the results cannot be taken as representative of a sow nursing a normal sized litter. In five of the tables the lactating animals show an actual daily loss, and where gains were made, they were very slight.

Another interesting point brought out by the tables is that in every case but one, the lactating animals were smaller than the dry factors, as evidenced by final weights and measurements. The differences in age between the lactating and open sows was so small that the above comparisons can be made. However, some of the tables show the dry factors to be the larger at the time the period began, and in such cases the difference in measurements at the end were not wholly due to the effects of lactation. Conclusive data would involve a large number of comparisons.

Where sufficient differences are present to study the effect of lactation on skeletal growth, it seems quite clear that skeletal growth was greatly retarded, and in some cases may have been completely checked during lactation. It seems quite safe to conclude that:

Where a normal sized litter is suckled, the drain on the mother is usually accompanied by a loss in weight.

The tables show that skeletal growth may be checked by lactation.

It is only through a knowledge of the amount of feed consumed and the number of pigs suckled that an intelligent study of the effect of lactation on growth can be made. Therefore, a discussion of the points mentioned above will be given at the end of the next table.

A COMPARISON OF THE FEED CONSUMED BY PREGNANT AND LACTATING FACTORS

The following table was compiled with the idea of giving an opportunity for a more extensive study of the amount of feed consumed by lactating and open factors, and the gain or loss in weight when a given amount of feed was consmed. The number of pigs suckled is given, since it is probable that there is a relation between the size of the litter and the loss incurred by the mother during lactation.

The periods chosen for comparison are of the same length for both the lactating and the open sows, and in most cases extend throughout the same time of year. The age, in each case, is practically the same for both of the factors. The number of the lactation period, the average weight for the period, the digestible nutrients and the gain or loss in weight are given in each sase. The initial weight for the lactating gilts is the one taken just after farrowing. The number of pigs suckled is the number reared to weaning time. All of the data in this table is taken from the individual weekly weight and feed records.

GROUP VI - TABLE I.

TABLE COMPARING FEED CONSUMED BY LACTATING AND DRY FACTORS.

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LACTATING FACTORS.

Factor	Date	Period	Weight	Feed	Dig. Nut.	Dig.Nut. Per M#.	Gain	No. of Pigs.
V	3/18/10-5/25/10	2nd	259	398	286.15	1104.7	- 35	5
V	9/10/10-11/16/10	3rd	290	470	337.95	1165.4	5	5
VI	2/24/10-5/4/10	2nd	213.9	467	335.75	1569.4	- 45	8
XI	4/18/10-6/15/10	1st	187	237	170.4	911.2	- 11	3
XIII	5/14/10-7/20/10	1st	162	361	259.6	1602.4	- 22	5
XIV	3/31/10-6/ 8/10	1st	162	366	263.16	1624	0	5
XIV	10/12/10-12/14/10	2nd	222	420	302	1360.4	- 6	7
XXXI	3/10/13-5/10/13	1st	253	559	401.9	1589	- 13	7
XXXI	9/7/13-11/8/13	2nd	263	443	318.5	1211	- 41	3
XXXI	6/10/14-8/15/14	3rd	337	475	341.5	1013.5	- 42	6
XXX	8/9/13-11/8/13	2nd	286	659	473.8	1656.6	-100	8
XL	3/18/14-5/21/14	1st	283	613	440.7	1557.2	- 42	6
XL	2/25/15-4/25/15	2nd	312	387.8	278.8	893.6	5	4
L	2/13/15-4/17/15	1st	290	469	337.2	1162.8	4	6
LI	2/25/16-4/23/16	1st	260	471	338.65	1302.5	21	7
LXX	12/25/16-2/17/17	1st	237	295	212.2	895.4	26	1
LXXX	10/23/17-12/15/17	1st	311	456	355.2	1142.1	15	2
Total			4327.9	7546.8	5453.46	21761.2	-281	
Averages			254.5	443.5	320.8	1280.1	- 16.5	

DRY FACTORS.

Factor	Date	Weight	Feed	Dig. Nut.	Dig.Nut. Per M#	Gain
VIII	3/18/10-5/25/10	327.6	183	131.6	401.7	11
VIII	9/10/10-11/16/10	410	237	170.5	415.9	5
IV	2/24/10-5/4/10	316	277.8	199.75	631.9	29
XIA	4/18/12-6/15/12	266.2	321.5	231.2	868.3	57
XIIIA	5/14/10-7/20/10	298.6	236.6	170.05	569.1	6
XIIA	3/31/13-6/ 8/13	231	282.6	203.2	879.6	27
XIIA	8/26/13-10/28/13	275	317.6	228.3	830.2	50
XIIB	7/18/12-9/18/12	244.5	333.9	232.9	952.6	15
XIIB	1/16/13-3/17/13	274.4	319	229.4	836	16
XIIB	10/18/13-12/23/13	319.3	232	166.8	522.6	- 38
XXIA	8/9/14-11/8/14	327	447.8	322	984.7	14
XIIIB	3/18/12-5/21/12	149.2	329	236.6	1585.8	68
XIIIB	8/12/13-10/12/13	374	219	157.4	421	28
XXA	3/21/14-5/23/14	233.6	435.6	313.15	1342	56
III	11/9/09-1/8/10	233.7	223	167.5	716.8	12
XIIIA	12/25/12-2/17/13	214.5	327	235.15	1161.3	56
VII	10/23/09-12/15/09	262.5	167	120.1	457.5	27
Total		4757.1	4889.4	3515.6	13577	439
Averages		279.8	287.6	206.8	798.6	25.8

The table shows that the lactating factors lost, on the average, 16.5#s, while the dry factors over a similar period of time made an average gain of 25.8#s. The lactating gilts lost in weight in spite of the fact that they received on the average 1280.07 #s of digestible nutrients per 1000 #s live weight for the period under consideration. The dry factors received on the average 798.6 #s of digestible nutrients, or in other words, on 481.5 #s less of digestible nutrients per 1000 #s live weight the dry factors show an advantage over the lactating factors of 42.3 #s per head.

In the few cases where the lactating factors made gains, small litters were suckled. Factor LI is an exception to this statement; for while suckling a litter of seven she made a gain of 21 pounds. However, it may be that if a sufficient number of comparisons could be made it would be found that except where individuality played a large part, the loss in weight would be closely associated with the size of the litter. This table gives some evidence of such a correlation. The average weight for the lactating group was 252.9 pounds and the average for the dry animals was 279.4 pounds.

The table brings out another point that needs further investigation, namely, does an animal consume more feed and lose more in weight during the first lactation period than during successive ones? Only a few cases are

given here. In the first instance Factor XIV, on less feed during the second lactation period, suckled two more pigs, and yet lost only six pounds more in weight than during the first period. Factor XXXI during her second period lost 28#s more than during the first, while suckling three pigs instead of seven. Factor XL on much less feed showed a smaller loss by 47#s during the second period than during the first; yet she suckled only four pigs, compared with six in the first period. Another point worthy of note, which will be taken up later, is that gains of any significance were made by the later generations.

The loss during lactation was often so plainly evident that the eye could follow it from day to day. As shown by the second table, the loss was more marked in some cases than in others. Why one factor will gain when suckling a litter, and another of practically the same age and with similar previous treatment lost weight, when suckling a litter comparable in size to the first, must for the present go unanswered. The same sow may show a gain in one period and a loss in another. Factor XXXI, during her third lactation period on considerably less feed, suckled twice as many pigs and yet lost only one pound more than during the preceding period. Here, however, the difference in age and maturity may furnish an explanation. The more immature the animal, the greater the drain caused by lactation and the smaller the amount of feed given the more pronounced are the ill effects.

Generally speaking, lactation was accompanied by a marked loss on the part of the mother. The drain on the parent begins with parturition and becomes heavier as the pigs grow older and require more milk. Yet where gains have been made in the experiment, they were in the latter part of the period. An explanation of this fact may be that an animal stores up food during pregnancy and not until the reserve is used up does the animal begin to use its daily food supply for milk production and the renewal of its body tissues. Another explanation may be that the mother, in time, becomes

accustomed to the drain and so regulates her metabolism that she may produce milk more economically. If sufficient food is not given, the loss continues throughout lactation, and if allowed to proceed further, an emaciated condition of the animal results.

Another factor influencing the weight lost by the mother is the number of pigs in the litter. A sow gives milk from only as many teats as there are pigs in the litter, and the quantity given may be greatly decreased in the case of a small litter. If the pigs can be induced to eat for themselves during the latter part of the period, the drain on the mother would be materially decreased.

Although not shown in the tables, other things being equal, we can expect a greater loss in a young gilt than a mature sow. Since pregnancy has been shown not to retard growth, the reason for animals bred at an early age never reaching full size for the species may be due to the drain on the mother caused by the nursing of a litter. It has been found that cows bred at an early age never reach the size of those bred at a more mature age. These facts may indicate that the effects of lactation are more severe in the case of the young mother, and that it may not only check growth for the time being, but may permanently dwarf the animal.

The sow furnishes by far the larger part of the nutrients needed for growing the litter until the time of weaning. The milk constituents and as far as possible,

the milk yield is kept constant, even at the expense of the maternal tissues. Milk is very rich in those nutrients needed for growth, and in supplying these to the young through the milk, the mother may not have a sufficient supply left to sustain the growth of her own body. Milk is rich in the so called "vitamines" - both the Fat Soluble A and the Water Soluble B having been found in appreciable quantities in milk. Also, the coefficient of digestibility for various reasons may be lowered during lactation. However, data is stillwanting on this point; the results at present lead ng only to confusing and conflicting statements.

The results set forth in these tables will hold good only when the animal received liberal amounts of a ration so balanced as to meet body requirements and at the same time supply the nutrients needed for milk production. Theloss during lactation would be even more marked if the animal was poorly fed.

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS.

The tables in group VII give the average weight, the amount of feed consumed, the length of the periods and the gain or loss in weight during successive gestation and lactation periods.

The average weight for the gestation period was determined by taking the weight nearest to the beginning of the period as the initial weight and the weight just before farrowing as the final weight. The initial weight for the lactation period was taken just after parturition.

The feed consumed during pregnancy is expréssed as digestible nutrients per 1000 pounds live weight. Owing to the difference in length of the lactation periods, the amount eaten by the sow while suckling the litter is given in terms of pounds per 1000 pounds live weight per day. The gain during pregnancy represents the difference between the initial weight and the weight taken just before farrowing. The loss during lactation is the difference between the weight just after parturition and the weight taken nearest to the end of the period.

The loss during farrowing covers the week in which the sow farrowed, only weekly weights having been taken. The time of year during which the periods occurred is also given. 11/13/09-2/24/10 expresses the period from November 3rd, 1909 to February 24th, 1910.

IMMATURE GROUP.

GROUP VII - TABLE I.

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS.

PREGNANT.											LACTATING.									
Factor	Date	Period	Wt.	Feed.	Dig. Nut.	Per M# Live Wt	Gain	Farr'ing Loss	Days Period	Factor	Date	Period	Wt.	Das. in Period	Feed	Dig. Nut.	Per M# Live Weight	Per M# Per Da.	Gain.	Litter
VI	11/3/09-2/24/10	2nd	226	473	340.1	1504.8	73	33	112	VI	2/24/10-5/4/10	2nd	214	69	467	335.75	1569	22.73	- 45	8
VI	6/2/10-9/25/10	3rd	247	460	330.75	1338.8	104	+23	112	VI	9/25/10-11/23/10	3rd	292	59	411	295.5	1012	17.15	- 6	4
VI	12/12/10-4/3/11	4th	319	519	373.2	1169.9	65	28	112	VI	4/3/11-6/3/11	4th	262	61	294	211.4	806.87	13.22	-116	7
VI	6/6/11-9/26/11	5th	253	527.6	379.4	1499.4	121	23	115	VI	9/26/11-12/2/11	5th	298	67	483	347.25	1165.27	17.39	- 6	4
VI	12/13/11-4/2/12	6th	304	604	434.3	1428.6	59	17	111	VI	4/2/12-6/8/12	6th	329	67	527	378.9	1151.7	17.18	20	3
VI	12/23/12-4/16/13	8th	361	641	460.9	1276.7	58	17	114	VI	4/16/13-6/14/13	8th	348	59	658	473.1	1359.5	23.04	- 57	8
VI	6/21/13-10/13/13	9th	340	582	418.5	1230.9	83	0	114	VI	10/13/13-12/6/13	9th	354	54	464	333.65	942.5	17.45	- 64	6
VI	12/10/13-4/3/14	10th	354	783	563	1590.4	82	35	114	VI	4/3/14-5/30/14	10th	379	57	524	376.75	994	17.44	2	6
V	11/24/09-3/18/10	2nd	265	530	381.1	1438.1	60	28	114	V	3/18/10-5/25/10	2nd	259	68	398	286.15	1104	16.23	- 35	5
V	5/30/10-9/10/10	3rd	293	258.5	193	658.7	85	37	113	V	9/10/10-11/16/10	3rd	290	67	470	337.95	1165.2	17.39	5	3
V	12/9/10-3/31/11	4th	318	495	355.9	1119.1	59	29	112	V	3/31/11-6/3/11	4th	269	64	310	222.85	828.4	12.94	- 84	5
V	6/7/11-9/27/11	5th	280	525	377.45	1348	110	+ 4	114	V	9/27/11-12/2/11	5th	312	66	480	345.1	1106.1	16.76	- 33	3
V	1/10/12-5/3/12	6th	326	619	445.05	1365.2	66	20	112	V	5/3/12-6/29/12	6th	351	57	522	375.35	1069.4	18.76	- 12	7
V	1/26/13-5/21/13	7th	389	624	448.65	1153.4	49	1	115	V	5/21/13-7/27/13	7th	383	67	285	204.92	535.1	7.98	- 64	4
XI	12/26/09-4/18/10	1st	172	478	343.65	1998	86	18	113	XI	4/18/10-6/15/10	1st	187	58	237	170.4	911.2	15.71	- 11	3
XI	6/23/10-10/15/10	2nd	222	520	373.9	1684.2	84	22	114	XI	10/15/10-12/14/10	2nd	239	60	414	297.7	1245.6	20.76	5	5
XI	12/14/10-3/22/11	3rd	241	447	321.4	1333.6	12	24	119	XI	3/22/11-5/6/11	3rd Litter Died.								
XI	6/6/11-9/28/11	4th	246	534.6	384.35	1562.4	97	42	114	XI	9/28/11-12/2/11	4th	235	65	475	341.5	1453.2	22.35	- 35	6
XI	12/13/11-4/5/12	5th	257	620	445.75	1734.4	61	16	114	XI	4/5/12-6/8/12	5th	240	64	571	410.55	1710.4	26.72	- 7	7
XI	6/14/12-10/7/12	6th	253	530	381	1505.9	41	26	115	XI	10/7/12-12/7/12	6th	261	61	583	419.2	1606.1	26.33	4	6
XI	12/30/12-4/22/13	7th	278	706	507.6	1826	55	15	113	XI	4/22/13-6/14/13	7th	282	53	572	411.25	1458.3	27.51	- 21	7

GROUP VII - TABLE I (CONTINUED)

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS

PREGNANT.										LACTATING.										
Factor	Date	Period.	Wt.	Feed.	Dig. Nut.	Per M# Live Wt.	Gain.	Far'ing Loss	Days Period	Factor	Date.	Period	Wt.	Days Period	Feed	Dig. Nut.	Per M# Live Weight	Per M# Per Day	Gain.	Litter.
XI	12/11/13-4/3/14	8th	339	779	560	1651.9	57	27	113	XI	4/3/14-5/30/14	8th	334	57	524	376.75	1127.9	19.78	- 40	6
XIII	1/22/10-5/14/10	1st	176	480	345.1	1960.8	87	28	112	XIII	5/14/10-7/20/10	1st	162	67	361	259.6	1602.5	23.91	- 22	5
XIV	12/7/09-3/31/10	1st	155	451	324.25	2092	107	26	114	XIV	3/31/10-6/8/10	1st	162	69	366	263.15	1624.5	23.54	0	5
XIV	6/22/10-10/12/10	2nd	242	523	376	1553.6	97	34	112	XIV	10/12/10-12/14/10	2nd	222	63	420	302	1360.3	21.59	4	7
XIV	1/22/11-4/26/11	3rd	---	---	---	----	8	2	119	XIV	No lactation period.									
XVI	5/29/10-9/25/10	1st	295	354	254.55	863	77	-	114	XVI	9/26/10-12/14/10	1st	282	79	596	428.5	1519.5	19.23	- 21	4
XXII	10/11/10-2/3/11	1st	180	488	350.85	1949	16	30	111	XXII	No lactation period.									
XXII	3/17/11-7/6/11	2nd	202	352	253.1	1253	49	33	111	XXII	No lactation period.									
XXII	12/12/11-4/1/12	3rd	303	559	401.9	1322	36	39	111	XXII	4/1/12-6/8/12	3rd	290	68	528	379.6	1309	19.25	- 31	4
XXII	6/12/12-10/1/12	4th	310	517	371.7	1187.5	101	28	111	XXII	10/1/12-12/7/12	4th	293	67	644	463.5	1580.5	23.59	- 49	9
XXII	12/15/12-4/6/13	5th	309	691	496.8	1608	70	14	114	XXII	4/6/13-6/7/13	5th	317	62	717	515.25	1625.5	26.21	- 42	8
XXII	6/15/13-10/7/13	6th	322	624	448.7	1393.3	138	47	111	XXII	10/7/13-12/6/13	6th	289	60	662	475.95	1646.9	27.43	- 65	7
XXII	12/9/13-3/31/14	7th	341	729	524.2	1537.2	74	22	112	XXII	3/31/14-5/30/14	7th	364	60	535	384.65	1056.8	17.44	- 25	4
XXII	6/14/14-10/4/14	8th	390	565	406.25	1041.8	81	16	113	XXII	10/4/14-12/5/15	8th	361	62	436	313.5	868.4	14.00	- 51	7
XXII	12/9/14-4/1/15	9th	393	617	443.6	1128.8	91	62	112	XXII	4/1/15-5/22/15	9th	390	51	346	248.75	637.8	12.49	- 50	4
XXII	7/20/15-11/9/15	10th	409	491	353	863.1	71	34	114	XXII	11/9/15-1/8/16	10th	411	60	453	325.7	792.4	13.2	- 24	5
XXII	3/6/16-6/28/16	11th	462	555	399.05	863.8	122	19	116	XXII	No lactation period.									
XXX	10/1/12-1/25/13	1st	226	514.8	370.15	1637.8	72	40	110	XXX	No lactation period.									
XXX	4/21/13-8/9/13	2nd	333	345	248	744.7	37	22	112	XXX	8/9/13-11/8/13	2nd	286	91	659	473.8	1656.8	18.20	-100	8
XXX	9/13/14-1/3/15	3rd	439	610.9	439.15	1300.2	48	17	110	XXX	No lactation period.									
XXX	2/9/15-5/30/15	4th	406	648	465.95	1015.5	48	17	110	XXX	5/30/15-7/31/15	4th	425	62	374	268.9	632.7	10.20	- 42	4
XXX	8/7/15-11/23/15	5th	434	613	440.7	1147.7	62	15	119	XXX	No lactation period.									
XXXI	11/16/12-3/10/13	1st	244	517	371.7	1523.5	97	26	114	XXXI	3/10/13-5/10-13	1st	253	61	559	401.95	1588.7	26.04	- 13	7
XXXI	5/15/13-9/7/13	2nd	251	585	420.6	1675.8	60	20	115	XXXI	9/7/13-11/8/13	2nd	263	62	443	318.5	1211	19.53	- 41	3

GROUP VII - TABLE I (CONTINUED)

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS.

PREGNANT.										LACTATING.										
Factor	Date	Period	Wt.	Feed.	Dig. Nut.	Per M# Live Weight	Gain.	Farrowing Loss	Days period	Factor	Date.	Period.	Wt.	Days Period.	Feed	Dig. Nut.	Per M# Live Weight	Per M# per day	Gain.	Litter.
XXXI	2/16/14-6/10/14	3rd	348	819.9	589.6	1694.5	66	2	114	XXXI	6/10/14-8/15/14	3rd	337	66	475	341.5	1013.4	15.35	- 42	6
XXXI	12/9/14-3/31/15	4th	376	609	437.8	1164.4	15	5	112	XXXI	3/31/15-6/5/15	4th	361	66	334	240.15	665.2	10.8	- 45	1
XXXI	6/22/15-10/12/15	5th	358	549.9	395.3	1104.2	56	26	112	XXXI	10/12/15-12/7/15	5th	321	56	477	342.95	1068.3	19.07	- 72	7
XXXI	5/31/16-9/22/16	6th	485	295	212.1	437.35	- 7	15	113	XXXI	No lactation period.									
XXXI	6/11/17-10/5/17	7th	546	349-B	288.62	528.6	48	20	116	XXXI	10/5/17-12/1/17	7th	538	57	546-A	425.3	790.5	13.87	- 10	3
XL	11/22/13-3/18/14	1st	247	751	539.95	2186	117	15	116	XL	3/18/14-5/21/14	1st	283	64	613	440.7	1557.5	24.33	- 42	6
XL	11/2/14-2/25/15	2nd	349	513.7	369.45	1058.8	-12	7	115	XL	2/25/15-4/25/15	2nd	312	69	387.8	278.8	893.6	15.14	5	4
XL	6/18/15-10/10/15	3rd	328	565	406.2	1238.5	10	25	114	XL	10/10/15-12/7/15	3rd	323	58	503	361.65	1119.6	19.3	12	3
XL	12/11/15-4/5/16	4th	377	1018	731.94	1941.5	95	21	116	XL	4/5/16-5/31/16	4th	384	56	709	509.7	1327.3	23.7	- 47	7
XL	6/7/16-9/30/16	5th	361	341	245.15	679.1	16	19	114	XL	9/30/16-11/25/16	5th	315	56	441	317.1	1006.6	17.97	- 77	7
XL	12/1/16-3/26/17	6th	300	90-C 318.5sr	433	1441.8	113	25	115	XL	3/26/17-5/22/17	6th	358	57	799	574.5	1604.7	28.14	35	8
L	10/20/14-2/13/15	1st	221	705	506.9	2293.6	115	+ 5	116	L	2/13/15-5/1/15	1st	290	77	469	337.2	1152.8	15.1	15	2
L	5/10/15-8/31/15	2nd	330	687	493.9	1496.8	22	17	115	L	No lactation period.									
L	10/1/15-1/22/16	3rd	373	707	508.3	1362.6	20	23	113	L	1/22/16-3/18/16	3rd	364	55	436.5	313.85	862.2	15.67	- 79	5
L	12/15/16-4/8/17	4th	411	425-2 164-C	415.3	1010.4	54	26	115	L	4/8/17-6/4/17	4th	401	57	571	410.55	1023.8	17.96	- 42	9
L	6/11/17-10/1/17	5th	427	678-B	551.38	1291.05	132	33	112	L	10/1/17-11/30/17	5th	441	60	578	415.6	942.4	15.7	- 49	6
LI	1/13/15-5/6/15	1st	234	643	462.3	1975.5	112	21	113	LI	5/6/15-7/24/15	1st	260	79	471	338.65	1302.5	16.48	- 33	2
LX	11/4/15-2/25/16	1st	234	624	448.65	1917.3	80	31	113	LX	2/25/16-4/23/16	1st	233	57	393	282.55	1212.7	21.27	21	7
LX	6/4/16-9/25/16	2nd	283	345	248.05	876.3	32	16	113	LX	9/25/16-11/21/16	2nd	279	57	381	273.93	981.7	17.22	- 17	5
LX	11/25/16-3/19/17	3rd	291	560-SR 480-6A	439.47	1510.2	--	35	114	LX	3/19/17-5/14/17	3rd	336	56	746-A 8.5-B	588.16	1750.5	31.26	31	7
LX	5/19/17-9/13/17	4th	375	738-B 6-A	615.83	1642.1	123	9	117	LX	9/13/17-11/19/17	4th	404	57	385.5A	301.3	745.8	13.08	- 26	4
LXX	9/3/16-12/25/16	1st	204	632	454.4	2227.5	79	9	113	LXX	12/25/16-2/17/17	1st	237	54	395	212.2	895.4	16.58	26	1
LXX	2/21/17-6/15/17	2nd	314	102-2 262.5C 19.5-B	409.98	1305.6	126	36	114	LXX	6/15/17-8/11/17	2nd	293	57	526.5A	410.14	1399.6	24.55	- 67	10
LXXX	7/2/17-10/23/17	1st	256	618.5B	512.2	2000.8	143	28	113	LXXX	10/23/17-12/15/17	1st	311	53	7-B 449-A	355.56	1143.08	21.56	15	2

HALF MATURE GROUP.

GROUP VII - TABLE II.

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS.

PREGNANT.										LACTATING.										
Factor	Date	Period.	Wt.	Feed	Dig. Nut.	Per M# Live Weight	Gain.	Farr'ing Loss	Days Period	Factor	Date	Period.	Wt.	Days Period.	Feed	Dig. Nut.	Per M# Live Weight	Per M# per Day	Gain.	No. Pigs Litter.
III	5/27/10-9/19/10	1st	327	244	175.45	536.6	55	15	115	III	9/19/10-11/16/10	1st	307	58	386	277.5	904	15.58	- 45	6
III	2/21/11-6/13/11	2nd	327	380	273.2	835.5	34	30	112	III	No lactation period.									
III	1/7/12-4/28/12	3rd	425	606	435.7	1025.3	93	58	112	III	4/28/12-6/29/12	3rd	399	62	402	289.05	724.4	11.68	- 61	5
III	7/3/12-10/24/12	4th	388	504	366	943.3	113	53	113	III	10/24/12-12/21/12	4th	357	58	421	302.7	847.9	14.61	- 52	7
III	12/23/12-4/15/13	5th	373	716	514.8	1380.3	84	50	113	III	4/15/13-6/15/13	5th	352	61	676	486	1380.5	22.63	- 46	8
III	6/21/13-10/9/13	6th	369	608	437.15	1184.8	120	5	110	III	10/9/13-12/6/13	6th	407	57	514	369.6	908.2	15.93	- 10	3
III	11/26/13-3/19/14	7th	417	754	542.05	1300	68	28	113	III	3/19/14-5/23/14	7th	419	65	586	421.35	1005.8	15.47	- 53	6
VII	7/23/10-11/15/10	1st	393	336	241.6	614.8	66	26	115	VII	11/15/10-1/14/11	1st	387	60	297	213.5	551.7	9.18	- 46	2
VII	1/23/11-5/17/11	2nd	367	432	310.6	846.3	56	--	114	VII	5/17/11-7/19/11	2nd	306	63	341	245.15	801.2	12.71	- 90	7
XI-A	9/17/12-1/8/13	1st	400	260	186.95	467.5	46	47	113	XI-A	1/8/13-3/8/13	1st	372	59	219	157.45	423.3	7.17	- 37	1
XI-A	3/13/13-7/4/13	2nd	377	437	314.2	833.5	44	4	113	XI-A	7/4/13-9/13/13	2nd	359	71	593	426.4	1187.8	16.73	- 50	4
XI-A	11/6/13-2/28/14	3rd	388	645	463.8	1195.25	117	30	114	XI-A	2/28/14-5/2/14	3rd	325	63	683	491	1510.8	23.98	-120	9
XI-A	5/2/14-8/24/14	4th	360	685	492.48	1368	145	30	114	XI-A	8/24/14-10/24/14	4th	341	61	616	442.9	1298.8	21.28	-107	8
XI-A	11/3/14-2/24/15	5th	373	777	558.65	1497.7	148	25	113	XI-A	No lactation period.									
XII-A	10/28/13-2/19/14	1st	326	603	433.55	1330	40	--	114	XII-A	2/19/14-4/22/14	1st	328	62	755	542.9	1655	26.69	- 5	3
XII-A	4/28/14-8/22/14	2nd	345	711	511.1	1481.3	69	42	116	XII-A	8/22/14-10/24/14	2nd	284	63	630	453	1595	25.31	- 96	8
XIIIA	10/28/13-2/20/14	1st	378	609	437.85	1158.3	68	30	115	XIIIA	2/20/14-4/25/14	1st	370	64	762	547.9	1481	23.14	- 51	8
XIIIA	4/28/14-8/20/14	2nd	363	695	499.65	1376.3	76	30	114	XIIIA	8/20/14-10/24/14	2nd	336	65	639	459.5	1367.5	21.03	- 91	8
XX-A	1/14/15-5/6/15	1st	394	611	439.3	1115	80	35	113	XX-A	5/6/15-7/10/15	1st	382	65	400	287.6	752.9	11.58	- 60	6

MATURE GROUP

GROUP VII -- TABLE III.

AVERAGE WEIGHT AND FEED CONSUMED DURING SUCCESSIVE PREGNANT AND LACTATION PERIODS.

PREGNANT.											LACTATING.										
Factor	Date	Period.	Wt.	Feed	Dig. Nut.	Per M# Live Weight	Gain.	Farring Loss	Days Period	Factor	Date.	Period.	Wt.	Days Period.	Feed	Dig. Nut.	Per M# Live Weight	Per M# per Day	Gain.	No. Pigs Litter
IV	9/25/10-1/14/11	1st	362	420	301.9	833.98	88	33	112	IV	1/14/11-3/18/11	1st	325	63	243	174.7	537.6	8.53	- 67	1
IV	4/18/11-8/11/11	2nd	308	368	264.6	859.1	55	--	114	IV	8/11/11-10/14/11	2nd	305	64	472	339.4	1112.3	17.38	- 88	8
IV	1/11/12-5/4/12	3rd	323	614	441.46	1366.7	64	--	113	IV	5/4/12-6/29/12	3rd	347	56	371	266.7	768.6	13.72	- 8	3
IV	7/5/12--10/30/12	4th	338	526	378.2	1119	69	41	117	IV	10/30/12-12/21/12	4th	319	52	425	305.55	957.8	18.41	- 36	5
IV	2/5/13-6/1/13	5th	347	743	534.2	1539.5	122	15	116	IV	6/1/13-7/26/13	5th	373	55	532	382.5	1025.5	18.64	- 40	3
VIII	5/2/11-8/25/11	1st	460	443	318.5	692.4	74	56	115	VIII	8/25/11-10/28/11	1st	458	64	424	304.85	665.6	14	2	3
VIII	1/17/12-5/10/12	2nd	467	595	427.8	916.1	91	60	114	VIII	5/10/12-6/29/12	2nd	458	50	241	173.25	378.3	18.9	- 34	3
VIII	7/3/12-10/27/12	3rd	452	484	347.95	769.9	71	53	116	VIII	10/27/12-12/21/12	3rd	395	55	434	312.05	790	14.36	- 57	7
VIII	12/25/12-4/19/13	4th	483	675	485.25	1004.7	133	+ 5	115	VIII	4/19/13-6/14/13	4th	427	66	643	462.3	1082.8	16.4	- 46	4
VIII	7/17/13-11/7/13	5th	461	548	394	854.7	73	8	113	VIII	No lactation period.									
VIII	11/22/13-11/7/13	6th	503	711	511.2	1016.5	111		115	VIII	Record incomplete.									
XIIB	2/13/14-6/6/14	1st	353	828	595.4	1686.8	46	0	112	XIIB	Record incomplete.									
XIIIB	2/19/14-6/13/14	1st	464	789	567.25	1222.5	39	20	112	XIIIB	Record incomplete.									

In almost every case gains were made during pregnancy. Lactation was usually marked by a loss in weight. The highest average weight generally occurred during the gestation period; but there are some exceptions in which the highest average weight is to be found in the lactation period.

The loss during the week of farrowing seems to bear little or no relation to the gain during the period of gestation. In other words, a large gain during gestation is not followed by an abnormal loss in weight during the week of farrowing. In some instances an actual gain was made; but in such cases the number in the litter was small. Where a sow was weighed shortly before and after farrowing a litter of ten pigs the loss in body weight was found to be 24 #s. Further evidence must be forthcoming before any definite statements can be made regarding the loss in weight of the mother at farrowing time.

Other things being equal, the loss in weight while suckling might be expected to be associated with the number in the litter. Table I in Group VIII is a summary of the preceding table so arranged as to furnish information on this point.

(Group VIII) Table I

No. in litter	Average Wt. lost by the mother	No. of litters considered	Average amount of feed consumed
3	-11.77	13	1039.7
4	-30.00	12	981.4
5	-31.4	10	1072.3
6	-38.5	11	1118.1
7	-45.0	15	1170.8
8	-65.7	11	1459.3
9	-70.3	3	1381.3

The table is self-explanatory, the larger the size of the litter the greater the loss in weight by the mother, and generally speaking as the size of the litter increased the greater the amount of feed the mother consumed. Too much emphasis must not be placed on these figures; since averages furnish the only basis for making such comparisons. Although the tables by no means furnish conclusive proof, they suggest that the loss in weight during lactation may be related to the number in the litter. In this table individuality and previous treatment are important points to consider.

The following table gives a comparison of the amount of feed consumed and the gains made during pregnancy by the original factors and the different generations in the immature group.

(Group VIII) Table II.

Factor	Amount of feed consumed	Gain during period	No. of periods
V	1380	80.6	8
VI	1180.4	71.5	6
XI	1662.05	61.62	8
XXII	1286.1	77.1	9
XXX	1069.1	53.4	5
XXXI	1189.8	55.83	6
XL	1424.3	56.5	6
L	1450.8	68.6	5
LX	1486.47	78.3	4

Table II seems to indicate that the later generations have consumed more feed than did the original factors. The gains made by factors in the later generations are with a few exceptions less than those made by the original stock. This table has only a limited value and at the best merely serves to bring out the points mentioned above.

Table III deals with the feed consumed and the losses incurred by the factors in the immature group during the period of lactation. The amount of feed is expressed in terms of pounds per 1000#s per day.

(Group VIII) Table III

Factor	Amount of feed consumed	Loss in weight	No. of periods
V	18.2	-34	8
VI	15.01	-37.16	6
XI	22.75	-15.5	7
XXII	19.2	-42.12	8
XXX	14.2	-72.0	2
XXXI	17.44	-37.16	6
XL	21.43	-19.0	6
L	16.18	-38.75	4
LX	21.2	2.25	4

In most cases the later generations have consumed greater amounts of feed, yet the figures given vary so widely that no definite results can be obtained, from such comparisons.

Table IV, Group VIII, gives a comparison of the amount of feed consumed by the factors in the immature group during succeeding gestation and lactation periods.

(Group VIII) Table IV.

No. of Period	Feed consumed during Gestation period	Feed consumed during Lactation period
1st period	1817.1	20.34
2nd period	1326.5	19.55
3rd period	1273.2	19.33
4th period	1312.5	16.42
5th period	1301.5	19.97
6th period	1262.01	23.57
7th period	1269.04	15.91
8th period	1323.1	18.94

Only the immature group was used in this table since if there is any difference in the amount of feed consumed during successive periods it must be due to a lack of maturity. Besides food requirements for maintenance and for the litter, in either intra uterine or ex uterine life, the mother needs nourishment for body growth; and this may be provided for by the extra food consumption during the early periods. The most feed per 1000#s live weight was consumed during the first gestation period, and with one exception this statement will hold for the lactation periods.

When a comparison was made of the groups it was found that the most feed per 1000#s live weight was con-

sumed by the immature factors both while pregnant and when suckling a litter. There was no marked difference in the gains or losses of either of the groups. The difference in age favors the half mature groups; but gain and loss in weight vary with previous treatment and the individuality of the animals.

The difference in weight must be considered in these comparisons. The sows were smaller during the first gestation and lactation periods; and therefore the amount of feed consumed per 1000#s live weight was larger than where the average weight was higher, as was the case with the older sows. On the other hand the actual amount of feed consumed was generally greater for the older sows.

THE EFFECT OF PREGNANCY AND LACTATION COMBINED ON GROWTH

Since the effects of pregnancy and lactation on growth have been studied separately, the next step in the problem is to determine what will be their combined effect on growth. Does an animal that has been bred make as rapid growth, and attain the same size as one that has never been pregnant and undergone the drain of a lactation period?

Many practical men have held the opinion that early breeding stunts growth. If such is the case, the animal is either retarded in its growth by the cumulative effects due to continued breeding, or the growth during dry periods is not sufficiently rapid to compensate for the ill effects of suckling a litter.

If the power to grow is not lost unless exercised then it would be reasonable to believe that through increased gains during dry periods following lactation, the sow would eventually reach normal size.

The tables in group IX are comparisons, during dry periods, between gilts that have never been bred and sows that have just previously weaned their litters. The sows in most cases were bred shortly after the weaning of the litter, leaving few opportunities for comparison. The tables were derived by the methods previously described, and all measurements are given in centimeters, while weights are expressed in pounds.

Group IX - Table I

Table Comparing Factor XVI After Her First Lactation Period, Age 17 mo. 15 days to 20 mo. 12 days, With Factor IV, Age 16 mo. 7 days to 20 mo. 13 days, and Never Pregnant.

	Factor XVI		Factor IV		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	XVI	IV	XVI	IV
Weight	275	253	255	321	-22	66	-.2417	.5238
Height at Withers	62	62	64.5	66.5	0	2	.0000	.0158
Height at Croup	69	69	70.0	74.0	0	4	.0000	.0316
Breadth of Shoulders	38	36	35.0	38.0	- 2	3	-.0219	.0238
Breadth at Sh. Pts.	28	30	32.0	35.5	2	3.5	.0219	.0277
Breadth of Hams	32	31	32.0	35.5	- 1	3.5	-.0109	.0277
Breadth at Hip Pts.	22.5	25	29.0	32.0	2.5	3.0	.0274	.0238
Heart Girth	122.0	115	124.0	138.0	- 7.0	14.0	-.0769	.1111
Paunch Girth	139.0	128	132.0	144.0	-11.0	12.0	-.1208	.095
Flank Girth	123.0	117	127.0	134.0	- 6.0	7.0	-.0659	.0555
Depth of Chest	39.0	49	40.5	44.0	10.0	3.5	.1098	.0277
Length of Body	94.0	100	94.0	106.0	6.0	12.0	.0659	.095
Width of Head	18.0	17	13.0	13.0	- 1.0	0.0	-.0109	.0000
Cir. of Shank Bone	17.0	18.5	16.0	16.5	1.5	.5	.0164	.0039
Cir. of Shin Bone	17.0	19.0	17.0	16.0	2.0	1.0	.0219	.0079
Dist. Elbow Pt. Down	29.0	31.0	30.0	33.0	2.0	3.0	.0219	.0238
Dist. Sh. Pt. Down	33.0	33.0	34.0	36.0	0.0	2.0	.0000	.0158
Amt. of Feed Consumed	610.3		524.6				6.7	4.05
Diges. Nutrients	438.8		377.1				4.82	2.99
Av. Wt. for Period	269.8		301.2					

Periods:

Factor XVI - 11/12/10 to 2/11/11.
Factor IV - 1/ 8/10 to 5/14/10.

Group IX - Table II

Table Comparing Factor XXX during a Dry Period Following Her Second Lactation Period, Age 21 mo. to 27 mo., with Factor VIII, Age 21 mo. 13 days to 29 mo. 11 days, and Never Pregnant.

	Factor XXX		Factor VIII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end.	XXX	VIII	XXX	VIII
Weight	300	385	340	428	85	88	.4696	.3636
Height at Withers	60	63	66.5	70	3	3.5	.0165	.0144
Height at Croup	70	71	76.0	78	1	2.0	.0055	.0082
Breadth of Shoulders	37	42	39.0	44	5	5.0	.0276	.0206
Breadth at Sh. Pts.	29	28	35.0	34	-1	-1.0	-.0055	-.0041
Breadth of Hams	31	35	36.0	40	4	4.0	.0220	.0164
Breadth at Hip Pts.	25	26	32.0	34	1	2.0	.0055	.0082
Heart Girth	130	140	142.0	146	10	4.0	.055	.0164
Paunch Girth	142	148	153.0	167	6	14.0	.033	.0578
Flank Girth	128	127	143.0	147	- 1	4.0	-.0055	.0082
Depth of Chest	37	42	43.5	48	5	4.5	.0276	.0185
Length of Body	104	104	104.0	110	0	6.0	.0000	.0247
Width of Head	18	19	14.5	22	1	7.5	.0055	.0309
Cir. of Shank Bone	17	17	18.5	20.5	0	2.0	.0000	.0082
Cir. of Shin Bone	17.5	17	17.5	21.0	- .5	3.5	-.0276	.0144
Dist. Elbow Pt. Down	30.0	30	32.0	35.0	0.0	3.0	.0000	.0123
Dist. Sh. Pt. Down	32.0	30	34.5	36.0	- 2.0	1.5	-.011	.0061
Amt. of Feed Consumed	1253.6		805.56				6.95	3.42
Diges. Nutrients	901.33		596.19				4.98	2.46
Av. Wt. for Period	365.7		416.7					

Periods:

Factor XXX - 1/1/14 to 7/1/14.
Factor VIII- 6/14/10 to 2/11/11.

Group IX - Table III

Table Comparing Factor XL during a Dry Period Following Her First Lactation Period, Age 14 mo. 19 days to 17 mo. 19 days, with Factor 21A, Age 12 mo. 2 days to 15 mo. 2 days and Never Pregnant.

	Factor XL		Factor 21A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	XL	21A	XL	21A
Weight	252	320	295	340	68	45	.7391	.4891
Height at Withers	58	61	62	63	3	1	.0326	.0108
Height at Croup	64	67	67	69	3	2	.0326	.0216
Breadth of Shoulders	32	38	38	41	6	3	.0652	.0326
Breadth at Sh. Pts.	24	26	30	29	2	-1	.0216	.0108
Breadth of Hams	31	36	36	36	5	0	.0543	.0000
Breadth at Hip Pts.	24	28	26	27	4	1	.0434	.0108
Heart Girth	112	128	122	133	16	11	.1739	.1195
Paunch Girth	131	140	136	143	9	7	.0978	.0760
Flank Girth	117	132	123	137	15	14	.1630	.1520
Depth of Chest	36	39	35	40	3	5	.0326	.0543
Length of Body	100	113	98	104	13	6	.1413	.0652
Width of Head	16	17.5	16	16	1.5	0	.0163	.0000
Cir. of Shank Bone	16.5	18.0	17	17	1.5	0	.0163	.0000
Cir. of Shin Bone	17.0	17.0	17	17.5	0.0	.5	.0000	.0054
Dist. Elbow Pt. Down	29.0	28.0	27	28.0	- 1.0	1.0	-.0108	.0108
Dist. Sh. Pt. Down	31.0	31.0	30	30.0	0.0	0.0	.0000	.0000

	Factor XL	Factor 21A	Daily XL	Daily 21A
Amt. of Feed Consumed	490.8	495.6	5.33	5.38
Diges. Nutrients	352.8	356.3	3.83	3.87
Av. Wt. for Period	276.7	291.5		

Periods:

Factor XL - 5/27/14 to 8/27.14.

Factor 21A- 7/6/14 to 10/6/14.

In table I it is seen that, although consuming more feed, the sow that has been bred showed an actual daily loss, while Factor IV made a daily gain in weight. The differences in skeletal measurements seem to favor the factor that has never been bred, yet the differences are too small to allow for comparison. The large loss in weight for Factor XVI is due to a low final weight. The average weight for the period being 16 pounds higher than the weight at the end. Here it seems evident that the greater growth was made by the factor that had never been bred.

In table II, Factor XXX, following her second lactation period, made a greater gain in body weight than did Factor VIII, which had always been open. The small differences in skeletal growth do not favor either animal. Factor XXX received 2.42 pounds more digestible nutrients daily that did Factor VIII, and this may account for the difference in daily gains in weight.

Following her first lactation period, Factor XL in table III made a greater gain in body weight by .25 pound daily, than the sow that had never been bred. The differences in skeletal gains for the two animals were small. Thus it is seen that in two of the tables the greatest gains in weight were made by those sows which had been bred.

Although no conclusions can be drawn, these tables seem to suggest that where sufficient feed is given

the mother during a dry period following lactation, she makes gains to a certain extent compensating for the loss in weight while suckling a litter. The gains made during such a period, as was the case in tables II and III, may be more rapid than those for animals that have never been bred.

Watson[36] found that rats which were bred and given a period for recovery following lactation were larger than rats which had never been bred. It may also be that gilts, although bred immaturely, will make a normal growth and reach a normal size if allowed a period for recovery from the effects of suckling a litter.

A COMPARISON OF FACTORS IN THE IMMATURE, HALF MATURE AND MATURE GROUPS AT A GIVEN AGE

In the tables in Group X are given comparisons between factors in the mature, half mature and immature groups at a given age, approximately equal. Such measurements would naturally be influenced by the condition of the animal at the time the measurements were taken, and to some extent, by the time of year. Owing to the small number of sows used in the experiment, it was impossible to find a sufficient number of animals comparable in all respects at any given age. Most of the animals considered were pregnant at the time of measurement. Although the time that the animal had been pregnant would have influenced the measurements taken, it seems that this should furnish a fairly uniform condition for comparison. A sow measured when suckling a litter or just after weaning her pigs would appear smaller than if pregnant or open.

By comparing the animals in the different groups at certain ages, any difference in growth rate due to previous treatment should be shown by final measurements. If early breeding retards but does not inhibit growth, then measurements taken after the animals would normally have reached maturity should not favor either group. All weights are expressed in pounds and measurements are given in centimeters.

GROUP X - TABLE 1.

COMPARING FACTORS IN IMMATURE, HALF MATURE AND MATURE GROUPS AT ABOUT 29 MONTHS OF AGE.

	IMMATURE								HALF MATURE.			MATURE.		
FACTORS	V	VI	XI	XXII	XXX	XL	L	LX	III	VII	XIA	IV	VIII	XIIIB
AGE IN MONTHS.	29-9	29-10	29-28	28-18	30	29-20	27-17	28-20	29-11	29-10	30-3	29-11	29-11	30-14
Weight	324	332	223	318	430	330	370	356	310	375	340	330	428	430
Height at Withers	64	66	56	61	66	63	64	67	66	67	63	67	70	70
Height at Croup	72	72	64	68	73	70	71	75	77	76	73	76	78	74
Breadth of Shoulders	38	40	30	39	47	38	40	37.5	36	38	35	39	44	45
Breadth at Sh.Pts.	32	30	25	28	27	27	28	28	29	32	27	30	34	30
Breadth of Hams	35	37	30	32	39	37	35	32	31	35	32	34	40	44
Breadth of Hip Pts.	29	28	22	25	30	28	32	28.5	27	28	25	27	34	30
Heart Girth	130	132	105	118	150	130	137	128	124	132	120	132	146	145
Paunch Girth	149	150	139	150	158	140	148	145	134	145	142	142	167	160
Flank Girth	134	131	107	122	133	130	139	131	127	136	126	135	147	147
Depth of Chest	44	44	35	39	43	41	41.5	44	42	44	41	45	48	45
Length of Body	98	105	99	103	113	112	114	109	107	105	112	105	110	114
Width of Head	17	19	17.5	19	19	18	22	20.5	20	19	18.5	20	22	20
Cir.of Shank Bone	18	19	17.5	17	16	17.5	19	19	19	18.5	17	19	20.5	19
Cir.of Shin Bone	18	19	17	18	17.5	18	18	19.5	20	19	16.5	19	21	18.5
Dist.Elbow Pt.Down	32	33	31	33	31	31	31.5	34	32	29	31	34	35	32
Dist.Sh. Pt. Down	35	33	33	35	34	33	33	35.5	35	32	33	37	36	33
Condition of factor at time of Meas.	Preg.	Preg.	Lact.	Preg.	Preg.	Preg.	Dry.	Preg.	Dry.	Preg.	Preg.	Lact.	Preg.	Preg.
Number of litters farrowed	3	3	4	3	2	2	3	3	1	1	2	1	0	0

GROUP X - TABLE II.

COMPARING FACTORS IN IMMATURE, HALF MATURE AND MATURE GROUPS AT ABOUT 41 MONTHS OF AGE.

	IMMATURE.							HALF MATURE.		MATURE.	
FACTORS	V	VI	IX	XXII	XXX	XXXI	XL	III	XI-A	IV	VIII
AGE IN MONTHS	41-15	41-16	41-16	40-4	42-1	42-1	41-18	41-16	42-1	41-16	41-17
Weight	315	311	275	350	402	384	366	420	333	322	454
Height at Withers	64	65	58	62	66	66	65.5	70	64	68	71
Height at Croup	71	71	64	71	73	74	71	80	74	77	77
Breadth of Shoulders	39	38	34	39	43	39	38	44	38	36	46
Breadth of Sh. Pts.	30	28	27	28	30	31	31	33	29	30	31
Breadth of Hams	36	36	30	33	39	34	33.5	38	33	36	41
Breadth of Hip Pts.	23	23	22	28	29	26	27.5	27	26	26	28
Heart Girth	130	125	110	116	132	130	127	142	124	133	152
Paunch Girth	149	138	150	137	140	140	155	155	144	140	162
Flank Girth	135	134	112	113	135	130	135	144	123	125	160
Depth of Chest	41	41	37	39	48	42	41	47	41	43	49
Length of Body	106	106	97	110	116	110	105	124	112	108	116
Width of Head	19	19	17.5	19	20	19	24	21	18	19	23
Cir. of Shank Bone	17	17	17	18	17	18	19	18	16.5	16.5	21
Cir. of Shin Bone	17.5	17	17	18.5	17.5	18.5	18	18	17	17	21
Dist. Elbow Pt. down	32	32	32	32	32	33	32	35	32	35	35
Dist. Sh. Pt. down	35	35	35	34	34	35	34.5	36	35	36	37
Condition of factor at time of Meas.	Preg.	Preg.	Lact.	Preg.	Preg.	Preg.	Preg.	Preg.	Preg.	Preg.	Preg.
Number of litters farrowed	5	5	6	6	4	4	4	2	4	2	1

GROUP X - TABLE III.

COMPARING FACTORS IN IMMATURE, HALF MATURE AND MATURE GROUPS AT ABOUT FIVE YEARS OF AGE.

	IMMATURE.					HALF MATURE.	MATURE.	
FACTORS	V	VI	XI	XXII	XXXI	III	IV	VIII
AGE.	5-2-16	5-2-17	4-11-18	5-1-27	5-1-5	5-2-17	5-2-15	5-2-5
Weight	356	355	299	370	528	408	378	400
Height at Withers	66	66	61	64	71.5	67	66	71
Height at Croup	73	73	68	71	77	77	76	78
Breadth of Shoulders	39	40	34	38	49.5	36	40	42
Breadth of Sh. Pts.	30	26	26	32	38.5	28	28	29
Breadth of Hams	32	32	31	34	43	34	34	37
Breadth of Hip Pts.	26	24	25	25	29	26	26	29
Heart Girth	130	123	121	121	168	127	132	143
Paunch Girth	140	147	145	150	175	151	150	158
Flank Girth	125	134	122	124	157	137	130	146
Depth of Chest	42	40	38	40	50	44	44	48
Length of Body	110	108	105	111	114	120	114	118
Width of Head	20	19	18	20.5	24	21	19	22
Cir. of Shank Bone	17.5	17.5	18	18	20	18	17	19.5
Cir. of Shin Bone	17	17.5	17	18	19.5	18	17	20
Dist.Elbow Pt.down	31	29	31	33	32	31	34	32
Dist. Sh. Pt. down	33	32	33	34	33.5	33	36	34
Condition of factor at time of Meas.	Dry.	Lact.	Lact.	Lact.	Preg.	Lact.	Dry.	Dry.
Number in litter at weaning time.	7	9	8	9	6	6	5	5

GROUP X

S U M M A R Y

	TABLE I.			TABLE II.			TABLE III.		
	Immature.	Half Mature.	Mature.	Immature.	Half Mature.	Mature.	Immature.	Half Mature.	Mature.
Weight	351.4	331.6	396	354.6	376.5	388	381.6	408	389
Height at Withers	64.4	65.3	69	63.5	62	69.5	65.7	67	68.5
Height at Croup	77.57	75.3	76	70.7	77	77	72.4	77	77
Breadth of Shoulders	39.9	36.3	42.66	38.5	41	41	40.1	36	41
Breadth at Sh. Pts.	28.55	29.3	31.33	29.28	31	30.5	*30.5	28	28.5
Breadth of Hams	35.2	32.66	39.33	34.5	35.5	38.5	34.4	34	35.5
Breadth at Hip Pts.	27.2	26.66	30.33	25.5	26.5	27	25.8	26	27.5
Heart Girth	132.1	125.33	141	134.2	133	142.5	132.6	127	137.5
Paunch Girth	148.55	140.33	156.33	144.1	149.5	151	151.4	151	154
Flank Girth	131.4	126.33	143	137.7	133.5	142.5	132.4	137	138
Depth of Chest	42.35	42.33	46	41.28	44	46	42	44	46
Length of Body	107.7	108	109.66	107.1	118	112	109.6	120	116
Width of Head	19.21	19.16	20.66	19.5	18.5	21	20.3	21	21.5
Cir. of Shank Bone	17.9	18.16	19.5	17.6	17.25	18.7	18.2	18	18.25
Cir. of Shin Bone	18.28	18.5	19.5	17.85	17.5	19	17.8	18	18.5
Dist. Elbow Pt. Down	32.2	30.66	33.66	32.14	33.5	35	31.2	31	33
Dist. Sh. Pt. Down	34.07	33.33	35.33	34.6	35.5	36.5	33.1	33	35
Average Number of Litters Farrowed.	2.7	1.33	.33	4.85	3	1.5	7.8	6	5

* Due to high condition of Factor XXXI.

A study of tables like these is best made by a comparison of individuals. In order to have a set of figures that would give a general idea of each group, averages have been taken. Tables I and its summary show the difference in weight to favor the mature group, yet the average weight of the half mature group falls below that for the immature. In securing an average, Factor XI in the immature group was omitted due to her low weight caused by suckling a litter. Another point worthy of note is that the immature sows had farrowed from two to four litters, the half matures from one to two, while only one sow in the mature group had farrowed at this time. In such skeletal measurements as height at withers, depth of chest, length of body and circumference of shin bones, the mature factors surpassed each of the other two groups, indicating that skeletal growth had been the most rapid in the group, which with one exception, had never been bred. There was little difference in the half mature and the immature group at this age, and in some measurements, such as body weight, the immature factors surpassed the half matures.

A comparison of the factors in the respective groups at about 41 months of age is given in Table II and its summary. With the exception of Factor XL, all the animals were pregnant at the time of measurement. The immature group, on the average, had farrowed nearly five litters, the half mature, three, and Factors IV and VIII

two and one litters respectively.

Omitting Factor XI, the average weight as shown in the summary is seen to be associated with the time bred. According to actual comparisons made through the summary as well as the table itself, the mature group is seen to be the larger at 41 months of age.

The half mature group has probably made a larger gain than the immature group, as evidenced by height measurements and the length of body. It is not to be overlooked, however, that the immature group surpasses in a few measurements. The difference in body weight is not large when the number of animals in the two groups is taken into consideration; and the same may be said of several of the measurements.

Table III and its summary show little difference in the body weight of the three groups. This table, however, must be studied with caution. Factor XXXI, with a body weight of 528 pounds, raises the average of the immature group, and Factor III, the only representative of the half-mature group, was suckling a litter at this time, which not only lowered her average but may have decreased the body measurements. Three of the sows in the immature group were suckling litters, while the sows in the mature group were either dry or pregnant. Previous treatment and condition at the time of measurement would possibly greatly

influence measurements and weights of sows at this age.

Although there is a difference in body weight and skeletal measurements between the mature and immature groups at five years of age, the difference is less marked than at an earlier age. The difference between the half mature and the immature group at this age is also small. The smaller difference between the groups may show that sows bred at an early age, although having their growth retarded in the first few years, may reach a size very nearly normal through having a longer growing period.

A FARROWING RECORD FOR THE FACTORS IN THE DIFFERENT GROUPS

A farrowing record should give an opportunity for a further study of the effects of early breeding, since it affords data on the number in the litter and the average weight at birth. If no injurious effects, due to early breeding, are apparent in the litters of the original stock, then they would probably appear in the offspring of the later generations, due to a cumulative effect. IIf early breeding has any influence on the litter, then pigs from older sows should be larger than those born of immature parents. Very little investigational work has been done along this line. Work at the Kansas Station showed no definite results. In 1888 the pigs from the mature sows were heavier at birth, and made more economical gains. The next year there was little difference between the two groups.

The following table gives the length of the gestation period, the number of boars and sows in the litter at birth, their average weight, the number reared to weaning, the average weight at that time and the daily gain while suckling. The litters were not always weaned at eight weeks of age. Other things being equal, the older the animal, the larger would be the daily gain. The litters generally received no feed except that eaten with the sow, until the time of weaning, when feed recordsof the litters were begun. Individual weights were not taken at birth, and the weights in the table appear as the average for each sex.

Group XI - Table I

TABLE SHOWING FARROWING RECORD FOR THE FACTORS IN THE IMMATURE GROUP.

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth			Average Wt.		No. of Pigs at Wean. Time	Wt. of Lit. at Wean. Time	Gain in Pounds Per Day
			Boars	Sows	Total	Boars	Sows			
V	1	115	1	2	3	2.75	2.5	3	34.3	.5044
V	2	114	5	2	7	1.7	1.875	5	38.6	.5676
V	3	113	7	3	10	1.8	1.916	3	--	--
V	4	112	4	5	9	2.25	2.000	5	--	--
V	5	114	8	1	9	2.00	2.25	3	29.66	.463
V	6	112	9	2	11	2.00	1.75	7	--	--
V	7	115	4	5	9	2.25	1.8	4	--	--
Average		113.6			8.25	2.10	2.01	4.285	33.87	.423
VI	1	113	2	6	8	1.5	2.19	8	33.87	.423
VI	2	113	3	6	9	2.33	2.12	8	40.00	.579
VI	3	115	6	4	10	1.66	1.5	4	--	--
VI	4	112	5	3	8	2.6	2.0	7	27.43	.449
VI	5	115	4	0	4	3.31	---	4	30.00	.472
VI	6	111	4	0	4	2.81	---	3	---	---
VI	7	114	5	6	11	1.66	1.77	7	---	---
VI	8	114	4	7	11	2.30	2.2	8	---	---
VI	9	114	4	2	6	3.25	3.0	6	---	---
VI	10	114	4	6	10	2.12	2.0	6	---	---
Average		113.5	4.1	4	8.1	2.35	2.09	6.1		
XI	1	113	2	1	3	2.75	2.5	3	36.66	.632
XI	2	114	2	4	6	2.25	2112	5	30.00	.448
XI	3	---	3	1	4	3.00	3.00	0	---	---
XI	4	114	2	5	7	2.25	2.2	6	24.16	.372
XI	5	114	5	4	9	2.5	2.0	7	---	---

Table I -(Continued)

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Lit. at Wean. Time	Gain in Pounds Per Day
XI	6	115	3	3	6	2.5	2.56	6	---	---
XI	7	113	3	4	7	2.66	2.4	7	---	---
XI	8	113	3	4	7	2.25	2.5	6	---	---
Average		113.7	23	26	6.1	2.52	2.42	5.7		
XIII	1	112	5	1	6	2.8	3.0	5	21	.313
XIV	1	114	2	4	6	2.5	2.12	5	34	.493
XIV	2	112	2	5	7	2.625	2.77	7	28	.40
XIV	3	90*	6	3	9	2.66	2.66	0 chol.	---	---
Average		113	10	12	7.33	2.59	2.49	6		
XVI	1	119	1	3	4	2.25	2.0	4	41.75	.423
XXII	1	114	4	2	6	2.4	2.25	0	---	---
XXII	2	111	3	0	3	3.25	0.0	0	---	---
XXII	3	111	2	3	5	2.625	2.66	4	46.25	.676
XXII	4	111	3	6	9	2.66	2.5	9	32.44	.484
XXII	5	111	5	4	9	2.6	1.75	8	---	---
XXII	6	114	3	7	10	2.16	2.65	7	---	---
XXII	7	112	0	4	4	0.0	2.5	4	---	---
XXII	8	112	6	4	10	2.0	1.75	0	---	---
XXII	9	113	6	6	12	2.0	1.6	4	---	---
XXII	10	112	4	2	6	2.13	2.25	5	---	---
XXII	11	114	5	1	6	1.9	2.1	0	---	---
Average		112.1	41	39	80	2.373	2.2	5.85	----	---

Table I - (Continued)

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Pigs at Wean. Time	Gain in Pounds Per Day.
XXX	1	116	4	5	9	1.56	1.45	0	---	---
XXX	2	110	6	6	12	1.83	1.66	8	36.76	.395
XXX	3	112	6	6	12	1.5	1.5	0	---	---
XXX	4	110	6	3	9	1.75	1.5	4	32.5	.524
XXX	5	108		one dead	1					
Average		111.2	17	21	76	1.65	1.527	3		
XXXI	1	114	2	7	9	2.0	1.64	7	28.85	.473
XXXI	2	115	3	0	3	2.33	0.0	3	28.00	.451
XXXI	3	114	3	4	7	2.16	2.5	6	34.83	.529
XXXI	4	112	3	3	6	2.16	2.0	1	---	---
XXXI	5	112	5	6	11	2.2	2.0	7	---	---
XXXI	6	117	7	3	10	1.93	1.5	0	---	---
XXXI	7	114	4	1	5	2.33	2.12	3	---	---
Average		114	27	24	7.28	2.16	1.96	3.85		
XL	1	116	3	5	8	2.0	1.95	6	31.33	.475
XL	2	115	3	3	6	2.0	1.66	4	---	---
XL	3	114	8	2	10	2.0	2.0	3	31.00	.534
XL	4	116	5	4	9	2.7	2.8	7	34.00	.597
XL	5	115	4	4	8	1.94	2.13	7	---	---
XL	6	115	6	5	11	2.6	2.5	8	---	---
Average		115.1	29	2.3	8.6	2.2	2.18	5.8		
LI	1	113	4	2	6	2.0	2.25	2	24	.304

Table I - (Concluded)

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Pigs at Wean. Time	Gain in Pounds Per day.
L	1	116	3	2	5	1.83	1.5	2	29.5	.351
L	2	113	2	2	4	1.75	1.5	0	----	---
L	3	---	1	9	10	.8	2.11	5	24.2	.44
L	4	115	3	8	11	1.9	2.05	9	27.66	.467
L	5	112	6	4	10	2.37	2.37	6	35.83	.597
Average		114	15	25	8	1.73	1.9	4.4		
LX	1	113	5	4	9	2.1	2.25	7.	16.55	.29
LX	2	113	7	3	10	1.7	1.9	5	25.8	.45
LX	3	114	5	3	8	2.9	3.3	7	39.7	.72
LX	4	117	2	6	8	2.88	3.12	4	35.25	.608
Average		114	19	16	8.75	2.40	2.64	5.75		
LXX	1	113	1	9	10	1.25	1.31	1	26.0	.426
LXX	2	114	6	4	10	2.77	2.84	10	20.6	.368
Average		113.5	7	13	10	2.01	2.075	5.5		
LXXX	1	113	8	-	8	1.875	-----	2	----	----

Group XI - Table II

TABLE SHOWING FARROWING RECORD FOR THE FACTORS IN THE HALF MATURE GROUP.

Factor.	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Lit. at Wean. Time	Gain in Pounds Per Day.
III	1	115	7	2	9	3.28	3.12	6	----	-----
III	2	112	2	5	7	----	----	0	----	-----
III	3	112	5	4	9	2.8	2.25	5	39.6	.639
III	4	113	5	5	10	2.6	2.5	7	29.55	.509
III	5	113	5	5	10	2.2	2.5	8	----	-----
III	6	110	2	2	4	2.5	4.0	3	----	-----
III	7	113	2	5	7	1.875	1.8	6	----	-----
Average		112.5	28	28	8.	2.54	2.69	5.83		
VII	1	115	-	-	7	----	----	2	32.5	.485
VII	2	114	4	3	7	----	----	7	----	-----
Average		114.5	4	3	7	----	----	4.5		
XI-A	1	113	1	2	3	3.0	3.25	1	25.0	.424
XI-A	2	113	3	5	8	3.0	2.7	4	45.0	.632
XI-A	3	114	7	3	10	2.43	1.83	9	27.66	.439
XI-A	4	114	6	3	9	2.79	2.75	8	29.25	.479
XI-A	5	113	2	3	5	3.0	2.83	5	----	-----
Average		113.4	19	16	7	2.84	2.67	5.4		
XII-A	1	114	5	6	11	2.4	1.83	3.	36.0	..666
XII-A	2	116	3	6	9	2.5	2.16	8	31.0	.492
XII-A	3	---	6	6	12	2.0	1.66	10	----	-----
Average		115	14	18	10.6	2.3	1.88	7		

Table II Concluded

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Lit. at Wean. Time	Gain in Pounds Per Day
XIII-A	1	115	3	8	11	2.5	2.13	8	37.88	.592
XIII-A	2	114	3	5	8	2.63	2.75	8	39.0	.600
Average		114.5	6	13	9.5	2.56	2.44	8		
XX-A	1	112	3	3	6	2.5	2.5	6	48.0	.558

Group XI - Table III

TABLE SHOWING FARROWING RECORD FOR THE FACTORS IN THE MATURE GROUP.

Factor	No. of Lit.	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Wt. of Lit. at Wean. Time	Gain in Pounds Per Day
IV	1	112	3	2	5	2.7	2.7	1	43.0	.682
IV	2	114	2	6	8	---	---	8	31.63	.439
IV	3	113	2	1	3	3.37	3.25	3	37.33	.679
IV	4	117	4	1	5	3.33	4.0	5	26.66	.501
IV	5	115	1	2	3	3.25	4.13	3	-----	----
IV	6	---	1	2	3	2.0	1.88	3	-----	----
Average		114.2	13	14	4.5	2.93	3.19	3.83		
VIII	1	115	5	3	8	1.7	1.91	3.	33.0	.515
VIII	2	114	1	5	6	4.0	4.0	3	31.0	.62
VIII	3	116	4	5	9	2.13	2.8	7	29.42	.535
VIII	4	115	2	4	6	2.5	3.4	4	33.25	.593
VIII	5	113	2	1	3	2.75	3.0	0	-----	----
VIII	6	115	3	9	12	1.66	1.66	0	-----	----
Average		114.8	17	27	7.33	2.455	2.795	3.4		
XII-B	1	113	5	1	6	2.2	2.5	3	-----	----
XIII-B	1	114	2	5	7	2.5	2.1	4	-----	----

Group XI - Table 4

SUMMARY FOR FACTORS IN THE IMMATURE GROUP

Factor	Days Gest. Per.	No. in Lit. At Birth Boars	Sows	Total	Average	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Av. No. Raised Per Lit.	Av. Gain in Lbs. Per Day	No. of Lit.
V	113.6	38	20	58	8.2	2.10	2.01	30	4.29	.511	7.
VI	113.5	41	40	81	8.1	2.35	2.09	61	6.1	.481	10
XI	113.7	23	26	49	6.1	2.52	2.42	40	5.0	.484	8
XIII	112	5	1	6	6.0	2.8	3.00	5	5.0	.313	1
XIV	113	10	12	22	7.7	2.49	2.49	12	6.0	.446	3
XVI	119	1	3	4	4.0	2.25	2.00	4	4.0	.423	1
XXII	112.1	41	39	80	7.18	2.37	2.2	41	3.72	.58	11
XXX	111.2	17	21	38	7.6	1.65	1.52	12	3.00	.459	5
XXXI	114	27	24	51	7.4	2.16	1.96	27	3.85	.484	7
XL	115.1	29	23	52	8.6	2.2	2.18	35	5.8	.535	6
L	114	15	25	40	8.0	1.73	1.9	22	4.5	.464	5
LI	113	4	2	6	6.0	2.00	2.25	2.	2.0	.304	1
LX	114	19	16	35	8.75	2.39	2.64	23	5.75	.518	4
LXX	113.5	7	13	20	10.0	2.01	2.07	11	5.5	.397	2
LXXX	113	8	0	8	8.0	1.875	----	2	2.0	---	1
Ave.	113.45	285	265	550	7.64	2.197	2.16	327	4.54	.4768	72

Group XI - Table V

SUMMARY FOR FACTORS IN THE HALF MATURE GROUP.

Factor	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Av. No. Raised Per Lit.	Av. Gain in Lbs. Per Day	No. of Lit.
III	112.5	28	28	56	8	2.54	2.69	35	5.83	.574	7
VII	114.5	--	--	14	7	----	----	9	4.5	.485	2
XI-A	113.4	19	16	35	7	2.84	2.67	27	5.4	.493	5
XII-A	115	14	18	32	10.6	2.3	1.88	21	7.0	.579	3
XIII-A	114.5	6	13	19	9.5	2.56	2.43	16	8.0	.596	2
XX-A	112	3	3	6	6.0	2.5	2.5	6	6.0	.558	1
	113.5	70	78	162	8.01	2.59	2.50	6	6.0	.544	

Group XI - Table VI

SUMMARY FOR FACTORS IN THE MATURE GROUP

Factor	Days Gest. Per.	No. in Lit. at Birth Boars	Sows	Total	Average	Average Wt. Boars	Sows	No. of Pigs at Wean. Time	Av. No. Raised Per Lit.	Av. Gain in Lbs. Per Day	No. of Lit.
IV	114.2	13	14	27	4.5	2.93	3.19	23	3.8	.575	6
VIII	114.8	17	27	44	7.33	2.45	2.79	17	2.8	.565	6
XII-B	113.0	5	1	6	6.0	2.2	2.5	3	3.0	---	1
XIII-B	114.0	2	5	7	7.0	2.5	2.1	4	4.0	---	1
	114.3	37	47	84	6.00	2.64	2.87	47	3.61	.537	

The tables seem to show no definite relation between the birth weight and the number in the litter. In several instances the birth weight for three or four pigs was not as great as where the litters were larger. The gains made by the litter while suckling are probably not correlated with the number in the litter. The sow may so govern her milk supply that each pig in a litter of two receives no more milk that those in a larger litter.

A summary of all of the groups shows the boar pigs to be the heavier at birth, and the same is brought out by studying the records for the different factors. Of course, there are many exceptions to such a rule, yet this tendency was noted by Minot (8) in shis work with guinea pigs. He found the males to be the heavier at birth, but due to a greater post natal loss, the sexes were of about the same weight for a short period after parturition.

The tables also show a longer gestation period for the mature group. This coincides with the general view that mature animals carry their young slightly longer than animals bred at an early age. The average for the half mature group covered a slightly longer period than that for the immature group.

There was very little difference between the proportion of boars and sows farrowed by the different groups. The immature group gives the most reliable information on this point; the proportion in this case being 107 males to

100 females.

The average number farrowed per litter was largest for the half mature group, followed by the immature group. The small number of animals in the mature group make this comparison of little value. Another point clearly brought out in the summary is that the birth weight was highest for the mature group and lowest for the immatures. The number of pigs raised to weaning time was largest for the half mature group and smallest for the mature group. This is readily explained since Factor VIII in the mature group lost her last two litters.

A study of the three groups shows that the mature sows farrowed larger litters and heavier pigs and carried their young for a longer period than did the immature group. Later generations in the immature group show neither a decrease in the number of pigs farrowed nor the average weight at birth.

In connection with this table it might be interesting to note that the third litter of Factor LX, representing the seventh generation, averaged 39 pounds at weaning time. The litter required only 200 days to reach 250 pounds. The amount of feed consumed per pound gain amounted to 3.91 pounds. Out of the four barrows, a pen of three was shown at the International Stock Show in the six months class. These barrows won first in their class and second and third when shown as individuals.

THE EFFECT OF EARLY BREEDING ON THE OFFSPRING

A study of early breeding is not complete without a consideration of the effects on the offspring. To study this phase of the experiment, comparisons have been made between early and late generations to determine whether or not there is any difference in the gains made during periods in which the conditions are comparable for both animals.

The following table gives the weights and measurements at the beginning and end of the periods, the actual daily gains, and the amount of feed consumed in making these gains. All weights are given in pounds and all measurements are expressed in centimeters.

A summary of the table shows little difference in the growth rate of early and late generations. IIn three cases out of five the sows in the later generations have made the greatest gains, and in tables IV and V, the differences in the gains made in skeletal growth are almost too small to allow for comparison, yet in three instances they seem to favor the later generations.

It must be remembered that the injurious effects of early breeding are probably acumulative and will be manifested only after a long period of years. Although

Group XII- Table I

Table Comparing Factor 50, Age 5 mo. 24 days to 7 mo. 6 days, with Factor XXI, Age 6 mo. 3 days to 7 mo. 1 day. Both Factors Open and Growing.

	Factor 50		Factor XXI		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	50	XXI	50	XXI
Weight	125	175	159	160	50	1	1.19	.0357
Height at Withers	49	52	49	47	3	-2	.0714	-.0714
Height at Croup	53	59	57	57	6	0	.1428	.0000
Breadth of Shoulders	24	30	30	30	6	0	.1428	.0000
Breadth at Sh. Pts.	18	20	24	25	2	1	.0476	.0357
Breadth of Hams	22	27	26	28	5	2	.119	.0714
Breadth at Hip Pts.	18	22	18	21	4	3	.0952	.1071
Heart Girth	85	106	93	102	21	9	.5000	.321
Paunch Girth	103	123	116	117	20	1	.4761	.0357
Flank Girth	84	110	101	104	26	3	.619	.1071
Depth of Chest	26	32	31	31	6	0	.1428	.0000
Length of Body	79	86	80	82	7	2	.1666	.0714
Width of Head	13	14.5	13	15	1.5	2	.0357	.0714
Cir. of Shank Bone	13	14.0	15	15	1.0	0	.0238	.0000
Cir. of Shin Bone	13	13.5	15	15.5	.5	.5	.0119	.0178
Dist. Elbow Pt. Down	25	27.0	25	25.0	2.0	0.0	.0476	.0000
Dist. Sh. Pt. Down	27	29.0	26	29.0	2.0	3.0	.0476	.1071
Amt. of Feed Consumed	259		113.5				6.14	4.05
Dig. Nutrients	186.2		81.6				4.33	2.91

Factor 50 made a greater daily gain in body weight and also larger gains in most of the skeletal measurements. She consumed more feed, however, than did Factor XXI.

Periods:

Factor 50 - 9/12/14 to 10/24/14.
Factor XXI - 10/22/10 to 11/11/10.

Group XII- Table II

Table Comparing Factor 70, Age 5 mo. 17 days to 7 mo. 19 days, with Factor XXX, Age 5 mo. to 7 mo. 3 days. Both Factors Open and Growing.

	Factor LXX		Factor XXX		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	LXX	XXX	LXX	XXX
Weight	125	196	137	206	71	69	1.127	1.078
Height at Withers	51.5	56.5	46	53	5	7	.0793	.1094
Height at Croup	57.0	60.0	56	61	3	5	.0476	.0781
Breadth of Shoulders	23.0	30.0	27	34	7	7	.1111	.1094
Breadth at Sh. Pts.	19.0	20.5	17	23	1.5	6	.0238	.0937
Breadth of Hams	23.0	25.5	23	30	2.5	7	.0396	.1094
Breadth at Hip Pts.	18.5	22.5	20	21	4.0	1	.0634	.0156
Heart Girth	86.0	106.0	85	104	20.0	19	.3174	.2969
Paunch Girth	106.0	133.0	108	133	27.0	25	.4286	.3906
Flank Girth	89.0	101.0	90	115	12.0	25	.1904	.3906
Depth of Chest	28.5	34.5	26	32	6.0	6	.0952	.0937
Length of Body	74.0	90.0	80	84	16.0	4	.2539	.0624
Width of Head	14.0	17.0	16	15	3.0	-1	.0476	.0156
Cir. of Shank Bone	13.5	14.5	14	16	1.0	2	.0158	.0312
Cir. of Shin Bone	13.0	14.5	14	16.5	1.5	2.5	.0238	.0390
Dist. Elbow Pt. Down	27.0	30.0	26	28.0	3.0	2.0	.0476	.0312
Dist. Sh. Pt. Down	28.5	31.5	27	31.0	3.0	4.0	.0476	.0624
Amt. of Feed Consumed	339.2		330				5.38	5.15
Dig. Nutrients	243.8		237.2				3.87	3.7

Factor LXX made a slightly greater gain in body weight. Skeletal measurements show very little diffwrence in favor of either of the Factors.

Periods:

Factor LXX - 8/12/16 to 10/14/16
Factor XXX - 8/31/12 to 11/ 3/12.

Group XII - Table III

Table Comparing Factor LX, Age 7 mo. 13 days to 8 mo. 24 days, with Factor 11A Age 6 mo. 1 day to 6 mo. 29 days. Both Factors Open and Growing.

	Factor LX		Factor 11A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end.	Meas. at Beg.	Meas. at end	LX	11A	LX	11A
Weight	122	177	120	142	55	22	1.341	.5366
Height at Withers	53	55	47	48	2	1	.0487	.0357
Height at Croup	58	61	57	58	3	1	.0731	.0357
Breadth of Shoulders	26	28	26	30	2	4	.0487	.1428
Breadth at Sh. Pts.	18	20	20	23	2	3	.0487	.1071
Breadth of Hams	26	26	26	27	0	1	.0000	.0357
Breadth at Hip Pts.	18	19.5	19	21	1.5	2	.0365	.0714
Heart Girth	90	98.0	88	98	8.0	10	.1951	.357
Paunch Girth	105	120.0	107	112	15.0	5	.365	.178
Flank Girth	96	107.0	98	103	11.0	5	.2682	.178
Depth of Chest	28	31.5	29	30	3.5	1	.0853	.0357
Length of Body	78	86.0	79	78	8.0	-1	.1951	-.0357
Width of Head	13.5	14.5	13.5	15	1.0	1.5	.0243	.0535
Cir. of Shank Bone	13.5	14.5	13.0	14	1.0	1.0	.0243	.0357
Cir. of Shin Bone	13.0	14.0	13.0	14	1.0	1.0	.0243	.0357
Dist. Elbow Pt. Down	26.0	30.0	24.0	24	4.0	0.0	.0874	.0000
Dist. Sh. Pt. Down	27.0	32.0	27.0	27	5.0	0.0	.1219	.0000
Amt. Feed Consumed	205		133				5	4.75
Dig. Nutrients	147.3		95.6				3.59	3.41

Factor LX made a greater gain in body weight, height measurements and length of body and depth of chest. This table seems to indicate a slightly more rapid growth by the later generation sow.

Periods:

Factor LX - 9/26/15 to 11/6/15
Factor 11A - 11/18/11 to 12/16/11.

Group XII- Table IV

Table Comparing Factor XXXX, Age 17 mo. 19 days to 20 mo. 19 days, with Factor XXII, Age 19 mo. 18 days to 22 mo. 11 days. Both Sows Pregnant During Period Measurements Were Taken.

	Factor XXXX		Factor XXII		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	XXXX	XXII	XXXX	XXII
Weight	320	357	275	319	37	44	.4021	.5176
Height at Withers	61	62	61	61	1	0	.0108	.0000
Height at Croup	67	67	70	70	0	0	.0000	.0000
Breadth of Shoulders	38	40	40	40	2	0	.0216	.0000
Breadth at Sh. Pts.	26	28	30	32	2	2	.0216	.0235
Breadth of Hams	36	38	31	35	2	4	.0216	.047
Breadth at Hip Pts.	28	28	26	25	0	-1	.0000	-.0107
Heart Girth	128	134	117	127	6	10	.0652	.107
Paunch Girth	140	145	137	147	5	10	.0543	.107
Flank Girth	132	140	124	130	8	6	.0869	.0705
Depth of Chest	39	41	37	40	2	3	.0216	.0352
Length of Body	113	115	101	109	2	8	.0216	.0941
Width of Head	17.5	18	17.5	18	.5	.5	.0054	.0058
Cir. of Shank Bone	18.0	18.0	16.5	16.5	0.0	0.0	.0000	.0000
Cir. of Shin Bone	17.0	17.0	16.5	17.0	0.0	.5	.0000	.0058
Dist. Elbow Pt. Down	28.0	28.0	31.0	33.0	0.0	2.0	.0000	.0235
Dist. Sh. Pt. Down	31.0	31.0	33.0	34.0	0.0	1.0	.0000	.0107
Amt. of Feed Consumed	417		384				4.53	4.51
Dig. Nutrients	299.8		276.09				3.26	3.25

Factor XXII made a more rapid gain in body weight. There was little difference in skeletal measurements.

Periods:

Factor XXXX - 8/27/14 to 11/27/14.
Factor XXII - 11/18/11 to 2/11/12.

Group XII- Table V

Table Comparing Factor LXX, Age 8 mo. 17 days to 9 mo. 15 days, with Factor 10A, Age 6 mo. 1 day to 6 mo. 29 days. Both Animals Growing.

	Factor LXX		Factor 10A		Gain		Daily Gain	
	Meas. at Beg.	Meas. at end	Meas. at Beg.	Meas. at end	LXX	10A	LXX	10A
Weight	227	237	100	116	10	16	.3571	.574
Height at Withers	55	58	43	44	3	1	.1071	.0357
Height at Croup	62	61	51	55	-1	4	-.0357	.1428
Breadth of Shoulders	30	33	24	27	3	3	.1071	.1071
Breadth at Sh. Pts.	19	22	20	22	3	2	.1071	.0714
Breadth of Hams	28	28	25	27	0	2	.0000	.0714
Breadth at Hip Pts.	24.5	26	15	19	1.5	4	.0535	.1428
Heart Girth	115.0	114	82	87	-1.0	5	-.0357	.178
Paunch Girth	132.0	132	94	107	0.0	13	.0000	.4643
Flank Girth	105.0	107	85	95	2	10	.0714	.357
Depth of Chest	37.5	39	26	28	1.5	2	.0535	.0714
Length of Body	85.0	86	63	68	1.0	5	.0357	.178
Width of Head	17.0	18	13	14	1.0	1	.0357	.0357
Cir. of Shank Bone	15.0	14.5	13	13	- .5	0	-.178	.0000
Cir. of Shin Bone	15.0	15.0	13	13	0.0	0.0	.0000	.0000
Dist. Elbow Pt. Down	30.0	29.0	24	23	-1.0	-1.0	-.0357	-.0357
Dist. Sh. Pt. Down	32.0	31.0	25	25	-1.0	0.0	-.0357	.0000
Amt. of Feed Consumed	140		133				5.0	4.75
Dig. Nutrients	118.3		95.4				4.22	3.4

Factor 10A made greater gains in body weight; but not in skeletal measurements.
Periods:
Factor LXX - 11/11/16 to 12/9/16.
Factor 10A - 11/18/11 to 12/16/11.

the gilts in this experiment have been bred to sires of an age corresponding to their own, yet these boars did not represent lines of continued early breeding. Under the present system, it will take twice as long to secure definite results. It has not always been possible to get the sows with pig shortly after the weaning of their litters, and such dry periods have allowed the sows to recover partly from the ill effects of suckling a litter. From the tables presented, it seems safe to conclude that in this stage of the experiment the growth rate of the later generations has not been retarded due to the effects of early breeding.

THE NUMBER OF DAYS REQUIRED AND THE AMOUNT OF FEED CONSUMED BY THE LITTERS IN REACHING 250 pounds.

The following table gives the number of boars and sows in each litter that were carried to 250 pounds, and wherever possible, their age in days at that time and the amount of feed required to reach that weight. This table was prepared from the weekly feed and weight records for the litters. The amount of feed consumed, as well as the number of days required to reach 250 pounds were calculated in every case to the point nearest that weight. The feed consumed is expressed in terms of Ration III, the method of calculation used being that described in the plan of the experiment.

GROUP XIII - TABLE 1.

RECORD FOR OFFSPRING OF IMMATURE GROUP GIVING NUMBER IN LITTER, AMOUNT OF FEED REQUIRED TO REACH 250 POUNDS AND THE AGE IN DAYS AT THAT WEIGHT.

IMMATURE GROUP

			No. alive at birth			No. at Weaning time			No. to reach 250 pounds				Age in days at 250 lbs.		
Factor	Litter	Date of Farrow	Boars	Sows	Total	Boars	Sows	Total	Boars	Sows	Total	Feed Consumed By Litter	Boars	Sows	Feed Consumed per pig
VI	1st	5-30-09	2	6	8	2	6	8	1	1	2	1880.23	332	332	940.1
VI	2d	2-24-10	2	6	8	2	6	8	2	5	7	7506.24	302	309	1072.3
VI	3d	9-25-10	6	4	10	2	2	4	-	-	-	-------	---	--	------
VI	4th	4-3-11	5	3	8	-	-	7	-	-	1	1130.42	348		1130.42
VI	5th	9-29-11	4	-	4	4	-	4	4	-	4	4278.5	274	---	1069.6
V	1st	7-8-09	1	2	3	1	2	3	1	1	2	1900.89	297	289	950.4
V	2d	3-18-10	5	2	7	3	2	5	3	2	5	5793.5	316	294	1158.7
V	3d	9-10-10	7	3	10	-	-	3	-	-	-	-------	---	---	-------
V	4th	3-31-11	4	1	5	4	1	5	-	-	-	-------	---	---	-------
V	5th	9-29-11	4	5	9	2	1	3	2	1	3	2792.0	260	274	930.6
XI	1st	4-18-10	2	1	3	2	1	3	2	-	2	1313.42	304	294	656.7
XI	2d	10-15-10	2	4	6	2	3	5	-	-	-	-------	---	---	-------
XI	4th	9-28-11	1	5	6	1	5	6	1	5	6	6545.09	281		1090.8
XIII	1st	5-14-10	5	1	6	5	1	6	2	-	2	1914.04	371		957.02
XXII	3d	4-1-12	2	3	5	2	2	4	2	-	2	1840.2	243	---	920.1
XXII	4th	10-1-12	3	6	9	3	6	9	3	6	9	9416.6	289	265	1046.2
XXX	2d	8-9-13	5	6	11	3	5	8	2	5	7	8222.2	294	332	1174.6
XXX	4th	5-30-15	1	3	4	1	3	4	-	-	3	3697.6	276.6		1232.5
XXXI	1st	2-10-13	2	7	9	-	-	7	1	3	4	5123.48	313	348	1280.8
XXXI	2d	9-7-13	3	0	3	3	-	3	3	-	3	4071.06	304	---	1357.02
XXXI	3d	6-10-14	3	4	7	-	-	6	-	-	6	6673.84	259.6		1112.3
XXXI	4th	3-31-15	2	3	5	-	-	1	-	-	1	1413.95	339.		1413.9

GROUP XIII- TABLE 1 CONCLUDED

Factor	Litter	Date of Farrow	No. alive at birth Boars	Sows	Total	No. at weaning time Boars	Sows	Total	No. to reach 250 pounds Boars	Sows	Total	Feed Consumed By Litter	Age in days at 250 lbs. Boars	Sows	Feed Consumed per pig
XL	1st	4-8-14	3	5	8	4	2	6	4	2	6	4681.4	286		760.2
XL	2d	2-25-15	2	2	4	2	2	4	2	1	3	3176.8	268.6		1058.9
XL	3d	10-10-15	7	2	9	2	2	4	1	1	2	2165.6	301	266	1082.8
XL	4th	4-5-16	5	4	9	3	4	7	3	4	7	7333.7	227.6	246.3	1047.6
L	1st	2-13-15	2	2	4	1	1	2	1	-	1	1697.47	420		1697.47
L	3d	1-22-16	-	7	7	-	5	5	-	5	5	5807.2		280	1161.0
LI	1st	5-6-15	4	2	6	-	-	2	-	-	1	1412.97	386		1412.97
LX	1st	2-25-16	5	4	9	3	4	7	3	-	3	4366.5	346	---	1455.5
LX	2d	9-26-16	7	3	10	3	2	5	3	2	5	5220.5	249.6	244	1044.1
LX	3d	3-19-17	4	3	7	4	3	7	4	3	7	6749.6	189.3	215.	964.2
LXX	1st	12-25-16	1	6	7	-	1	1	-	1	1	905.6	---	236	905.6

GROUP XIII - TABLE II.

HALF MATURE GROUP

RECORD FOR OFFSPRING OF HALF MATURE GROUP GIVING NUMBER IN LITTER, AMOUNT OF FEED REQUIRED TO REACH 250 POUNDS AND THE AGE IN DAYS AT THAT WEIGHT.

Factor	Litter	Date of Farrow	No. alive at birth Boars	Sows	Total	No. at weaning time Boars	Sows	Total	No. to reach 250 pounds Boars	Sows	Total	Feed Consumed By Litter	Age in days at 250 lbs. Boars	Sows	Feed Consumed per pig.
III	3d	4-28-12	5	4	9	1	4	5	1	1	2	2257.7	230	300	1128.8
VII	2d	7-17-11	4	3	7	3	3	6	3	-	3	3541.4	311	---	1180.4
XI-A	1st	1-8-13	1	2	3	1	-	1	1	-	1	1230.39	262	---	1230.9
XI-A	2d	7-4-13	3	5	8	1	3	4	1	1	2	2555.06	260	283	1277.03
XI-A	3d	2-28-14	7	3	10	-	-	9	-	-	8	8591.03	257.5		1073.8
XI-A	4th	8-24-14	6	3	9	-	-	8	-	-	8	9961.3	272		1245.1
XII-A	1st	2-19-14	5	6	11	3	-	3	3	-	3	3347.8	264	---	1112.6
XII-A	2d	8-22-14	3	6	9	-	-	8	-	-	7	8270.8	271		1181.2
XIII-A	1st	2-20-14	3	8	11	1	7	8	1	7	8	8058.6	255	244	1007.3
XIII-A	2d	8-20-14	3	5	8	-	-	8	-	-	8	8327.7	252		1040.9
XX-A	1st	5-6-15	3	3	6	3	3	6	3	3	6	7178.5	278		1196.4

GROUP XIII - TABLE III.

RECORD FOR OFFSPRING OF MATURE GROUP GIVING NUMBER IN LITTER, AMOUNT OF FEED REQUIRED TO REACH 250 POUNDS AND THE AGE IN DAYS AT THAT WEIGHT.

MATURE GROUP

			No. alive at birth			No. at Weaning time			No. to reach 250 pounds				Age in days at 250 lbs.		
Factor	Litter	Date of Farrow	Boars	Sows	Total	Boars	Sows	Total	Boars	Sows	Total	Feed Consumed By Litter	Boars	Sows	Feed Consumed per pig.
IV	2d	8-10-11	2	6	8	2	6	8	2	2	4	4663.3	303	346	1165.8
IV	3d	5-4-12	2	1	3	2	1	3	2	1	3	3117.0	249	245	1039.0
VIII	1st	8-25-11	4	3	7	2	1	3	2	-	2	2729.2	344	---	1364.6
VIII	2d	5-10-12	1	5	6	-	3	3	-	2	2	2202.8	---	249	1101.4
VIII	3d	10-27-12	4	5	9	4	3	7	2	2	4	5039.2	258	272	1259.8
VIII	4th	4-19-13	2	4	6	2	2	4	2	1	3	4016.2	266	301	1338.7
XII-B	1st	1-6-14	5	1	6	3	-	3	3	-	3	4559.3	337	---	1519.7
XII-B	1st	6-13-14	2	5	7	-	-	4	-	-	2	2081.3	263		1040.6

A practical feeder would ask if pigs from sows bred at an immature age would make as rapid gains and do so as economically as the offspring from mature mothers. To furnish some information on this point, a summary of the preceding table has been prepared.

	No. of litters	No. of Pigs	Amount of feed consumed per pig in reaching 250 #
Immature group	29	108	1080
Half Mature "	11	56	1135
Mature "	8	23	1235

Giving due consideration to the small number of litters in the mature group, it seems quite safe to at least conclude that the offspring from immature sows require no more feed to reach a certain weight than those pigs born of mature parents. The pigs in the immature group on the average reached 250 pounds at about 284 days, which was earlier than the time required by the mature group, yet fifteen days later than the age at which the half mature group reached the weight mentioned. The boars and the sows reached 250 pounds at approximately the same age. The small difference in favor of the sows may tend to disprove a more or less common belief that barrows feed out quicker than gilts. Since the litters were allowed to run together, no comparison can be made of the amount of feed consumed by the two sexes, yet such a comparison would probably show no great difference.

POINTS OF INTEREST TO THE COMMERCIAL HOG RAISER

This experiment furnishes some data that should be of interest to the commercial hog raiser; and through summaries of a few of the previous tables an effort has been made to give additional information on some of the practical everyday problems.

One phase of swine husbandry that has received little investigation is the relation between the number of previous pregnancies and the size and weight of the litter at birth. Minot[8], in working with guinea pigs, obtained the following interesting figures:

No. of litter	1	2	3	4	5	6	7	8
First	16	25	9				1	
Second		9	13	6	1			
Third		6	6	3				
Fourth			2	2				

The table shows that the number of young tends to increase with the number of previous pregnancies. Donaldson gives a similar table for rats, showing that the size of the litter increases until after the second litter, and then gradually diminishes. Unpublished data from the Purdue station representing 240 sows, 981 litters and 8964 pigs show the following results:

	No. of pigs farrowed
First litter -----------	7.746
Second litter ----------	8.856
Third litter -----------	9.277
Fourth litter ----------	9.626
Fifth litter -----------	9.188
Sixth litter -----------	9.237
Seventh litter ---------	8.13
Eighth litter ----------	8.836
Ninth litter -----------	7.502

These figures show an increase in the size of litters up to the fourth, and then an irregular decline. The small number of sows considered in the last three litters cannot be taken as representative of what might be expected had it been possible to include a larger number of animals.

The table in Group XIV gives a similar record for six sows in this experiment. Although the number of animals considered is small, the table deals with the same sows throughout and thus individuality is eliminated. With the exception of the third litter, the number of pigs farrowed is seen to be related to the number of previous pregnancies. The fourth, fifth and sixth litters show a heavier birth weight for both the boar and sow pigs than was the case with the first three litters. The number of pigs in the litter at weaning time was largest for the last three litters farrowed.

GROUP XIV - TABLE 1

TABLE SHOWING THE RELATION BETWEEN THE NUMBER OF PREVIOUS PREGNANCIES AND THE FARROWING RECORD

Period	Days Gest. Period	Record of Litter at Birth. Boars	Av.Wt.	Sows	Av.Wt.	Total	Av.No.Per Litter	At Weaning Time Total	Av.No.Per Litter	Av.Wt. at wean.time	Daily gain until wean.
I	114.1	14	2.28	23	1.99	37	6.16	21	3.3	31.9	.515
II	113.6	19	2.25	15	1.99	34	5.66	25	4.1	29.88	.442
III	113.4	29	2.03	17	2.10	46	7.66	20	3.3	37.2	.574
IV	112.8	21	2.46	23	2.23	44	7.33	30	5.0	31.6	.506
V	113.5	31	2.37	19	1.99	50	8.33	36	6.0	----	-----
VI	114.	32	2.26	20	2.35	52	8.66	31	5.1	----	-----

The tendency to farrow larger litters and heavier pigs probably was not due to the number of previous pregnancies, but to the difference in age of the mother. The individuality of the sow seems to be a big factor in determining the number in the litter.

The following table is a summary of Groups XI and XIII, and gives a comparison between spring and fall farrowed litters. Those farrowed between January 1st and July 1st were considered as spring pigs; while pigs farrowed in the latter half of the year have been fall litters.

The table gives the number in the litter at birth and weaning time; and the average daily gain while suckling the sow. The feed required to reach 250 pounds, and the age in days at that weight is also given.

Group XV - Table 1.

SPRING LITTERS

COMPARISON BETWEEN SPRING AND FALL FARROWED LITTERS.

Date Farrowed	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
5-30-09	1	113	8	8	.423	2	332	1880.23	940.1
2-24-10	2	113	9	8	.579	7	307	7506.24	1072.3
4-31-11	4	112	8	7	.449	1	348	1130.4	1130.4
3-18-10	2	113	7	5	.567	5	311	5793.5	1158.7
3-31-11	4	112	9	5	---	-	---	------	------
4-18-10	1	113	3	3	.632	2	299	1313.4	656.7
5-14-10	1	112	6	5	.313	2	371	1914.04	957.02
4-1-12	3	---	5	4	.676	2	243	1840.2	920.1
5-30-15	4	110	9	4	.524	3	276.6	3697.6	1232.5
2-10-13	1	114	9	7	.473	4	339.2	5123.4	1280.8
6-10-14	3	114	7	6	.529	6	286.	6673.8	1112.3
3-31-15	4	112	5	1	---	1	339	1413.9	1413.9
3-8-14	1	116	8	6	.475	6	286	4681.4	760.2
2-25-15	2	115	6	4	---	3	268.6	3176.8	1058.9

Table 1 Continued

Date Farrowed	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
4-5-16	4	116	9	7	.597	7	238.2	7333.7	1047.6
2-13-15	1	113	4	2	.351	1	420	1697.5	1697.5
1-22-16	3	---	9	5	.44	5	280	5807.2	1161.0
5-6-15	1	112	6	2	.304	1	386	1412.9	1412.9
2-25-16	-	113	9	7	.29	3	346	4366.5	1455.5
3-19-17	3	114	8	7	.72	7	200.2	6749.6	964.2
6-15-17	2	114	10	10	.368	5	---	----	-----
4-28-12	3	112	9	5	.639	2	265	2257.9	1128.8
5-17-11	2	114	7	7	---	3	311	3541.4	1180.4
1-8-13	1	113	3	1	.424	1	262	1230.39	1230.39
2-28-14	3	114	10	9	.439	8	257.5	8591.03	1073.8
2-19-14	1	114	11	3	.666	3	264.	3347.8	1112.6
2-20-14	1	115	11	8	.592	8	245.4	8058.6	1007.3
5-6-15	1	112	6	6	.558	6	278	7178.5	1196.4
1-14-11	1	112	5	1	.682	-	---	------	------

Table 1 Continued

Date Farrowed	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
5-4-12	3	113	7	3	.679	2	344	2729.2	1364.6
5-10-12	2	114	6	3	.62	2	249	2202.8	1101.4
4-19-13	4	115	6	4	.593	3	277	4016.2	1338.7
6-6-14	1	113	6	3	---	3	337	4559.3	1519.7
6-13-14	1	114	7	4	---	2	263	2081.3	1040.6
FALL LITTERS									
9-25-10	3	115	10	4	---	-	---	---	---
9-29-11	5	115	4	4	.472	4	274	4278.4	1069.6
7-8-9	1	115	3	3	.504	2	293.5	1900.89	950.4
9-10-10	3	113	10	3	---	-	---	---	---
9-29-11	5	114	9	3	.463	3	264.6	2792.0	930.6
10-15-10	2	114	6	5	.448	-	---	---	---
9-28-11	4	114	7	6	.372	6	281.0	6545.09	1090.8
9-25-10	1	119	4	4	.423	-	---	---	---
11-1-12	4	111	9	9	.484	9	261.8	9416.6	1046.2

Table 1 Continued

Date Farrowed	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
8-9-13	2	110	11	8	.395	7	321	8222.2	1174.6
9-7-13	2	115	3	3	.451	3	304	4071.06	1357.02
10-10-15	3	114	9	4	.534	2	283.3	2165.6	1082.8
10-1-17	5	112	10	6	.597	-	---	---	---
9-26-16	2	113	10	5	.45	5	205.2	5220.5	1044.1
12-25-16	1	113	10	1	.426	1	236	905.6	905.6
9-19-10	1	115	9	6	---	-	---	---	---
11-15-10	1	115	7	2	.485	-	---	---	---
7-4-13	2	113	8	4	.632	2	271.5	2555.0	1277.03
8-24-14	4	114	9	8	.479	8	272	9961.3	1245.1
8-22-14	2	116	9	8	.492	7	271	8270.8	1181.2
8-20-14	2	114	8	8	---	8	252	8327.7	1040.9
8-10-11	2	114	8	8	.439	4	324.5	4663.3	1165.8
8-25-11	1	115	8	3	.515	2	344	2729.2	1364.6

Table 1 Continued

Date Farrowed	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
10-27-12	3	116	9	7	.535	4	262.5	5039.2	1259.8

SUMMARY

	No. of Lit.	Days Gest. Per.	No. in lit. at birth	No. at weaning time	Daily Gain until wean. time	No. to reach 250#	Age in days at 250#	Feed Consumed by Litter	Feed Consumed per pig.
Spring Litters	34	113.3	248 7.29	170 5	.4904	116	278.8	1110.8	1110.8
Fall Litters	24	114.1	190 7.91	122 5.08	.477	77	269.6		1130.8

A summary of the table shows a slight difference in the length of the gestation period, the sows farrowing in the fall having carried their young the longest. This may be due to more favorable nutritional conditions during the summer months. A slightly larger mumber per litter were farrowed in the fall. To attribute this to a difference in nutrition would be to ignore the fact that poor rather than good nutrition incites fecundity. It is more probable that complex nervous effects are the chief factors.

Another interesting point in the table is that the fall pigs reached 250 pounds in a shorter time than did the spring farrowed litters; and did so on only slightly more feed. The pigs in this experiment were liberally fed at all times and were given well balanced rations. Although the spring pigs were on grass most of the period required to reach 250 poubds, yet it may be that owing to a full ration being fed most of the time, they did not make an economical use of the pasture and therefore most of the gains made by the spring pigs must be credited to the feed given. This is the only explanation that can be given at this time by the author, and more data would be necessary before any conclusions could be drawn.

Under farm conditions the fall pigs frequently receive little grass and a poorly balanced ration with only limited shelter during the winter months. This gives the spring pigs a decided advantage, for grass does a great deal to supplement a poorly balanced ration. The figures given here will hold only where the fall pigs are liberally fed on good rations and good care is coupled with adequate housing facilities during the winter months.

The farmer in raising hogs for the market has been interested almost entirely in the number of pigs raised and the pounds of pork produced. Various breeders have not agreed upon the most advisable age at which to breed the youn gilts; yet they are almost of one mind as to the time to breed for the greatest profit.

Some commercial hog raisers not particularly interested in the establishment of blood lines; and not having adopted a constructive breeding policy allow their gilts to farrow only one litter, and then market the sows with the offspring; selecting new breeding stock every year. Such a practice has lowered the initial charge against the litter since there is no maintenance cost for the mother during long dry periods, such as is the case where the sow is held over and allowed to farrow only one litter a year.

To determine the relative profit of the three Groups the table under Group XVI has been prepared. This table extends over a period of 50 months and gives the amount of feed consumed, the respective number of pigs farrowed by each factor and the number raised to weaning time. The record for the litters is carried not farther than weaning since the mother had finished her part with the weaning of the litter, and the profit from then on would depend upon the system of management used. Previous data has shown little or no difference in the amount of feed required by pigs from mature and immature parents in reaching a given weight. The records for Factors XI and XXII were closed at the date

which marked the end of the fifty month period for the original factors. The feed record gives the number of pounds of each ration consumed and their total value in terms of standard ration. The total feed consumed by the mother was in each case divided by the number of pigs raised to weaning time and this amount of feed charged as the initial cost for each pig.

The immature group farrowed their first litters at from eight to ten months of age, the half mature group at twenty-four to twenty-six months of age, while the mature group did not farrow until twenty-eight to thirty-five months of age. The original factors in the immature group farrowed six and seven litters respectively, a total of 94 pigs, of which 67 were raised to weaning time. In addition by the end of the fifty month period the first generation sow of the immature group had farrowed 6 litters, while within the same period XXII, a second generation sow, had given birth to 4 litters. This makes a total of 23 litters for this group and a farrowing record of 145 pigs, of which number 107 were raised to weaning time.

During a similar period Factor III of the half mature group had farrowed 4 litters and a total of 34 pigs of which number 18 were raised. Factor VII died shortly after she farrowed her second litter. Within fifty months the mature group had farrowed only 7 litters, a total of 42 pigs with 30 still living at weaning time.

A study of the feed charged to each pig at

weaning time shows a close relation between the initial cost per pig and the time at which the dam was bred. This cost was lowest for the pigs of Factor VI and was due to the high per cent of the pigs born being raised to weaning time. The most feed charged to any pig was in the case of Factor VIII where only three litters had been farrowed by the end of the period and only thirteen pigs were alive at the close of the lactation period.

Group XVI - Table 1

TABLE GIVING RELATIVE PROFIT FROM THE THREE GROUPS

Factor	No. of Lit.	No. of pigs farrowed	No. raised to weaning time	Lbs. feed consumed by sows	Age at farrowing time	Lbs. Feed Charged to pigs at weaning time
Immature Group						
V	6	45	26	5809.9	10 mo.6 da.	223.4
VI	7	49	41	6447.7	8 mo.29 da.	157.24
XI	6	34	27	5727.7	10 mo.18 da.	212.5
XXII	4	17	13	3690.7	10 mo. 2 da.	283.9
Half Mature Group						
III	4	34	18	5070.0	~~24~~mo. 19 da.	281.7
VII	2	14	9	2597.6	26 mo.15 da.	288.6
Mature Group						
IV	4	20	17	4987.0	28 mo. 14 da.	293.3
VIII	3	22	13	5030.8	35 mo.24 da.	386.9

A comparison of the three groups over a fifty month period shows not only a greater number of pigs farrowed by the original factors in the immature group, but this number is greatly increased by the number of litters farrowed by the first and second generations of these factors. The initial feed charge is highest for the mature group and lowest for the immature group, which of course is largely due to the feed consumed by the mature group during the long period at the beginning, when both of the factors were open. It seems from this study that if commercial pork production is the only aim, the breeder should not delay breeding later than 8 to 10 months. If pure bred hogs are a speciality, and the sows are to be kept over a long period of years and a rapid growth with the maximum size at maturity is desired, it would be well to delay breeding until a later date.

SUMMARY

In this experiment the effects of early breeding would be observed in one or all three of the following ways: (1) By the effect on the mother, (2) By the influence on the offspring, and (3) By changes in the characteristics of the breed. A careful study has been made of the data at hand with these three things in mind. In order to determine the effect of early breeding on the mother comparisons were made of the growth of sows during different periods of reproductive activity and the growth over corresponding periods of animals that had never been bred.

To study the effect of pregnancy on growth comparisons were made between pregnant and non-pregnant animals comparable as to age and the amount of feed consumed. In ten of the eleven tables the pregnant sows made greater gains in body weight than did the non-pregnant animals. The differences in skeletal growth were small and probably in most cases within the range of error. In eight of the eleven tables the greater gains in skeletal measurements were made by the pregnant animals.

In this experiment pregnancy did not retard body growth; and in the majority of cases caused no check in skeletal development. On the contrary there is evidence to show that pregnancy slightly favored body growth. The gains during pregnancy are closely linked with the individuality of

the animal, and in a few cases the small gains made by a few of the pregnant sows may thus be explained.

The increase in weight during pregnancy might be accounted for by the quieter disposition of a pregnant animal; or better nutritive conditions that may be established during the gestation period. The small amount of dry matter in the fetus and a probable higher coefficient of digestibility may also serve to explain the increase in weight of the pregnant mother.

A comparison during dry periods of three sows which had lost their litters at birth and a corresponding number of gilts, which had never been bred, in two cases out of the three, indicated no decrease in the growth rate of the animals that had previously been pregnant. The sows that had never been bred were no larger at the end of the period than those animals that had lost their litters. No final conclusions can be drawn from these tables due to the small number of animals involved.

Comparisons of the gains made during different stages of a single gestation period bring out the fact that greater gains were made during the second month than the first. Similar comparisons for the first and third months show the larger gains in weight to be made during the latter period.

A comparison of the feed consumed by pregnant and non-pregnant factors cannot be absolutely accurate

since individual records were not always kept. The tables show that although the pregnant factors consumed slightly more feed, they required 2.1 pounds less feed to make one pound gain than did the non-pregnant factors.

It has been a matter of common observation that lactation checks growth. Seven comparisons were made between dry sows and sows suckling pigs. These tables show that where normal sized litters were suckled the sow lost in weight during the lactation period. This loss in body weight was accompanied in most cases by an apparent check in skeletal growth. In a few instances, where small litters were suckled, the sows gained in weight. The lactating sows received on the average 481.5 #s more digestible nutrients than the dry factors; yet lost 16.5#s while the sows that were not suckling litters gained 25.8 pounds per head. The results recorded in this experiment seem to show that the injurious effects of early breeding are probably due to the drain on the mother while she is suckling her young.

The records indicate that the loss in body weight of the mother during lactation may be associated with the size of the litter. There is some evidence that later generations in the immature group consumed more feed while suckling their litters than did the original factors. The experiment shows that more feed was consumed per thousand pounds live weight by the sows in the immature group

during the first gestation period than any succeding pregnancy. Leaving out one period, the same holds true for the lactation periods.

A comparison of the three groups developed the fact that the most feed per thousand pounds live weight was consumed by the immature group during both pregnancy and lactation.

Where sows were compared during dry periods following lactation with sows that had never been bred, final body weights and measurements showed the open gilts to be the larger. In two out of the three tables the greatest gains in body weight were made by the sows recovering from the effects of suckling a litter. This suggests that when given a sufficient amount of feed, a sow will within certain limits recover from the losses in weight during lactation, by making increased gains during a following dry period.

Comparisons of factors in the three groups at 29 months of age showed the body weights of the animals to be in direct relation to the age at the time of breeding. Considering the more important skeletal measurements, skeletal growth was the most rapid in the mature group. At this age there appeared to be little difference in the size of the immature and half-mature groups.

At 41 months of age the body weight was greatest for the mature group, followed in turn by the half-

mature group. There was little difference in skeletal measurements between the immature and the half-mature groups at this age.

At five years of age the sows in the mature group were still the largest; but the difference was small as compared with measurements taken at an earlier age. These three tables indicate that sows bred at the first heat period never reach the size attained by animals bred at apparent maturity. In this experiment the immature group compared more favorably from the standpoint of size, with the mature group at five years of age than at an earlier date. This fact points to a longer growing period for sows bred at an early age.

As far as it was possible to determine, the sows in the later generations of the immature group were no smaller at a given age than the original factors.

A study of the farrowing records for the different factors developed no definite relation between the number of pigs in a litter and the individual weight at birth.

The proportion of the sexes was found to be approximately 107 males to 100 females.

The mature sows carried their young for a longer period than did the immature group and farrowed larger pigs. The number in the litter was greater for the half-mature than the immature group. When later generations within the immature group were compared with the

original factors, no marked decrease was found in either the number in the litter or the weight at birth.

Comparisons between sows representing early and late generations in the immature group, during periods comparable for each animal, showed no marked decrease in the growth rate or size of the later generations due to any cumulative effect of early breeding.

A summary of tables giving the amount of feed consumed by the litters in reaching 250 pounds, as well as the age of the pigs in days at that weight, brings out the fact that the offspring of the immature sows required neither a greater amount of feed, nor a longer period of time to reach 250 pounds than did the litters from the mature sows. It was found that the gilts reached 250 pounds at a slightly earlier age than did the barrows. Although the evidence on this point is not conclusive, it may serve to show the falsity of a common opinion that barrows feed out quicker than gilts.

An accumulation of data on the effect of previous pregnancy on the farrowing records showed a relation between the number in the litter at birth and the number of previous pregnancies. The birth weight was heavier for the fourth, fifth and sixth litters than for the first three. The number raised to weaning time was greatest for the last three periods considered in this table.

Little difference was noted between spring and

fall farrowed litters as regards the number in the litter at birth, the percent raised to weaning time or the average weight at that time. The fact that the fall farrowed pigs reached 250 pounds in a slightly shorter time, and on only a little more feed, may indicate that under proper management, there need be no big difference in either the amount of feed consumed or the time required by spring and fall farrowed litters to reach a given weight. However, this statement has a limited application, since each feeder modifies feeding practices to meet his own conditions.

A table giving the relative profit of each of the three groups was prepared. The table shows that the value of early breeding to the commercial hog raiser lies not only in the greater number of litters farrowed by the original stock within a given period; but also in the possible addition to the breeding herd of gilts from the early bred sows.

The minimum amount of feed charged to the offspring of any one factor in the immature group was 157.24 pounds at weaning time. The litters of Factor VIII in the mature group, were charged with 386.9 pounds of feed at birth. This high initial cost for each pig was due not only to the small number of pigs raised by the sow to weaning time; but to the high maintenance charge during the long period previous to the time at which she was bred.

CONCLUSIONS

1. Pregnancy does not retard growth. A pregnant condition in this experiment favored an increase in body weight.

2. Lactation represents a drain on the mother. The losses during this period probably account for any deleterious effects arising from early breeding.

3. There is evidence to show that the sows bred at an early age never reached the size of those bred at approximate maturity.

4. Although the data is not entirely satisfactory; it seems that neither the size, fecundity, prepotency or constitutional vigor was decreased in the later generations of the immature group by any cumulative effect arising from the system of early breeding employed in this experiment.

5. The mature sows farrowed larger litters and heavier pigs than the gilts bred at the first heat period.

6. The offspring of immature parents required neither more feed nor a longer period of time to reach 250 pounds than the litters born of mature parents.

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