The brood sow and litter feeding and management

E. L. Quaife
Iowa State College

Follow this and additional works at: http://lib.dr.iastate.edu/bulletinp

Part of the Other Animal Sciences Commons

Recommended Citation
Available at: http://lib.dr.iastate.edu/bulletinp/vol2/iss59/1

This Article is brought to you for free and open access by the Iowa Agricultural and Home Economics Experiment Station Publications at Iowa State University Digital Repository. It has been accepted for inclusion in Bulletin P by an authorized editor of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Quaife: The brood sow and litter feeding and management

March, 1944

BROOD SOW
And LITTER
Feeding and Management

AGRICULTURAL EXPERIMENT STATION—AGRICULTURAL EXTENSION SERVICE, Cooperating
IOWA STATE COLLEGE
AMES, IOWA

Published by Iowa State University Digital Repository, 1944
## CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing the gilt</td>
<td>907</td>
</tr>
<tr>
<td>Select and breed the well grown gilt</td>
<td>907</td>
</tr>
<tr>
<td>Healthy condition is essential at breeding time</td>
<td>908</td>
</tr>
<tr>
<td>The boar and the mating</td>
<td>908</td>
</tr>
<tr>
<td>Feeding during pregnancy</td>
<td>909</td>
</tr>
<tr>
<td>The feed for the pregnant sow</td>
<td>909</td>
</tr>
<tr>
<td>Self-feeding the pregnant sow</td>
<td>910</td>
</tr>
<tr>
<td>Minerals and vitamins necessary</td>
<td>911</td>
</tr>
<tr>
<td>Roughage valuable in brood sow ration</td>
<td>912</td>
</tr>
<tr>
<td>Brood sows following cattle</td>
<td>912</td>
</tr>
<tr>
<td>Exercise essential</td>
<td>912</td>
</tr>
<tr>
<td>Farrowing time</td>
<td>912</td>
</tr>
<tr>
<td>Sanitation is important</td>
<td>912</td>
</tr>
<tr>
<td>Care of the sow</td>
<td>913</td>
</tr>
<tr>
<td>Save the pigs</td>
<td>913</td>
</tr>
<tr>
<td>Feed lightly and carefully following farrowing</td>
<td>913</td>
</tr>
<tr>
<td>Raising orphan pigs</td>
<td>913</td>
</tr>
<tr>
<td>The nursing sow</td>
<td>914</td>
</tr>
<tr>
<td>A heavy milk flow calls for good feeding</td>
<td>914</td>
</tr>
<tr>
<td>When sows do not milk</td>
<td>914</td>
</tr>
<tr>
<td>Feeding the little pigs</td>
<td>916</td>
</tr>
<tr>
<td>Care of the little pigs</td>
<td>916</td>
</tr>
<tr>
<td>Watch out for anemia</td>
<td>916</td>
</tr>
<tr>
<td>Scours</td>
<td>917</td>
</tr>
<tr>
<td>Sunshine and exercise valuable</td>
<td>918</td>
</tr>
<tr>
<td>Pigs lose tails</td>
<td>918</td>
</tr>
<tr>
<td>Pigs are born fighters</td>
<td>918</td>
</tr>
<tr>
<td>Castration of the pigs</td>
<td>918</td>
</tr>
<tr>
<td>Watch out for robbing</td>
<td>919</td>
</tr>
<tr>
<td>Weaning of pigs</td>
<td>919</td>
</tr>
<tr>
<td>Rebreeding the sow</td>
<td>920</td>
</tr>
<tr>
<td>Protein supplements</td>
<td>920</td>
</tr>
<tr>
<td>Simple mineral mixtures</td>
<td>920</td>
</tr>
</tbody>
</table>

The Brood Sow and Litter

Feeding and Management

By E. L. Quaife

Successful pork production depends first upon selection of good breeding stock. The ability to produce and nurse a large litter well and impart to the litter efficiency in the use of feed is essential in the inheritance of the breeding stock selected. Equally important are proper feeding and management of the brood sow and her litter.

DEVELOPING THE GILT

It is a good plan to separate the gilts from the fattening hogs at 4 to 5 months of age and feed them a growing ration. Whole oats or a mixture of one-half oats and barley or wheat coarsely ground, self-fed, constitute a good foundation for a ration. Enough corn should be fed, probably a couple of ears daily, to each gilt to keep her gaining.

One-half gallon of skimmilk daily or ¼ pound of protein concentrate will furnish sufficient protein for one gilt in addition to what she obtains from grain and pasture. (The protein concentrate may be hand-fed or mixed with the grain on the basis of 5 pounds to each 100 pounds of grain.)

SELECT AND BREED THE WELL GROWN GILT

Gilts at breeding time should weigh at least 200 pounds and be well developed for age.

Select gilts from large, uniform well nourished litters. They should have clean-cut faces and neat, trim jowls. They should be deep in the flanks, wide through the loin and broad and deep in the hams. Their body conformation should suggest easy feeding quality. Their underlines need to be long with 5 or 6 well developed teats on each side of the belly. The gilts should stand squarely on feet and legs.
HEALTHY CONDITION IS ESSENTIAL AT BREEDING TIME

Gilts or sows picking up in flesh conceive more readily and stand a good chance of producing large litters. Those too fat or out of condition at breeding time may produce small and weak litters.

If the gilts have the “flu” at breeding time, they are difficult to settle. Usually the litter from a gilt with flu will be small and weak, unless she is restored to health before being bred.

To avoid the practice of breeding spring gilts each fall, some producers select their gilts from fall farrowed litters. These gilts are bred the following spring to farrow their first litters the next fall. These gilts are rebred to farrow the succeeding spring’s pig crop and are then sold.

Abortion causes much loss of little pigs. Do not bring gilts or boars on the farm which have not been tested for contagious abortion.

Isolate all new breeding stock for at least 2 weeks before allowing them to run with the rest of the herd.

THE BOAR AND THE MATING

The boar influences the type, gaining ability and size of the litter. He, too, must be well developed for his age. His body conformation should indicate good feeding quality. A long-legged, shallow-bodied boar is likely to sire pigs of the same type.

Boars are often too closely confined. They become slow and may fail to settle the sows. The boar needs, in addition to his pen, a small yard where he may exercise.

If many sows are to be bred, turn the boar with the herd for only a short time each day, or else put the individual sow in the pen with the boar. Some producers with herds of 30 to 40 sows use two boars, allowing each boar to run with the herd one-half day at a time.

In small herds, the boar may be allowed to run with the sows during the entire breeding season. Yearling or mature boars may breed as many as three sows a day. One service a day is better for boars under 1 year of age. Small litters or failure to settle sows may result from over use or a thin
run-down condition of the boar.

The same feeds as are fed the gilts may be fed to the boar, although during the breeding season he should have at least 1 pound of protein concentrate daily.

**FEEDING DURING PREGNANCY**

The pregnant gilt may well gain 1 to 1½ pounds per day during the pregnancy period of 112 to 115 days. The amount the tried sow gains will depend much upon her condition at breeding time. Keep the sow from getting too fat by exercise and through the use of protein and bulkier feeds.

Gilts will need from ½ to 2 pounds of grain per hundredweight a day while older sows may do with 1¼ to 1¾ pounds per hundredweight.

**THE FEED FOR THE PREGNANT SOW**

During the winter months 1 to 2 pounds of whole dry oats per sow, hand-fed, with enough corn to keep the sow in good gaining condition, form the basis of a satisfactory pregnant sow ration. Give sows access to a mineral mixture and to all the good legume hay, such as alfalfa, red clover or soybean, she cares to eat. Feed ¼ to ½ pound of some good protein supplement* or ½ gallon of skimmilk to the gilt each day. The protein supplement might be limited to the second half of the pregnancy period for tried or older sows.

Coarsely ground barley or wheat may replace part or all

*See page 920 for suggested protein supplement and mineral mixtures. Whatever is used may be determined by availability and relative price.
of the corn in the brood sow ration in localities where these grains are comparable in price with corn. Avoid the use of rye in gestation rations.

When on good pasture, the pregnant sow will need only enough grain to make a satisfactory gain. During the latter half of the pregnancy period, feed ½ pound of protein supplement daily per sow.

If slopping is practiced during winter, 950 pounds ground oats, 950 pounds of ground wheat or middlings and 100 pounds protein supplement make an excellent mixture when corn is hand-fed in addition. About 3 pounds or one-half the daily feed should be the grain in slop and the other half corn.

**SELF-FEEDING THE PREGNANT SOW**

Pregnant sows may be self-fed with a saving of the detailed labor required in hand-feeding; the sows can eat according to their needs; more legume hay will be consumed. Self-feeding involves grinding of part or all of the feeds, and unless the ration is made bulky, the sows may become too fat.

For dry lot or winter feeding, a mixture made up of ⅔ ground shelled corn, ⅔ ground oats and ⅓ coarsely ground alfalfa with 100 pounds of a protein supplement added to each ton of the mixture has been satisfactorily self-fed to both gilts and older sows. Minerals may be added to this mixture at the rate of 20 pounds of minerals to the ton of feed, or they may be self-fed.

In making up the grain and roughage mixture, different proportions can be used, depending upon the availability of various feeds and the age and condition of the sows. Some swine producers have fed up to 50 percent of the mixture in the form of alfalfa to old sows. The protein supplement may be left out until the second half of the period for tried sows. Skimmilk can also be used to replace the other protein feeds.

*A second procedure* which does not involve grinding the corn is to use a mixture of 600 pounds ground alfalfa, 600 pounds ground oats and 100 pounds of protein feed. The ear corn can be fed separately at some distance from the sleeping quarters and the amount fed should be governed by the condition of the sows.

To make the sow exercise, the self-feeders should be set
15 to 20 rods from the sleeping quarters. The waterers should be near the sleeping quarters so the sows will drink both going to and coming from the feeder. It is very essential in self-feeding bulky dry feeds that the sows get sufficient water. The sows should be taken away from the self-feeder 2 or 3 days prior to farrowing. Sows and gilts should be fed separately; otherwise, the old sows may fight the gilts from the feeders.

On pasture, either whole oats may be self-fed or a mixture of ⅔ ground oats and ⅓ ground corn or wheat may be used, with 5 pounds protein supplement to each 100 pounds of grain.

MINERALS AND VITAMINS NECESSARY

Weakness of the back and the hind legs of brood sows suckling pigs sometimes occurs when the litters are large. This trouble may be caused by mineral, protein or vitamin deficiencies in the feed. To prevent this trouble, provide plenty of these minerals in the ration. Experience shows that feeding all the alfalfa hay sows will eat helps prevent paralysis of the hindquarters. If such trouble has occurred previously on the farm, it is a good plan to force-feed minerals. Use a simple mineral mixture* at the rate of 4 to 5 pounds with each 100 pounds of protein supplement. Do not deprive the sow of minerals.

*Suggested mineral mixture, page 920.
ROUGHAGE VALUABLE IN BROOD SOW RATION

Legume hays such as alfalfa, clover and soybean contain high quality protein and mineral elements such as calcium and phosphorus. They are also rich in vitamins.

Roughage distends the digestive apparatus and develops roomier brood sows. In localities where alfalfa is plentiful, it may make up 40 percent of the total feed consumed by the pregnant sow. When this much alfalfa is fed, it should be ground. Smaller amounts, such as \( \frac{1}{2} \) to 1 pound a day, may be fed in the form of hay in racks or in the nest.

BROOD SOWS FOLLOWING CATTLE

Allowing brood sows to follow cattle is a common practice but none too safe. The danger lies in sows getting bunted or kicked or in wallowing in deep mud. These hazards can be lessened some by removing the sows 3 or 4 weeks before farrowing. Even though protein supplement is fed to the cattle, additional grain and protein supplement should be fed by hand to the sows during the latter half of the pregnancy period.

EXERCISE ESSENTIAL

Exercise is best obtained by allowing pregnant sows to forage in the stalk fields or in a field where corn and soybeans have been hogged-down, or by scattering their feed some distance from the sleeping quarters.

FARROWING TIME

SANITATION IS IMPORTANT

The little pig should be born in clean surroundings. Pigs farrowed late in the spring or during the early fall months may well be farrowed out in the field where they have the opportunity of avoiding exposure to infections common to old lots. Winter or early farrowed spring pigs are usually farrowed in a central hog house, or in batteries of movable houses where there is less possibility of pigs being exposed to infectious diseases.

Scrub the pen with scalding hot water and lye (1 pound lye to 20 gallons water) and when dry, bed with clean short straw.

Brush or wash off dirt or filth from the belly and udders of the sow before putting her in the farrowing pen.
CARE OF THE SOW

Usually when milk fills the udders, the sow will farrow within 24 hours. Constipation of the sow is serious at this time. It must be guarded against by feeding laxative feeds such as whole oats or bran, or a handful of linseed meal a day or two prior to farrowing. Allow plenty of water. The sow might be shut in the pen at night and let out during the day for exercise. Sows are often confined for too long a period before farrowing. Pet the sow some or accustom her to handling so that if she needs help at farrowing time, it may be rendered without the sow becoming excited. Heavy pig losses usually result from cross or clumsy sows. Hog houses too hot or too cold cause sows to be restless. A temperature of 55° F. to 70° F. is satisfactory.

SAVE THE PIGS

Many a pig is crushed by the sow. A 2"x4" or 2"x6" guard rail along the sides of the pen 8 inches from the floor and 6 inches from the wall will save many a pig which would otherwise be crushed.

Be on hand at farrowing time. If the weather is cold, provide a basket with some warm bricks or a jug of hot water in the bottom covered with a gunny sack. Dry the pigs off and put them into the basket until the sow is through farrowing. If a sow farrows during the night, it is often best to take the pigs away and return them in the morning. One strong pig may be left with the sow to keep her contented.

When artificial heat is necessary, electric brooders provide a fine source of heat.

FEED LIGHTLY AND CAREFULLY FOLLOWING FARROWING

For a couple of days following farrowing, feed only whole dry oats or a little slop. If the sow is constipated and shows a tendency to feverishness, 1/2 pound linseed meal or some bran added to the slop will be beneficial. Heavier feeding may be started 4 or 5 days after farrowing when most danger from fever has passed. At the end of a week or 10 days the sow should be consuming a full feed.

RAISING ORPHAN PIGS

1. Pigs must be kept warm. Chilling causes scours.
2. Newborn pigs should have the colostrum (first milk) of
914

the sow or from a cow. When the colostrum is not available half a teaspoonful of mineral oil given to each pig will help clear the bowels.

3. Cow's whole milk, sweetened slightly by adding corn syrup and fed warm, is all that is necessary.

4. A nipple on a bottle facilitates feeding, although pigs may be taught to drink from a pan at an early age.

5. Utensils should be kept clean.

6. Feed six times per day during the first 3 or 4 weeks; after that three times may suffice.

7. During the first week $\frac{1}{2}$ to 1 cupful a day; the second week, 1 to $1\frac{1}{2}$ cupfuls; the third week, 1 pint; and the fourth week, 1 quart a day may be satisfactory.

8. For pigs fed cow's milk and with no access to soil, add $\frac{1}{2}$ ounce of a saturated solution of copperas in water (made by dissolving a pound of copperas in $\frac{1}{2}$ gallon hot water) to each quart of milk to prevent anemia.

9. At a week to 10 days of age, offer the pigs rolled oats or coarsely ground wheat and cracked corn; at 4 to 6 weeks of age, skimmilk may be substituted for the whole milk.

10. Let the pigs have access to sunshine.

**THE NURSING SOW**

**A HEAVY MILK FLOW CALLS FOR GOOD FEEDING**

Self-feeding of sows nursing pigs reduces labor, stimulates milk production and helps keep the sow in good flesh. Self-feeding may be begun 10 days after farrowing, although some producers leave the sows on self-feeders all of the time. A ration of shelled corn, whole or ground oats and some good protein mixture may be self-fed separately with excellent results. Barley or wheat may replace some of the corn. One to two gallons of skimmilk or buttermilk is a good replacement for other protein feeds.

A feed mixture for slop consists of 100 pounds of ground oats and 100 pounds middlings or ground wheat to which 50 pounds of protein feeds have been added. This mixture fed in thick slop with full-feeding of corn is satisfactory.

**WHEN SOWS DO NOT MILK**

"Drying up" or failure to produce milk by the sow often occurs. This may be due to any one of a number of factors,
Fig. 3. Electric brooders provide uniform, safe, satisfactory heat.

such as fever in the udders, overworking the sow, an inadequate diet or the lack of inherent ability to produce milk.

Fever in the udders may be caused by over-feeding at the time of farrowing or by sows lying on a cold floor. The sow is restless and refuses to let the pigs nurse. Milk congests in the udders and the sow may dry up.

A run-down condition due to overworking with previous litters may also cause sows to dry up. It is not a good practice to full feed the sow immediately following farrowing. Therefore, she should have some reserve flesh to draw upon until she is consuming a full ration.

An inadequate diet is a frequent cause of failure to milk well. A ration made up entirely of corn is deficient for milk production. Swine producers often make the remark that their sows dry up, although they are feeding all the skim-milk or buttermilk the sows will drink. The probabilities are that the sow is not eating enough other feeds such as corn, oats, wheat and protein supplement which furnish dry matter out of which milk may be made. Two gallons of buttermilk or skimmilk probably represents about the maximum amount of milk which should be fed daily with grain to the brood sow.

When adequate rations for milk production have been fed and other known requirements met, and little or no milk is
produced, it is probable that the pituitary gland, which is involved in milk production, is not functioning. This frequently occurs when the sow has been badly overworked as a breeding animal. An injection of an extract from the pituitary glands is often helpful in bringing these sows to their milk.

Finally, some sows are naturally poor mothers and milkers. Swine have gone through extreme changes in type. Corn has been used heavily in the rations, and there has been a tendency to produce a "lardy" hog. Sows of this type are often failures as nurses for large litters.

FEEDING THE LITTLE PIGS

Little pigs will begin to eat grain at 10 days of age. A small pen or creep into which the pigs can go but which excludes their dams should be provided.

Hulled oats or "oat groats" are excellent and may be either self-fed or hand-fed. Pigs will eat rolled oats sooner than any other feed. A complete grain and protein feed mixture, commonly called pig meal, can be made as follows and self-fed in a creep: 50 pounds coarsely cracked corn; 25 pounds hulled oats, or flour middlings or ground wheat or oats; 10 pounds meat and bone scraps; 7 pounds soybean oilmeal; 5 pounds alfalfa meal; 3 pounds of a simple mineral mixture.

Other satisfactory feed combinations are shelled corn or cracked wheat, self-fed, plus a protein mixture self-fed. If skim milk or buttermilk is available, a quart of either per pig daily will furnish the protein required when fed with shelled corn or other grains. Ground wheat, barley or oats can sometimes be fed to advantage to replace a part of the corn. Fish meal may also be used in place of the soybean oilmeal or replace half the tankage or meat scraps.

CARE OF THE LITTLE PIGS

WATCH OUT FOR ANEMIA

Anemia often occurs in little pigs confined for 2 or 3 weeks to a pen where they receive no feed other than the milk of the sow. External symptoms are thumping of the sides, paleness of the skin, shrinking in flesh and roughness of the hair. Pigs so affected generally die within a few days. Sow's milk is deficient in iron and copper. Apparently these
minerals cannot be fed to the sow to make up for this deficiency in the milk.

A good preventive of anemia and thumps is a piece of clean, fresh sod or dirt put into the pen every few days. The pigs will "nose over" the dirt and get some of it, containing mineral matter, into their mouths and into their systems. Mixing ¼ pound finely ground copperas in 100 pounds of dirt makes it more effective.

Painting the udders of the sow once a day with a solution of an iron salt until the pigs are 3 to 4 weeks old is also effective in preventing anemia. This solution is prepared by dissolving 1 pound of copperas in ½ gallon of hot water. A small amount of corn syrup added to make it slightly sticky helps in keeping the solution on the teats and udder.

Encouraging the pigs to eat protein feeds and grains out of a creep at the earliest possible date is helpful in preventing this trouble. Pigs raised out on pasture are seldom affected with anemia, for they get minerals from the green feed and from rooting about in the soil.
SCOURS

Ordinary scours in little pigs may be brought on by overfeeding of the sow, sudden change of feed, damp, chilly, cloudy weather, filthy pen conditions and exposure to drafts, or from the pigs getting wet.

White scours are due to organisms which get into the digestive tract of the pigs from contaminated teats or feed.

Location of the cause and its removal are the first steps to take in controlling these troubles. A thoroughly cleaned and disinfected pen, with dry bedding and a floor flooded with direct sunshine, together with great care as to cleanliness of feed and utensils, are the most important factors to consider in preventing either kind of scours. Do not force the milk flow too soon after farrowing; use only clean, sweet feeds.

Clean sod placed in the pen, a tablespoon of baking soda or dried blood meal fed in slop to the sow, are commonly used, in the belief that these materials aid in checking scours.

SUNSHINE AND EXERCISE VALUABLE

The sooner little pigs and the sow can be put out upon clean ground and into the sunshine, the greater success one will have. This may be when the pigs are a couple of days old.

If the sow must be confined to the pen, some provision should be made to exercise the pigs. This can be accomplished by letting the pigs out into the alley where they can play.

PIGS LOSE TAILS

Sometimes the tails of little pigs will become sore at the base and “slough” off. This is due to a bacterial condition usually associated with damp bedding and infection in the pen. A disinfected pen, clean, dry bedding and sunshine are the best preventives of this difficulty. Pigs farrowed out on pasture are seldom bothered.

PIGS ARE BORN FIGHTERS

Clipping the long black teeth of little pigs when pigs are a day or so old should be done only with large litters when fighting takes place. If the operation is performed the teeth should be clipped off rather than pulled. Swab the gums afterwards with a weak solution of tincture of iodine.
CASTRATION OF THE PIGS

Pigs may be castrated any time after they are a week old. If done at a young age, there will be very little setback in the growth. There is some advantage in spreading the various operations such as castration, vaccination and weaning. Any two of these done at the same time may cause considerable setback in rate of gain.

WATCH OUT FOR ROBBING

Runty pigs are often the result of robbing. This occurs when large numbers of litters of uneven ages and sizes run together during the suckling period. Four or five litters of even size and age are as many as should run together. This may be impractical when large numbers of sows are kept. Some hog producers run large numbers together, but arrange to have the sows and their litters in separate pens at night.

WEANING OF PIGS

The age at which pigs are weaned depends to some extent upon whether the sow is to be rebred. If the dam is a gilt and is to be rebred while the pigs are nursing, weaning may be done when the pigs are 6 to 7 weeks old. Pigs may be left longer with old sows.

If the sow is not rebred, the pigs might remain with the dam until they are 8 to 10 weeks of age.

Pigs weaned at 4 or 5 weeks of age suffer a setback when
taken from the sow. Pigs when weaned should be eating corn, oats and other feeds so well that they will suffer no loss in weight when taken from the sow.

A few days prior to and following weaning, limit the ration of the sow to dry oats and water so that the milk flow will be reduced and the udders will dry up without swelling and becoming caked.

Taking the larger pigs away and leaving the smaller ones with the sow may result in some udders being neglected and as a result become swollen, caked and ruined.

REBREEDING THE SOW

Sows will often take the boar the third day after farrowing. The practice of breeding this soon, however, is not to be recommended except where the litter is late and it is necessary to rebreed early for a second litter. If sows are well fed and kept up in flesh, there should be no difficulty in getting them in pig 2 to 3 weeks after farrowing. Sows often may be brought into heat by shutting the pigs away from the sows a few nights in succession.

PROTEIN SUPPLEMENTS

I. Pasture Feeding
   A. Tankage—60 percent protein, or meat and bone meal 50 to 52% protein.
   B. Tankage—50 pounds, soybean oil meal—50 pounds.
   C. Tankage—33\(\frac{3}{4}\) pounds, soybean oil meal—33\(\frac{3}{4}\) pounds, linseed oil meal—33\(\frac{3}{4}\) pounds.
   D. Soybean oil meal—90 pounds, minerals—10 pounds.

II. Dry Lot Feeding
   A. Tankage—40 pounds, soybean oil meal—40 pounds, alfalfa meal—20 pounds.
   B. Tankage—30 pounds, soybean oil meal—40 pounds, linseed oil meal—10 pounds, alfalfa meal—20 pounds.
   C. Soybean oil meal—70 pounds, alfalfa meal—25 pounds, minerals—5 pounds.

III. Whole soybeans may be used to the extent of one pound per day per sow during gestation. During the suckling period, it would be better to limit the soybeans to one-half the protein supplement.

SIMPLE MINERAL MIXTURES

I. Dry Lot or Winter Feeding: 20 pounds salt, 10 pounds steamed bone meal or high grade phosphate, 68 pounds ground raw limestone, 2 pounds iron oxide, ½ oz. potassium iodide, ⅛ pound manganese sulphate.

II. Pasture Feeding: 10 pounds limestone, 10 pounds steamed bone meal or high grade phosphate, 2 pounds salt.

III. Wood ashes and salt, equal parts by weight.