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IODINE, A FACTOR IN FEEDING YOUNG GROWING SWINE

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Iodine is now generally believed to be absolutely essential for the proper growth and development of the mammalian organism, and its use in animal feeding is becoming more and more general, particularly in goitrous regions.

Inasmuch as the whole northern half, practically speaking, of the United States is goitrous, and inasmuch as the iodine content of water in this generalized area is very, very low, the possibilities of beneficial results accruing from iodine feeding are seemingly large. It has been demonstrated that iodine is absolutely essential in a good many localities, particularly in the northwestern portions of the United States, to successful reproduction; and that the absence of a sufficient amount of iodine in the ration of pregnant cows, mares, ewes, does, and sows results in a pathological condition in the new-born. Hairlessness in the new-born pigs is one of the outstanding symptoms in swine: the pathological syndrome in this species includes such symptoms as weakness; smallness, thick, and pulpy, and somewhat wrinkled skin, susceptibility to sun-burning; and general loss of stamina and vitality. In many cases the pigs are born dead, and in a good many other cases they are born alive but die soon after birth. Some hairless pigs, not too badly affected will live and in a month or so will become apparently normal. With cattle, we find that in a goitrous district both adults and young calves are affected, the disease being no discriminator as regards sex. Affected calves are often spoken of as "big-necked," and the cows that mother these abnormal calves often have thyroids of abnormal weight and dimension. A microscopical examination of the thyroid in cows and calves indicates the development of pathological changes, these being more marked in severe cases.

Horses are, according to Kalkus (1), oftentimes widely affected, it being estimated that in some goitrous districts from one-third to a half of the adult horses "have visibly enlarged thyroid glands."

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The period of gestation of mares, as well as other animals, is often lengthened, and the colts come weak, in many instances not being able to stand without being supported, because, as Kalkus (1) puts it ". . . of the decided contraction of the flexor tendons in the forelegs, which causes a knuckling over and an extension of the flexors of the hind legs." There are other symptoms, such as labored breathing, high pulse rate, lack of appetite, and sometimes marked jugular pulse, heart and other involvements.

Goats are quite susceptible to goitre, so much so that Angora breeders find it impossible to ". . . raise kids in goitrous sections." Kalkus (1) found that there was a hundred percent loss in his experimental kid crop in 1917.

Sheep, in our own experience, appeared to be more susceptible to goitre, under Iowa conditions, than did swine. In three years out of fourteen, at the Iowa Agricultural Experiment Station, we have had a noticeable development of "big-neck" in some of our new-born lambs. In one of these years the goitrous condition was unusually marked, a considerable percentage of the new-born lambs being affected with enlarged thyroids, the so-called "big-neck." The losses occurring among the new-born lambs in our experimental flock were very large in that disastrous year.

In the other eleven years of our personal experience in charge of this experimental flock of some fifty or more ewes, goitre or symptoms of noticeable iodine deficiency have not been in evidence. We have noted that the goitrous lambs have been unusually weak at birth, and that many of them were troubled with dyspnea. In some cases we have noted dystocia. Lack of wool covering has been evident, particularly in the case of the lambs with the markedly enlarged thyroids.

In our experience with cattle at the Iowa Agricultural Experiment Station, we have not noted in the new-born calves, any particular sign of iodine deficiency, excepting perhaps a combined general weakness and a knuckling over on the posterior part of the fetlock, — in a couple of instances, one being noted in February and the other in mid-summer. These two calves were observed by Professor R. S. Stephenson, colleague in the Animal Husbandry Department, in 1924. The senior writer has noted one instance, on a farm just a few miles from Ames, Iowa, in which the new-born calf was practically hair-less.

Welch (2), of the State of Montana, has had excellent success in practice from the field use of iodines in the prevention of goitrous conditions in the new-born.

Welch (3) emphasizes that his correspondence with stockmen throughout the country indicates that here and there in Minnesota and Wisconsin and in some eastern states, goitre is more prevalent than ordinarily supposed. Welch (4) tells us that he has used a minimum dosage of one-half grain of potassium iodide per sow daily during the first sixty days of the gestation period with success, and that judging from experiments which he has not published it is his belief that one-tenth of a grain per day, taken over the same period, is ample. He finds, however, that one grain per sow daily, for the last thirty or forty days of the gestation period, has not succeeded in preventing goitre. He believes, therefore, that early administration is the best plan.

The dosage of iodine which is necessary to prevent goitre or hairlessness has, according to Hart, Steenbock, and Morrison (5), not yet been definitely determined. These workers state that two grains of either potassium or sodium iodide given throughout the period of gestation will prevent the difficulty. They also think a smaller daily dose may be sufficient, or, presumably in order to save iodine, they suggest another possibility, or namely, ". . . treatment during only the latter part of the gestation period." It is emphasized by them, however, that further experiments are necessary in order to decide these points.

Smith (6) has pointed out that pigs which are born in the early spring months of March and April are more frequently affected with fetal athyrosis than are those which come in the later months of summer, and that even in badly affected regions the fall litters are usually normal. Smith (7) was the first to point out the use of iodine to prevent this goitrous condition in swine.

Seidell and Fenger (8) have shown that the iodine content of the thyroid glands of swine, as collected at a Chicago packing house, may vary from 0.133 to 0.531 per cent in the dry matter from early spring to early fall. Presumably the pigs when grazing on pasture increase their store of iodine. The fact that there should be such a wide range in the iodine content of the thyroid under apparently normal or average conditions, suggests that the iodine content of the thyroid gland, in early spring, before the green grass comes might be too low for future safety, inasmuch as their determinations showed the swine to store some four times the original thyroid supply during the summer months.

It is known from the work of a number of investigators, that the iodine content of feeds varies greatly, and that the same feeds grown under different conditions, or in the same locality in differ-

ent years, may vary greatly in their iodine content, from nothing up to a considerable amount. The presence of iodine appears to be accidental but nevertheless, on the average, less iodine is found in the feeds coming from a goitrous region than from a non-goitrous section. These facts should stimulate us to inquire deeply into the advisability of feeding iodine to human beings as well as to livestock, particularly so, when we consider that the source of iodine in the food supply is so haphazard and uncertain. If the water supply is likewise low in iodine, as is the case of certain water from a fairly deep well at Ames, Iowa, and of Iowa River water, at Iowa City, which according to McClendon and Hathway (9) analyzed respectively only 1.2 and 1.5 parts per one hundred billion parts, then the source of iodine, if of such character, is hazardous.

Concerning the feeding of iodine to swine, other than pregnant sows, Morrison, Fargo, and Martin (10) are of the opinion that, "Wherever there has been trouble from hairless pigs, then iodine should be added to the ration of the pregnant sows to prevent this disease. There is, however, no proof that there is any benefit from adding iodine to the ration of pigs except this prevention of hairlessness." They also, contrary to Welch (4), state that "Fortunately, in Wisconsin there is but very little trouble from hairless pigs."

It has been our belief that even though hairlessness or goitrous conditions generally were not noted in the breeding herd, that this was not proof, by any means, that swine did not nevertheless suffer from iodine deficiency. We shall dwell more fully upon this matter shortly.

Mitchell (11) thinks that the general use of potassium or sodium iodide is ". . . neither necessary nor advisable." Rice and Mitchell (12), although appreciating that the administration of small amounts of iodide seems to be an effective remedy for goitre when administered to breeding animals in those localities where this disease is prevalent, emphasized that this offers no excuse for the general administration of iodides to farm stock.

We beg to differ with Rice and Mitchell in regard to the administration of potassium iodide to young growing swine, even though goitrous conditions have not been noted in the swine breeding herd. Our experimental experience at Ames, Iowa, in a goitrous region, indicates quite conclusively that the addition of a small amount of potassium iodide to the ration of young growing swine is good insurance for adequate nutrition from the

iodine feeding standpoint. It is our belief that in the northern half of the United States, particularly in those regions as mapped by McClendon and Hathway (9), and more especially in those regions where the iodine supply in the water is unusually low, that the addition of iodine to the feeds of farm animals, particularly swine, is indicated unless there is evidence to the contrary. A detailed study of local conditions which involves a careful study of the animals on the farm, in the locality, and the iodine determination in the feeding stuffs and water over a period of about three years, would constitute good evidence against iodine feeding if the animals were absolutely healthy and there was demonstrated to be, in all three years, an adequate supply of iodine present in the feed and water used. Even this evidence is not "bullet-proof", inasmuch as the fourth or fifth year might show iodine deficiency in the feed and water used, and furthermore the animals too might clinically demonstrate that they were not receiving sufficient of the essential iodine.

The First Experiment in Feeding Potassium Iodide to Young Swine

In the summer of 1920 we fed two lots of pigs, five each, from July 29 until the pigs reached the approximate average weight of 225 pounds. These pigs were about two and one-half to three months old, and weighed on the average about 50 pounds per head when the experiment started. Both groups of pigs were fed on rape pasture.

The basal ration used was shelled corn of mixed color, yellow and white, self-fed; plus a supplemental protein feed mixture consisting of 60 percent protein meat meal tankage, 30 parts; corn gluten meal, 15 parts; corn oil cake meal, 20 parts; linseed oilmeal, 10 parts; cottonseed meal, 20 parts; bone meal, 3 parts; and flake salt, 3 parts; all by weight, likewise self-fed; plus block salt of good grade, this too being self-fed. The first lot was the check lot, and did not receive any added iodide. The second lot received .1 of a pound of potassium iodide with every 1,000 pounds of the supplemental protein feed mixture.

The iodine consumption, added in this manner, ranged daily per pig from 0.25 to 0.77 grain, or an average of 0.51 grain during the feeding period.

The check group took 145 days of feeding to get to the required weight, whereas the iodide fed group took 12 days less time, or 133 days. The average daily gains were respectively 1.23 and

1.33 pounds per pig. The feed required for 100 pounds of gain, other than the rape pasture, was 440 pounds in the check lot, and 385 pounds, or 55 pounds less, in the iodide fed lot.

Evidently the iodide feeding was beneficial in this first experiment, inasmuch as the iodide fed pigs made 8.4 per cent greater gains and required 12.5 per cent less feed for unit gain.

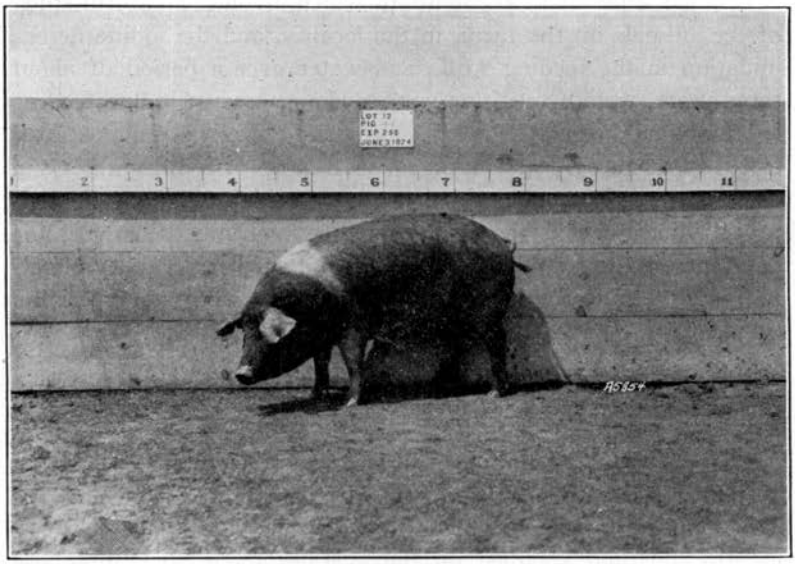

Fig. 1. This is a Representative Pig in the Check Lot of the Third Experiment, Conducted in 1923-24. It did not receive any added iodide. This photograph was taken June 3, 1924.

THE SECOND EXPERIMENT IN FEEDING POTASSIUM IODIDE TO YOUNG SWINE

The second experiment in iodine feeding gave results closely in accord with the first one. In this second experiment, carried on in the summer of 1921 in dry lot, we fed two lots of seven pigs each from August 4 until the pigs reached the average weight of 225 pounds. These pigs were about three months old when the experiment started, and they weighed approximately 50 pounds per head.

The basal ration fed consisted of shelled corn of mixed color, yellow and white, self-fed; plus a supplemental protein feed mixture consisting of cottonseed meal, 80 parts; and dried blood meal 20 parts; by weight, likewise self-fed. Ten pounds of a mineral mixture were mixed with each hundred pounds of this supplemental protein feed mixture, this mineral mixture consisting of

high calcium limestone, 33.333 percent; flake salt, 33.333 percent; and bone meal, 33.333 percent; all mixed by weight.

The first group received the aforementioned basal ration whereas the second group was fed experimentally the same with the exception that 0.1 pound of potassium iodide was added to each 99.9 pounds of the mineral mixture described. The second group averaged, per pig daily, 0.65 grain iodine in the added potassium iodide for the daily ingestion.

In this second experiment the check pigs took 112 days to reach the 225 pound weight, whereas the iodide fed pigs took 102.5 days, a saving of 9.5 days in time. The average daily gain was respectively 1.52 for the check group and 1.65 pounds per pig for the iodide fed group.

Whereas the check lot took 425 pounds of feed for the hundred pounds of gain, the iodide fed group took only 385 pounds of feed to make the same gain, a saving of 40 pounds.

Computing these results in the second experiment we find that the iodide addition resulted in 8.3 percent greater gains and a lessened feed requirement for the hundred pounds of gain amounting to 9.4 percent. Measurements taken on these two groups of pigs showed that the iodide fed pigs were practically three inches longer, almost an inch higher, and possessed fore shins having two-tenths larger circumference.

The Third Experiment in Feeding Potassium Iodide to Young Swine

The third experiment was run in the winter of 1923-24. Two lots of six pigs each were fed from December 28 until the three hundred pound weight was reached on the average. These pigs were over three months old when the experiment started, and their average weight was about 67 pounds per head.

The basal ration fed consisted of shelled corn grain, mixed in color, yellow and white, self-fed; plus a supplemental feed mixture consisting of cottonseed meal, 30 parts; corn oil cake meal, 20 parts; linseed oil meal, 15 parts; standard wheat middlings, 10 parts; soybean oilmeal, 14 parts; peanut meal, 7 parts; alfalfa meal, 4 parts; by weight, likewise self-fed; plus a simple mineral mixture consisting of flake salt, 20 parts; high calcium limestone, 40 parts; and spent bone black, 40 parts; by weight, this likewise being self-fed.

Both lots were fed in dry lot. The check lot received the ration mentioned whereas the second lot was fed potassium iodide in

addition 0.05 pound being mixed with 99.95 pounds of the mineral mixture fed in the basal ration.

The iodide fed group had a very small added iodide consumption, they consuming an equivalent of only 0.06 grain of iodine per pig daily during the feeding period.

The check group took 170 days to reach the 300 pound weight, whereas the iodide fed group took only 150 days, a saving of 20 days. The average daily gains were respectively 1.372 and 1.551

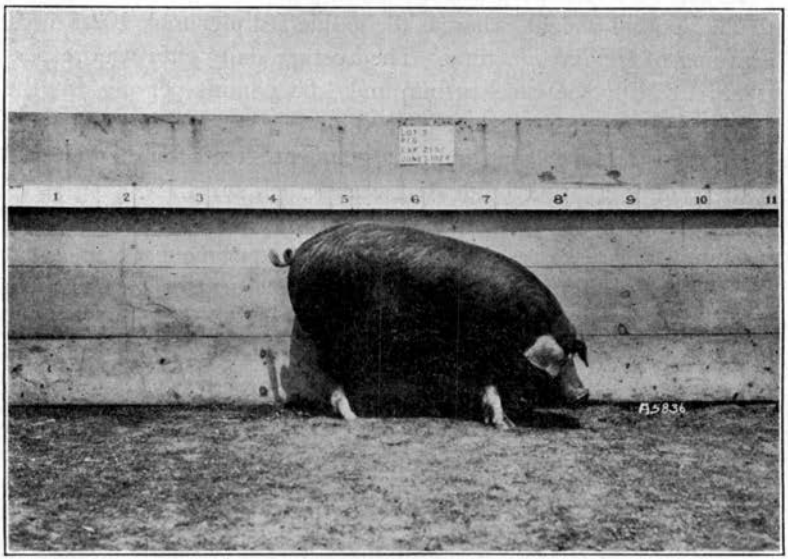

Fig. 2. This is a Representative Pig from the Iodide Fed Lot of the Third Experiment, Conducted in 1923-24. Note that this pig is longer, taller and fatter than the pig to which compared. This picture was taken June 3, 1924.

pounds per pig. The feed requirement for the hundred pounds of grain was 485 in the check group, and 446 in the iodide fed group, — a saving of 39 pounds.

This third experiment gave results similiar to the first two. The iodide fed pigs made 13.05 per cent greater daily gain and the feed requirement for 100 pounds gain was 8.04 per cent less. The dimensional growth of the iodide fed pigs was likewise greater; during the 180 days the pigs receiving iodide increased their length 82 per cent, whereas the check group only increased their length 66 per cent. These figures are in round numbers. The length of the pigs was measured from the ears to the tail. The shoulder height was increased 65 per cent in the iodide fed group, but only 58 per cent in the check group. The iodide fed

pigs likewise increased their fore shin circumference by 50 per cent as compared with 47 per cent in the check group.

Summary of Results

The general average of these three experiments shows clearly that the iodide fed pigs had the advantage of 9.91 per cent greater gains, and 10.00 per cent lessened feed requirement. Inasmuch as in every experiment the iodide fed pigs clearly excelled the check, no iodide fed pigs, it is pretty good evidence in favor of iodide feeding, under the conditions existing in the goitrous region of which Ames is a localized point.

It must be remembered that none of the pigs of these experiments showed any gross signs of iodine deficiency.

It is our belief that iodine feeding should be more generally practiced in live stock production in the goitrous region of the United States, as mapped by McClendon and Hathway (9).

Further reasearches are in order.

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