

Present Situation in Nutrition. No. III

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In our many hundreds of experiments we have found a considerable number of rations which, without the addition of inorganic salts are practically a failure, but which when adequately supplemented by suitable inorganic salts from laboratory bottles, become excellent for growth. It is not profitable at this time to attempt an explanation of why this is so. We are at present making a detailed study with a view to finding what composition promotes growth and supports reproduction most satis-

salt to the extent of seven-tenths of one per cent. This salt is known chemically as sodium chloride. There is also found a small amount of the salts of lime, magnesium, and potassium. The blood also contains some sugar and other food materials in solution, and from this source the organs and muscles derive their nourishment. The kidneys do not let any of these food materials pass out with the urine secreted to carry off the waste products of tissue activity. They have the peculiar property of

the proper functioning of the living tissues.

Effect of Salt on Heart Action

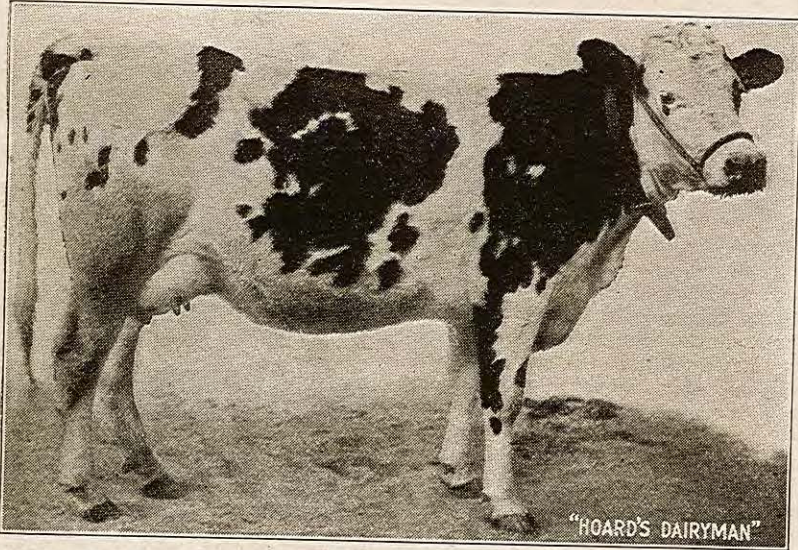
Another experiment which is very instructive in showing the importance of having a proper adjustment of the amounts of the several salts in the solution in which a heart is beating is the following: If a turtle is killed and its heart removed immediately and placed in a moist, warm container it will continue to beat for hours. If it be placed in a solution of pure common salt of the same strength as the salt content of the blood, its beats soon fade out. If now we add a little of some salt of lime it will at once begin to beat again, but its action is not normal. As we add more of the lime salt it will be seen that the heart does not relax far enough and the more we add the more we intensify this abnormal action. The heart makes short beats, staying in the contracted state, and when enough has been added it stops beating in a state of complete contraction.

While it is in this condition we can start it to beating again by adding to the solution containing both the common salt and the lime salt, a little of some salt of potassium. Potassium causes relaxation of the heart, lime salts cause contraction, and by adding a sufficient amount of the potassium the heart can be caused to stop beating, and this time in a state of complete relaxation. Only when the strength of the common salt is the same as that of normal blood and when there is present the right amount of lime and potassium will the contractions and relaxations be normal and continue for hours together. There is no explanation for these things. They are things that we see in carefully regulated experiments, and they reveal to us the bad effects which may result from causing an animal which is eating a uniform ration from day to day to absorb from its digestive tract regularly, a mixture of mineral elements in the wrong proportions. It is by no means extravagant to predict that a few years hence when we have made a careful and thorough study of this side of the feeding problem, it may be practicable to make salt additions to some of our farm rations.

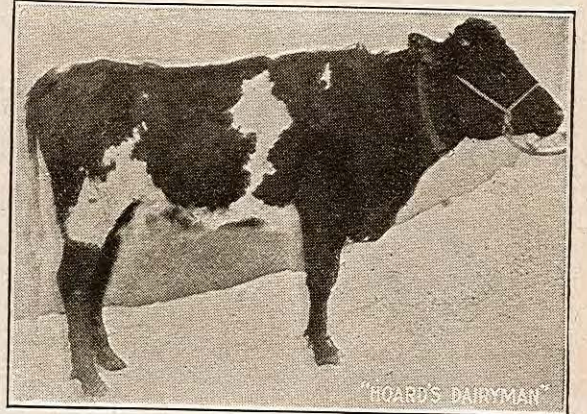
Such additions, to obtain the best results, will not be made in the form of crude mixtures of wood ashes, or by combining promiscuously low ash and high ash foods, but rather in the form of relatively pure salts and in carefully regulated proportions.

Mineral Salts Must Be Fed in the Right Proportions

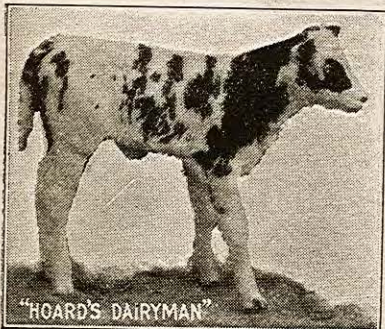
By way of illustration of the effects which follow the feeding of a monotonous ration containing an unsatisfactory mineral content, the illustrations Nos. 1 and 3 of a cow, whose rations differed only in that in one case the mixture of corn grain and wheat straw was supplemented by a salt mixture and in the other no such additions were made. The difference was observable in the



No. 1. This and the illustration of calf No. 2 show the importance of having a suitable inorganic content in the ration of a growing animal. This cow grew on a ration of corn grain and wheat straw to which we added a suitable salt mixture. She was in a good state of nutrition and had a vigorous calf. Note the result in the illustration No. 3 when the same feed mixture was given and to the same cow but without the addition of the salt mixture.



No. 5. This mother lived from an early age on a ration of wheat and wheat straw. Note the poor nutritive condition of the mother and the condition of the young at birth. Professor Hart and the writer have been conducting experiments for ten years which show that wheat is toxic to animals.



No. 2. Calf of cow No. 1.

factorily. One or two facts may be mentioned, however, which give one an appreciation of the way in which unfavorable proportions among the mineral elements of the diet may operate to interfere with the proper functioning of the living tissues.

What the Blood Contains

The blood contains common table

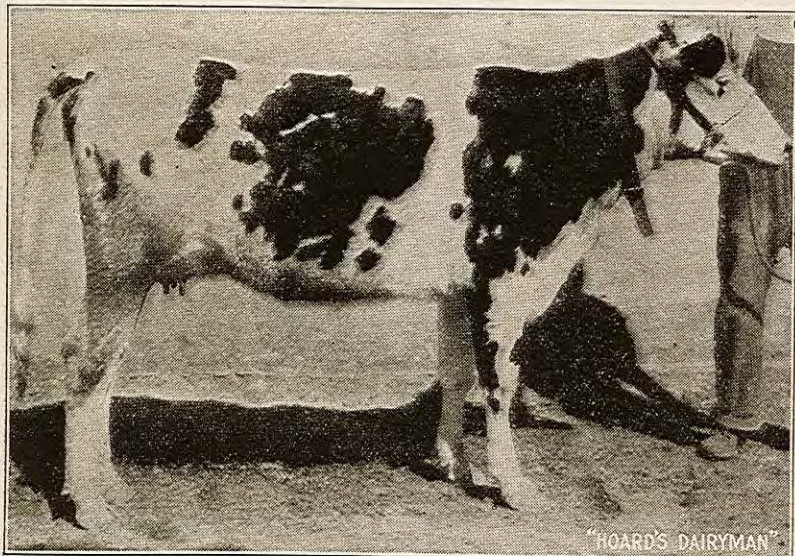
letting certain things which are of no value go through, and of holding back the useful ones. If, however, we inject into the veins of an animal some salt solution made of perfectly pure table salt, having the same strength of salt content as is contained in the blood itself, a curious effect on the kidneys is observed. Under these circumstances the kidneys become unable to hold back the sugar in the blood, and let it filter through into the urine. If, however, we add to this same pure salt solution some potassium, lime, and magnesium salts in small amounts we can inject large amounts of it into the veins without causing any disturbance of the kidney function whatever. We cannot say why this is so, but it has been observed many times, and physiologists learned years ago that a "balanced" salt solution is necessary for



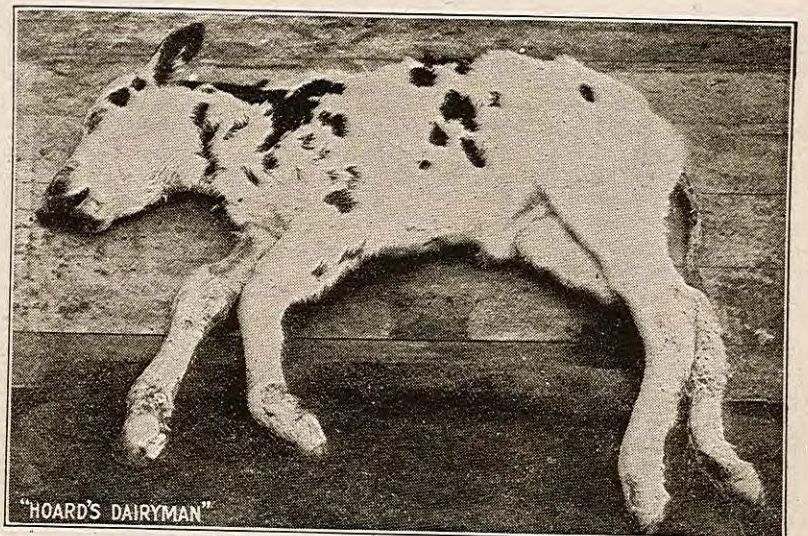
No. 6. Offspring of cow No. 5

appearance of the mothers, but was much more marked in the condition of their offspring. The cow that grew and reproduced on the mixture described could not produce a living calf, while the same ration plus the salts enabled the other cow to produce a calf which was practically normal in appearance and vigor.

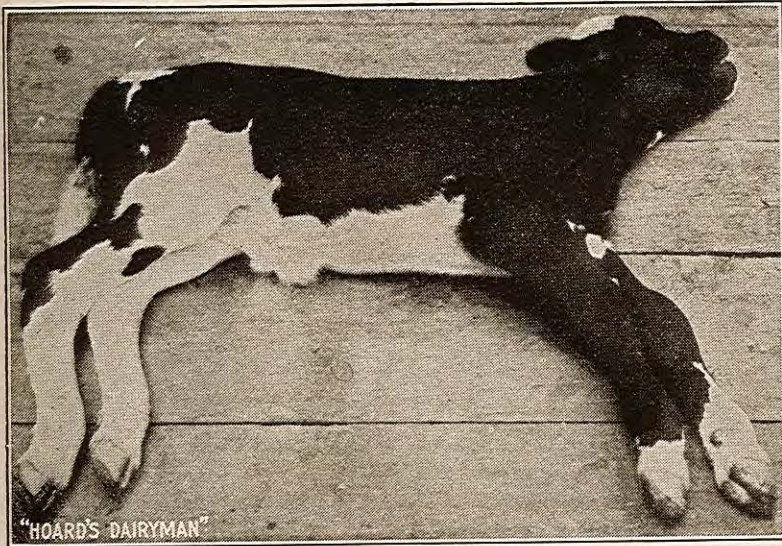
Several other instances in which the effects of a poor proportion among the inorganic elements could be cited from our records. A mixture of 70 lbs. corn grain and 30 lbs. (corn) gluten feed produces very runty looking pigs and growth soon ceases. The same mixture we have been able to supplement with inorganic salts alone so as to produce nearly



No. 3. This shows that a mixture of corn grain and wheat straw can support growth in cattle but leads to disaster in reproduction. Cows fed this ration with no salt additions produced dead calves. When, however, a suitable mixture of several inorganic salts was added successful reproduction was attained.



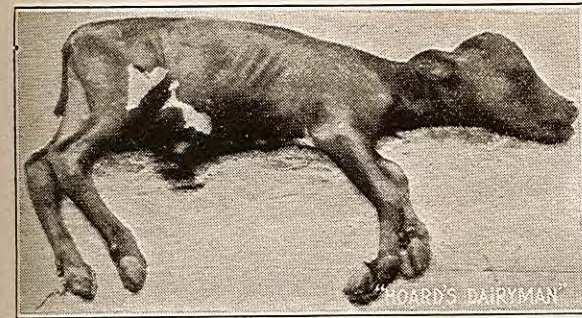
No. 4. Calf of cow No. 3



No. 7. The mother of this calf ate a ration of wheat grain and wheat straw with a salt mixture. She was unable to reproduce successfully. This ration, when half of the roughage was supplied as alfalfa hay, was improved so as to permit the production of a fairly vigorous calf.

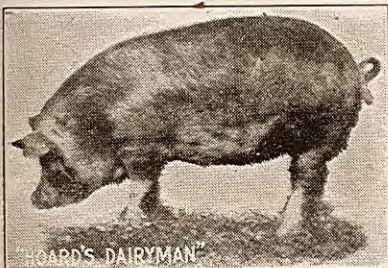
normal growth. Illustration No. 10 of two pigs fed as just described tell the story better than words. There is no subject relating to agriculture regarding which there is greater need for definite and specific information than that relating to the influence of the composition and the amount of the inorganic content of the diet on growth and reproduction.

The assumption has usually been made that the only thing we need to consider in connection with the inorganic content of the rations is to see to it that there is an adequate amount of each of the essential elements in the food. Authorities have said that the digestive tract can exercise in some degree a selective



No. 8. The mother of this calf was fed exclusively on a ration of wheat germ, corn starch, and corn stover. The wheat kernel, especially the germ, contains a poisonous constituent. This is in great measure removed with the oil when this is extracted. The mother of this calf stood the ration fairly well but the disastrous effects of feeding wheat in liberal amounts is always seen in reproduction. This calf was aborted at seven months.

function in regard to what it absorbs, and the kidneys can by a nicely adjusted selective action promptly excrete any excess of this or that element which may be brought into the blood through absorption of the food. Our experience points definitely to the inability of an animal to effect this adjustment of the proportions among the mineral constituents of the body fluids and escape injury, under such conditions as involve the consumption of a monotonous diet over an extended period. The capacity for self protection in this respect exists,



No. 9. This pig grew up on a ration of 95.5 lbs. of wheat meal, 2.5 lbs. wheat gluten, 2.0 lbs. of butterfat, and a salt mixture. After eight months on this diet he began to lose weight rapidly. Failure was due to the poor quality of the wheat proteins and to the toxic character of the wheat products.

to be sure, but its extent has been over-rated.

Wheat Rations and Toxicity

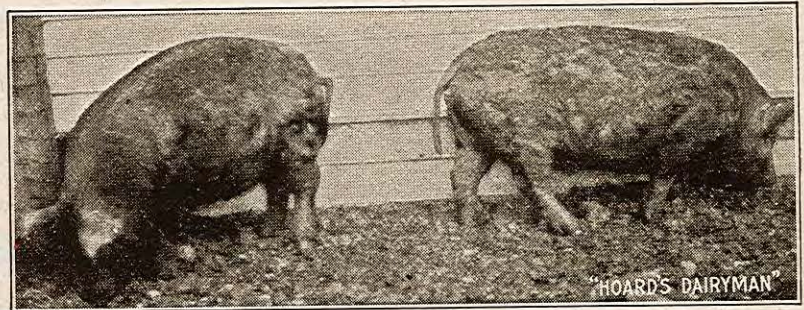
For ten years Professor Hart and the writer have been feeding wheat products in various combinations to cows. The experiments have all been directed toward the solution of the problem of why animals eating a large proportion of wheat so regularly show signs of malnutrition. Going on the theory that the cause was to be sought in proteins of a poor quality, or to an unsatisfactory inorganic content in the ration, we modified these in the earlier years of the work, but the results continually pointed to the existence in the wheat kernel and in the straw of something which caused

injury to the animals because of its poisonous nature. This showed itself to some extent in the condition of the cows which ate wheat products, in rough coats and unthrifty appearance, but the effects on the offspring were much more pronounced. Cows so fed regularly abort, or deliver dead or moribund young. The illustration No. 5 shows the poor nutritive condition of the mother and the kind of young she produced when the ration consisted of wheat grain and wheat straw. No. 7 shows the improvement of the appearance of the offspring of a cow fed exclusively on wheat, wheat straw, and a salt mixture. The young were born dead, however, showing that the salts were not the only factor concerned. This same ration with half the roughage supplied as alfalfa hay, was so improved as to permit the production of a fairly vigorous calf. The wheat germ proved to be especially toxic to cows, pigs, and rats. Illustration No. 8 shows the character of the offspring of a cow fed wheat germ, corn starch, and corn stover. The young was aborted at seven months.

Similar results were seen when pigs were grown on rations containing a considerable amount of wheat. They were stiff and lame and indifferent to their surroundings when receiving a ration of wheat, wheat gluten, salts, and three pounds each of whole milk daily. During the first six months they grew fairly well, but beyond this time growth was not sustained. Illustration No. 9 shows the appearance resulting from a ration of wheat products and butterfat and salts as supplements. These did not overcome the bad

effects of the wheat. This question was finally taken up in the large number of trials made of feeding the various parts of the wheat kernel after they were separated. The results finally made it clear that the poisonous principle is in great measure located in the fats of the wheat and are removed with the wheat oil when it is extracted. One-third of the ration as wheat germ will depress the growth of a rat for about one-half the usual rate and lead to early death, while another lot will thrive on the same mixture if the wheat oil is taken out, and the residue only is fed.

I have now pointed out the several factors which operate to make a diet a good or a poor one. They are protein of poor, medium, or good quality, a suitable inorganic content, an adequate supply of the two as yet unidentified dietary factors which we now call the fat soluble A and the



No. 10. These two pigs ate a ration of corn 70 lbs. and gluten feed 30 lbs. Note how runty they are as compared with the other pair shown in No. 11 whose ration was like it except that a suitable mixture of several salts was added. We are at present making an extended study of the effects of the composition and amount of the mineral elements in the ration on the growth of young animals.

water soluble B, and the presence of possible poisonous constituents in natural foods which we have long regarded as Nature's own ideal mixtures. We will next see wherein lie the deficiencies of several of our natural foodstuffs.

(To be continued)

New York Milk Producers Prepare for Fight

HOARD'S DAIRYMAN:—It is sometimes claimed that Chenango county, New York, is a leading county in dairying in the nation. In some ways that may be correct. At any rate it seems to be taking the lead in the matter of organization for what looks like the coming fight in the East for fair milk prices. Several meetings have been held and others are being planned, and these meetings are attended by the farmers. It is unlike the ones that are held to show how to raise larger crops, where the attendance is rather slim and shows want of interest many times. The marketing problem is the one that interests. It is not surprising, then, that the meetings for the purpose of helping to prepare for an advance in the price of milk should be well attended and enthusiastic.

Legislative Investigation

The investigation that was planned last winter by the politicians for use just before election (this is not my surmise but comes from some people well up in the matter) has been begun. It is to look into conditions, not only in dairy matters, but farming generally, and by agreement it is proposed by the farm papers, the colleges, farm bureaus, and other agencies to bring to the attention of the committee sufficient information to enable the commission to make a complete report. If they show any disposition to slight the facts, I am told that they will be published by the farm papers without the advice of the commission. I am not trying to underestimate the wishes of the legislative commission. Some of them I know to be men of integrity and good intentions and I have no reason to suspect that all are not of

the same stripe. It was generally understood, however, before any other effort was made that the investigation would not be much to the advantage of farmers. We are hoping now for something better. It may help in obtaining fair prices for milk. The commission can do us much good, and will, we hope, do so.

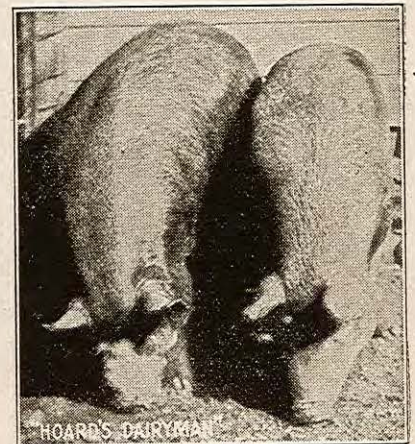
All farmers should be ready as far as possible to place before the legislative commission facts relating to the cost of producing milk. This is the real purpose of the commission, to determine if the producers are getting as much as they should for the milk. It is to be hoped that the cost of handling from the time it reaches the station until it comes on the wagons for delivery will be determined also. In this it would be well to note that in the city the plants for the handling of milk are also used for other purposes: such as manufacturing ice for sale. In one case the president of the con-

cern told me that his company got expenses for the ice and interest on the whole plant in addition.

Time ought to be given for farmers to present the costs of production, and it is a misfortune if the hearing in the country districts comes at a time when farmers can ill afford to give up time to it. Give all sides a fair chance, and not let any take undue liberties. A discussion of cheapness of milk in comparison with other foods would be interesting if within the jurisdiction of the commission.

Milk Prices Advancing

In the meantime it looks as though the recent activities of farmers are bringing fruit already. True, there are other reasons for an ad-



No. 11. These two pigs received same ration as those shown in No. 10, with the exception of the salt mixture.

vance in milk prices, but no matter what the demand for milk, there would have been little advance from the dealers without necessity for it. For July the Sheffields have advanced the price ten cents a hundred, the Borden 19 cents, and one independent concern, the Wildi Evaporated Milk Company, advanced the price 25 cents per hundred, making it now \$1.70 for milk testing 3.8 per cent. This is claimed to be the highest ever paid for July milk. I have not verified this statement.

(Continued on page 54)