ed how humus furnishes to advantage food for crops, its potash and phosphoric acid being much more available than those present in the soil through the disintegration of the originating rock materials. But the chief constituent of value in this organic matter is nitrogen, a high percentage of which always betokens a good soil. Indeed we may say that vegetable organic matter and nitrogen are concomitants, increasing and decreasing together. This nitrogen before it can be of service to plants must first be converted into nitrates, a combination effected through the agency of certain micro-organisms in the soil under favourable conditions of tilth and climate.

The beneficial action of humus in soils, from a chemical aspect, may then be summarized as follows :—

1. It furnishes in the products of its decomposition, (a) available mineral food derived originally from the inert rock material of the soil and (b) nitrogen in a form without difficulty converted into nitrates—compounds readily taken up by plants. In other words, an application of vegetable organic matter means that a considerable quantity of previously unavailable plant food is presented thereby in a condition already digested and easily assimilated by farm crops.

2. Its decay in the soil sets free, among other products, carbonic acid. This dissolving in the soil water, acts as a solvent upon the locked-up stores of phosphoric acid and potash, thereby rendering them of use to farm crops, increasing the yield.

Upon a future occasion we shall consider the mechanical benefits that humus confers upon a soil, and the sources from which a farmer may draw in order to enrich his soil in this valuable constituent.

(To be continued)

ROTHAMSTED EXPERIMENTS.

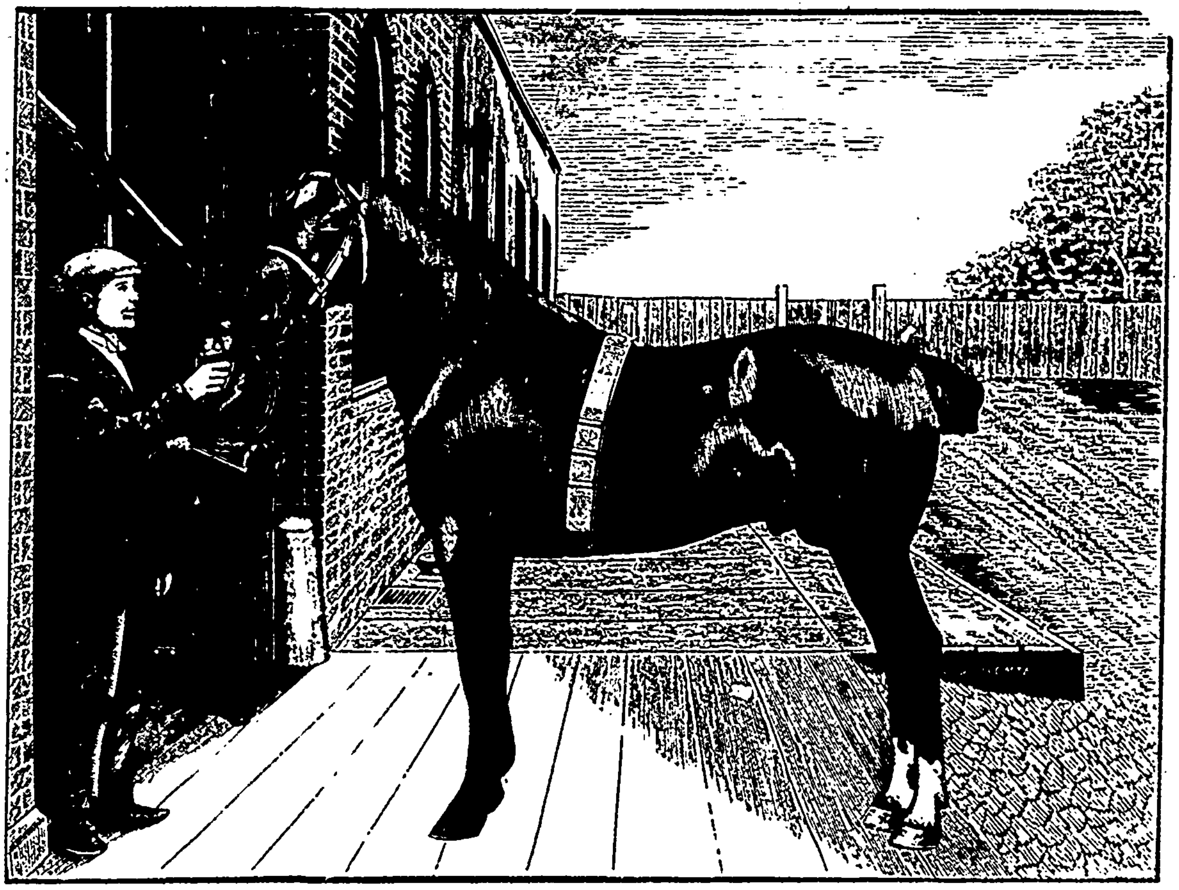
(Continued)

Pigs —Varied foods — Maize-meal— 40 o/o of the fat is from the carbohydrates — General results — Weiske's experiments—Recalculation of results.

Here, then, the calculations afford no evidence that fat must have been produced from carbohydrates. But, as already explained, the mode of estimate adopted assumes the whole of the ready-formed fat in the food to have been stored up, and the whole of the carbon of the nitrogenous substance, beyond that in the animal increase and in the urea formed, to have been utilized for fat formation. Neither of these assumptions is, however admissible; and it will be seen further on, when due correction is made in regard to these points, that even in this experiment, with so abnormally high a proportion of nitrogenous substance in the food, it is pretty certain that some of the produced fat must have had its source in the carbohydrates.

In experiment 2 the food consisted of bean meal, lentil meal, bran, and maize meal, each given separately, and ad libitum; and in experiment 3, of an equal mixture of bean meal and lentil meal, also given ad libitum. It is seen that in both cases the proportion of crude non-nitrogenous to 1 of crude nitrogenous substance in the food was even lower than in experiment 1, being in experiment 2, 3.3, and in experiment 3 only 2, against 3.6 in experiment1. Here again, as might be expected, with so high a proportion of nitrogenous substance in the food, the calculations show that there was more than sufficient carbon available from the nitrogenous substance of the food for the formation of all the fat that was estimated to be produced.

Experiments 4 and 5 show a very different result. In experiment 4 the food consisted of maize meal alone, and in experiment 5 of barley meal alone, in each case given ad libitum. In America, especially, maize meal is largely used for the fattening of pigs, almost, if not quite, alone, and in our own country barley meal is undoubtedly recognized as the most appropriate fattening food of the animal. It is seen that in experiment 4 with maize meal the proportion of crude nonnitrogenous to 1 of nitrogenous substance in the food was 6.6, and in experiment 5 with barley meal, it was 6, or, in both cases very nearly that which is recognized as appropriate in the fattening food of the animal.



The Champion Imported Hackney Stallion, Royal Standard (3918).

The property of Messrs. Graham Bros., Claremont, Ont.

Accordingly, the calculations show much less nitrogenous substance consumed for the production of 100 increase in live weight, and much less left available for fat formation after deducting the amount estimated to be stored up in the increase. Then, as to the fat, the animals were undoubtedly much fatter than the analyzed "fat" pig. Deducting the amounts of fat supplied in the food from that in the increase, there remained in the one case 52.7 and in the other 58.8 parts formed within the body, requiring in the first case 40.6 and in the second 45.3 of carbon; while the amounts of carbon estimated to be available from the nitrogenous substance of the food were only 24.7 and 27.4 parts, leaving in the one case 15.9 and in the other 17.9 parts to be provided from other constituents of the food. Or, if the calculations are made for 100 carbon in the estimated newly-formed fat, the figures show that in one case 39.2 and in the other 39.5 per cent of the total carbon of the produced fat must have been derived from other constituents of the food.

In other words, even on this mode of calculation, nearly 40 per cent of the newly-formed fat must have had its source in the carbohydrates. We shall see further on that even a considerably larger proportion still must, in reality, have been so derived.

The peculiarity of the experiments 6, 7, 8, and 9 was that the food contained less ready-formed fat than in any of the other cases, and that a large proportion of the nonnitrogenous substance supplied was in the form either of pure starch, pure sugar, or both. In experiments 6, 7, and 8 a fixed quantity of lentil meal and bran, averaging 3 pounds 3 ounces of lentil meal and 9 ounces of bran, was given per head per day; and, in addition, in experiment 6, sugar ad libitum; in experiment 8, sugar and starch, each separately ad libitum. Lastly, in experiment 9, lentil meal, bran, sugar, and starch, were each given separately and ad libitum. It will be seen that the proportion of crude nonnitrogenous to 1 of crude nitrogenous substance was 4.1 in experiments 6 and 7, 4.7 in experiment 8, and only 3.9 in experiment 9; that is, the food contained a higher proportion of nonnitrogenous substance than in experiments 1, 2, and 3, but considerably lower than in experiments 4 and 5. Accordingly the final result of the calculations is intermediate between that for the other two series.

To go a little into detail, it is seen that, for 100 increase in live weight, the amount of nitrogenous substance estimated to be available for fat formation was, in this series, intermediate between that in the other two. With much less fatty matter supplied in the food, the amount of fat estimated to be newly formed was about the same as in the other cases. The amount of carbon estimated to be available for fat formation from the nitrogenous substance of the food was, in each case, notably less than the amount required for the production of the newly-formed fat. The indication is, therefore, that, in each case, a considerable proportion of the produced fat must have had its source in other than the nitrogenous constituents of the food.

The bottom division of the table shows that, reckoned for 100 carbon in the estimated newly-formed fat, in the first case 18.9, in the second 18.8, in the third 25.2, and in the fourth 14.1 per cent, or, on the average, about 10 per cent of the whole must have been derived from other sources—in fact, from the carbohydrates. Nor can there be any doubt that the figures underestimate the proportion of the produced fat which could not have had its source in the albuminoids of the food.

The general result of the whole series of experiments is, then, that when the food of the fattening animal contains an abnormally high amount and proportion of nitrogenous substance, enough of it will probably be available for the possible formation of all the fat produced in the body; but that when the amount and proportion of such substances in the food are only normal, or low, there will remain a large proportion of the produced fat which could not have had its source in the proteids, and must have been derived from the carbohydrates.

Referring to our results and conclusions as given above, Professor Voit, in a paper which he published in 1869, (1) admits that in the experiments in which there was only a medium albuminoid supply in the food, there was, as the figures stand, a considerable deficiency for the formation of the fat produced, and a still greater deficiency when the relation of the nitrogenous to the nonnitrogenous constituents was lower still, and hence it would appear that in these instances a considerable amount of fat had been derived from the carbohydrates. Still, he says he can not allow himself to consider that a transformation of carbohydrates into fat is proved thereby. He says he has not been able to get a clear view of the experiments from the figures recorded,

(1) Ztschr. Biol., 5 (1869).