ginally calculated, without the emendations now adopted.

The results, even as given in the first of the three columns, in the calculation of which it is assumed that the whole of the nitrogenous substance and fat of the food were digested and available, show that for 100 increase in live weight 26.2 parts of fat, for 100 total fat in increase 33.2, and for 100 newly-formed fat 49.7 parts must have been derived from carbohydrates.

Reckoning, as in the second column, that 90 per cent of the nitrogenous substance and fatty matter consumed were digestible and available, the calculations show that for 100 increase in live weight 31.7 parts of fat, of 100 total fat in increase 40.1 parts, and of 100 newly-formed fat 57.3 parts would be derived from carbohydrates. Or, reckoning as in the third column, that only 80 per cent of the nitrogenous substance and fat of the food were digested and available, the results show that for 100 increase 47.2 parts, and of 100 newly-formed fat 64.3 parts, or nearly two-thirds of the total produced fat, would have its source in the carbohydrates.

It may be observed that, in the case of this experiment with maize, the results given in the third column would very nearly accord with those which would be obtained if Wolff's average percentages of digestible constituents had been adopted.

Let us now refer to the results of experiment 5, in which the food was barley meal alone, given ad libitum, and the albuminoid ratio was nearly that recognized as most suitable for the rapid fattening of the pig.

The first of the three columns, calculated on the assumption that the whole of the nitrogenous substance and fat consumed were digested, shows that under such conditions there would be for 100 increase in live weight 30.3 parts of fat, for 100 total fat in increase 41.9 parts, and for 100 newly-formed fat 50.6 parts, or about half, must have been derived from other constituents than the fatty matter and nitrogenous substance of the food.

The results in the second column, calculated on the assumption that 90 per cent of the fatty matter and nitrogenous substance were digested, show that in 100 increase in live weight 34.8 parts of fat, in 100 of total fat in increase 48.1 parts, and of 100 newly-formed fat 57 parts must have been formed from carbohydrates.

Lastly, the results in the third column, reckoning only 80 per cent of the nitrogenous substance and fat to be digested show that on this supposition of 100 increase in live weight 39.4 parts of fat, of 100 total fat in increase 54.5 parts, or of 100 newly-formed fat 63.1, or again nearly two-thirds, MUST HAVE BEEN DERIVED FROM CARBOHYDRATES.

So much for the evidence of results relating to pigs in their bearing on the question of the sources of their fat, when fed on their appropriate fattening food. IT IS CUMULATIVE AND DECISIVE THAT AT ANY RATE A LARGE PROPORTION OF THE STORED-UP FAT MUST HAVE ITS SOURCE IN OTHER CONSTITUENTS THAN THE FAT AND NITROGENOUS SUBSTANCE OF THE FOOD; IN OTHER, WORDS, IN THE CARBOHYDRATES.

HUMUS IN THE SOIL.

(Continued)

Sources of humus on the farm—Dung—Analysis of dung—Nitrates—Green manuring—Mucks.

Having, in previous articles, considered in detail the nature of humus (vegetable organic matter) and how it affects the fertility of the soil, improving it both in composition and texture, we may now enquire as to the more common sources from which the farmer can draw for a supply of this material.

As a supplier of humus, good barnyard manure stands easily first. From this statement it most not be inferred that the chief value or such manure lies in the amount of organic matter it contains. By no means. We must distinctly understnd that the value of any particular sample is directly dependent upon the actual percentage of Nitrogen, Phosphoric acid, and Potash it possesses. While recognising this fact, however, the further benefit that barnyard manure imparts to the soil from the organic matter it supplies should not be lost sight of.

From analyses made in the laboratories of the Central Experimental Farm, we learn that manure contains from 14 p. c., to 15 p. c., of organic matter, according to the conditions under which the manure has been preserved, the extent to which it has been rotted etc. This organic matter is of such a nature that favorable climatic condition alone are required to bring about its easy decay in the soil. It is this property of being subject to ready decomposition in and incorporation with the soil, that has assigned the high value to the organic matter of manure before alluded to. Now, this further decay is the direct result of the life of microscopic plants-germs, which find in the excrement of animals a food peculiarly adapted to their growth We are only beginning to understand the important rôle that these micro-organisms play in the soil, but sufficient experimental work has been done to justify the assertion that it is through their agency that the inert nitrogen of the soil is converted into "nitrates," a form or compound of nitrogen available to plants. Decomposable humus, therefore, performs a very useful function in furnishing food for the development of these newly-discovered friends of the farmer.

Green manuring, or turning under with the plough a growing crop is also an effective method of supplying humus. The manifold benefits of this system of land improvement, especially when one of the legumes is grown for the purpose, need not here be entered upon. In the present connection, it will be sufficient to point out the immense amount of vegetable organic matter contained in such a crop. It was found as the results of experiments at the Experimental Farm that an ordinary crop of clover contains in its leaves, stems, and rotts, between 5000 lbs and 6000 lbs of organic matter per acre. Thus, it has been demonstrated that this crop is capable of storing up in its tissues a very large quantity of material derived chiefly from the atmosphere, a material that in its decomposition enriches and improves both heavy and light soils.

Finally, swamp or black muck, must be mentioned as a source of humus. In many parts of the Dominion, vast deposits of it occur; indeed many farmers can obtain for the expense of digging and hauling when dried by exposure to air, good samples contain from 60 p. c., to 80 p. c., of organic matter and from 1 p. c., to 25 p. c., of nitrogen, the latter being the chief element of fertility in mucks. Unlike the organic matter of barnyard manure and of *green crops, that present in crude mucks* is not readily decomposed in the soil. To ensure immediate results, the natural acidity must be corrected and fermentation started before its application to the soil. This is effected by first piling the muck and allowing it thus to be weathered for several months. A compost composed of alternate layers of the air-dried muck and stable manure should then be made, the heap being kept moist and occasionally turned. The air-dried muck may also be used to good advantage as an absorbent for liquid manure about the farm buildings. This latter method is particularly to be recommended since thereby a large amount of plant food is saved that otherwise would be lost. The resulting manure is rich and forcing.

F. T. SHUTT.

SCIENCE IN ITS RELATION TO AGRICULTURE.

The soil—County analysts—Artificial manures—Mistakes in using them—Feeding stock—Remedies of ignorance.

In the course of his speech at the South-Eastern Agricultural College the Duke of Devonshire remarked, "However good a practical farmer a man may be, he can hardly fail to be a better one by becoming acquainted with the discoveries of science in relation to agriculture"; and yet how few farmers will allow themselves to be convinced that his Grace's statement is in reality the truth. To so many men the mere word "scientific" in relation to agriculture is synonymous with "expensive," and therefore to be avoided at all hazards. If such is the case, farmers are to be commended for a proper sense of thrift; but I venture to asert that the consensus of opinion of those best qualified to judge does not uphold the theory that science and expense must necessarily go hand in hand, but rather that if science is rightly and properly applied to the practice of agriculture the result will be larger crops of better quality, the produce of which will ensure an infinitely higher return, whether it be employed for the raising of stock, meat, or milk.

Without going into any scientific details, I think it is possible to make it clear to the most pronounced sceptic that at the present time it can hardly fail to be of benefit to the farmer to pay a little attention to science.

Firstly, let ut take the soil; It is the duty of every farmer to find out the composition of the soil on his holding, both as regards its physical and chemical properties. Then comes the question, "How am I to do this? I have no chemical laboratory." My answer is, Send a fair sample to the county analyst, or, if a member, to the R.A.S.E., and the charge for an analysis and report will be amply repaid by the information gained, giving, as it does, an insight into the extent of the capabilities of the soil in respect of the plant food it contains, and, further, enabling the farmer to develop those capabilities by means of applying suitable special manures.

Secondly, it behoves the farmer to endeavor to acquire a knowledge of the composition of artificial manures, and also the extent to which various crops are lacking in the different elements of plant food. Having acquired this knowledge, he will be enabled to *apply the proper artificial manure to* the crop it will be of benefit to; and surely this is far better than indulging in the obnoxious practice of looking through advertisements to find out which manure is cheapest, at the same time utterly disregarding the fact that it may not contain a single useful ingredient. Only last summer whilst going over a farm in Hampshire, I happened to ask the tenant if he had used any artificial manures on his cereals. He replied: "I have, and never intend to do so again." On further questioning him, I found that he had spent a large sum in purchasing quantities of nitrate of soda, superphosphate of lime, and kainit, all of which he had mixed together in a heap! He had then applied the mixture as a top-dressing to his wheat and oats, and was dreadfully hurt and surprised that he had rather worse crops than usual. The above, I fear, is only one case out of hundreds in which a hard-working and well-meaning man throws away large sums in purchasing manures the properties of which he has not the slightest knowledge, nor does he think it worth his while to do otherwise than his father and grandfather have done before him.

Lastly, let us take the feeding of stock, whether it be for the production of work from our horses, milk from our cows, or meat from our sheep and cattle. Here, again, I am positive large sums are annually wasted by farmers in purchasing feeding-stuffs, the ingredients of which are wholly useless for the purposes for which they are employed, the reason being that the users have not the knowledge as to the kind of feeding-stuff best suited to the different classes of stock.

Of course, I am well aware that the argument may be raised as to how all this knowledge it to be obtained. Even this, I venture to think, can be answered satisfactorily.

Firstly, if the farmer is lucky to have his dealings with a friend who has a knowledge of agricultural science, let the farmer consult him in these matters and ask his advice as the efficacy or otherwise of artificial manures, feeding-stuffs, &c.

Secondly, in his spare moments the farmer might with advantage read any of the hundreds of publications dealing with the question of scientific agriculture, such as the series of Morton's Handlooks of the Farm; also let him read the results of the experiments which have been and are being carried on in different parts of the country, especially those at Rothamsted and Woburn.

Lastly, there are the technical education classes of the county councils, at which lectures are given on subjects likely to be of benefit to the farmer, and at these doubtless valuable knowledge may be gained, though I am afraid many of the lecturers appointed have gained this scientific knowledge without a sufficient amount of practical experience, and have consequently failed when questioned on matters of practice, the result has been that many farmers refuse to believe that science can be applied to practice, and is not simply a mass of expensive "new-fangled notions."

In conclusion, I do not mean to say that science is going to restore agricul-