off straight, every one will say his farm is so much poorer; but what difference would it make if he fed that hay and grain to cattle and sold the beef, or to milk cows and sold the produce? He would simply save the excrement of the cattle, and of that a considerable quantity would be lost even under the most careful management. A portion, then, of the hay and grain—in other words, so much of the fertility of the soil—would go off in the beef or dairy produce, and part would remain as manure, and this portion which goes back to the land as manure, will, according to his theory, not only make up for what went off in beef, milk or other products, but increase the fertility over what it originally was. Mr. Shaw's argument is that a part is not only as great as the whole, but very much greater. If by any means confined to the farm itself, and the cultivation of it, the quantity of produce sold is increased, the exhaustion is correspondingly increased, and if Mr. S. sells double the produce off his farm now that he did eight years ago, and has brought nothing to it from outside sources, as food or manure, he is simply "robbing the land" twice as fast as he did before.

Mr. S. says he believes that even an *exhausted* farm can be *restored* by dairying and cattle raising, only it would take a longer time. There are a great many farmers in our own and other countries who would like to be shown how this can be done, and if Mr. S. can instruct them he will rank as the greatest benefactor of mankind in modern times. But why did not Mr. S. explain how it could be done when the question was asked at the meeting in Huntingdon?

Mr. S. says he will discuss the question with any living man. Why then does he ignore Prof. Tanner, from whom I quoted in my former letter.

If Mr. Shaw's views on the restoration and fertility are correct, why is it that farmers in the old world and in the Eastern States find it necessary to import such large quantities of fertilizing materials, besides the immense quantities of food both for man and beast from all parts of the globe? The imports of wheat and flour alone into Britain are equal to over two hundred million bushels of wheat—seven times the whole average crop of Ontario! As every Canadian farmer knows, mostly all our cheese, surplus cattle, butter, linseed cake and oil, too, go there. Immense quantities of corn and cotton seed meal for cattle food go there from the States, and all kinds of food are got from mostly every country under the sun. Of this immense quantity of stuff, a great proportion is imported especially for cattle food, and the manure made is all carefully saved and put on the land, and from the material consumed as human food, a large quantity of manure is available for use on farms. Yet, notwithstanding this immense importation of fertility from other people's farms, the whole world has been ransacked for artificial fertilizers of every description. The importations for the year 1885-6 amounted to 514,000 tons, consisting of guano, nitrate of soda, fish guano, bones and phosphates of all kinds, besides which there were home supplies of phosphatic minerals and great quantities of sulphate of ammonia from iron and gas works. In the Eastern and older States the consumption of artificial fertilizers is estimated at some 500,000 tons a year. It is in the very districts where dairying is most practiced that the use o artificial fertilizers, and cotton seed meal, and corn from the western and southern regions, are specially used.

How is it that the experienced farmers of the old world have never thought of Mr. Shaw's theory? It would save them millions of money if they could get on without buying artificial manures, and I would like Mr. S. to show where they are in error. If he can explain that away he will go so far in establishing his theory.

Yours truly,

SUBSCRIBER.

How Plants Vary in Selecting Food.

The following article on this subject from the pen of Sir J. B. Lawes is worthy of attention, especially in connection with the article on the rooting habits of plants which we publish in another column. It should be closely studied by farmers who use salt upon their land, because, being a chloride of sodium, supplies soda to the plant, and, as Sir John shows, some plants take up soda instead of potash. His experiments explain the reason why salt is beneficial to mangels. The article reads thus:

I am quoted as saying that sodium supplies the place of potassium when the latter is deficient in the soil, but I certainly do not wish it to be understood that sodium can perform all the functions of potash. In some of our experiments soda has been used without potash, and in others potash without soda, for twenty years in succession, and yet soda is hardly to be found in either the grain or the straw. The ash of pasture grass shows, however, that when it is supplied with a sufficient amount of both potash and soda, it will always select the former; if it is supplied with soda alone, it will take up such a large amount of that substance that more soda than potash is found in the ash.

These facts may be thoroughly relied upon, as they are based upon the most exhaustive and complete series of ash analyses which have ever been carried out. Mangels supplied with soda will take up large amounts of that substance, while potatoes under similar circumstances do not take up any. The juice of potatoes—where we should expect to find any soluble salts taken up by the plant—contain hardly any soda, even when manured with nitrate of soda. The juice of mangels, on the other hand, under similar circumstances of manuring, contain almost as much soda as potash. It is these special properties of different classes of plants that make our attempts to give any exact explanation of the economy derived from a rotation of crops so exceedingly difficult.

There is another peculiar property of plants which requires to be thoroughly studied. I allude to the different capacity possessed by different plants for taking food out of a soil. Without at all arguing that red clover derives its nitrogen from nitric acid, I have pointed out that it has greater advantages than any of the other agricultural plants commonly grown for taking up a substance which is diffused so rapidly through the soil. It has a longer life, and the plant grows very close together on the soil; the roots penetrate deep into the subsoil, and the leaves are always green. If, however, red clover can obtain more nitrogen from the possession of these properties, it might be supposed that they would have enabled it also to collect more mineral food. I should certainly have imagined that such would have been the case.

Let us see, however, what experiment tells us. At Rothamstead, between 1850 and 1873, wheat, turnips, barley and beans were grown upon an unmanured soil. In 1874, red clover was sown and the plant was very good, although the crop was small. Between 1873, when the seed was sown, and June, 1874, when the crop was cut, all the phosphoric acid which it could pick up out of an acre of land only amounted to two and one-half pounds. It may be said that after the removal of so large an amount of crops the soil was exhausted of its phosphoric acid, but such was not the case, as the wheat which followed the clover took out more than seventeen pounds of that substance; while the turnips which followed the wheat fared even worse than the clover, for they could only obtain one and one-half pounds, but the barley which followed the turnips took out ten pounds, and in 1883—after thirty-six unmanured crops had been carried off—the wheat removed twenty pounds of phosphoric acid per acre.

We get in these results some clue to the conclusions derived from practical experience in all countries, that mineral manures are much more beneficial to some crops than they are to others. It is evident that the cereal crops possess a greater capacity for obtaining their food from poor soil than any other of the crops generally grown. It is fortunate for the human race that such is the case, as nations must have bread to eat without having to be dependent for it upon the aid of science.

According to Mr. T. B. Terry, the celebrated Ohio potato grower, who digs with the fork, a man can dig five-eights of an acre per day, or 180 bushels. One of his men dug 220 bushels in nine hours. He says the average potato crop in Ohio is 77 bushels per acre. He has ascertained that it takes 30 hours to cultivate six acres when the field is square, while the same area can be cultivated in 10 hours when the rows are 60 rods long.

The following estimate of waste from a hill-side barnyard is by Prof. Roberts, of Cornell University: At Cornell there were 32 inches of rainfall in the year. The barnyard is 100x100 feet, about one-quarter of an acre. Every inch of rain would make 100 tons for an acre, or 3,200 for the year to an acre, or 800 tons for the barnyard. If one-half was leached out, it would be 400 tons. Each ton of water leached out would carry off 60 cents worth of plant food, or $240 worth from the barnyard. 'Tis true, the inky streams running from the barnyard down the road, into the creek or on the neighbor's lot, is the best part of the manure. It is money running away.

Prof. Henry, in an article on cooking foods, says: "The softening, moistening and breaking up of the food by heat and water are really of no aid to digestion. If there is any advantage from all this it seems to be overcome by the better mastication necessitated by the dry food before it can be swallowed. Our experiments must be repeated again and again with all classes of food articles and pigs in all stages. Vegetables (potatoes for example) can hardly be fed without cooking, but here the cooking is essential to get the potato into edible condition. Many farmers think they cannot feed shorts, for example, dry, but must either wet or cook them. I would advise all such to try for a week or two feeding them dry, mixed or not with other feed, giving plenty of water to drink in a separate trough, or both in the same trough as that in which the feed was given."

There are differences of opinion as to whether manure or fertilizers should be placed in the drill or spread broadcast, either as a top-dressing or to be plowed under. When it is desired to manure the crop, drill manuring may sometimes do, but broadcasting manures the land and comes good for several successive crops. Quicker returns are to be expected from drill fertilizing; but, as a rule, for permanent cropping, broadcasting is the preferable method, although more manure may be required at the outset to produce the same results. However, for planting trees or small fruits, no plan can supercede a partial system, at least, of fertilizing in the hills or drills. Bone dust and ashes should be placed under the trees or bushes, but not near the surface, for this will cause some of the roots to grow upwards, where they will be lacerated by tillage and exposed to drouths. Top dressings of barnyard manure should also be given from time to time.