quent cultivation, they would be brought nearer the surface. Thus the troublesome effect would be spread over a number of years. However, if they germinate before the close of the season, they may be destroyed by cultivation late in the fall, or, in some cases, by the winter's frost. The germination of these seeds would be best aided by harrowing, cultivating, or a very shallow gang plowing immediately after the crop is taken off, and a subsequent fall plowing after the weeds have sprouted would destroy them.

The weed seeds may be returned to the soil by the manure, into which they may enter either by being in the bedding given the animal, or by seeds that have passed through the animal system. The vitality of these seeds is rarely if ever destroyed by passing through the animal, if their covering is not broken either by the animal's teeth or by some machinery before it enters the stomach. The heat in the manure pile, if not overheated, which will deteriorate the value of the manure very materially, is insufficient to destroy the vitality of most weed seeds. This clearly shows that weed seeds in the manure heap may be as vital as those left in the fields the previous autumn, and will germinate whenever conditions are favorable.

The destruction of most weeds is an easy matter if the growth of new plants is prevented, and is generally most effectually accomplished by thorough cultivation. If the weeds are in the hay field, it is better to cut the hay when the weeds are in blossom, or before going to seed, if there are many in the field, otherwise they should be spudded.

With respect to thistles, when grown in dense patches, they are frequently destroyed most economically by cutting when in bloom. If not entirely destroyed, they will be materially lessened —all depending upon the soil and season. By this method of destruction, the advantage of a green manuring crop is obtained. No inflexible rule can be given for their destruction in all cases, for much depends upon the character of the soil, so that each farmer should study the question for himself.

Rooting Habits of Plants.

A knowledge of this subject aids us very considerably in the profitable tillage of land. Thereby we can be guided to determine the depth of cultivation most suitable for each particular plant, the distance that should be left between each plant or rows of plants, the condition in which, and the depth of which to apply manures or fertilizers. We do not intend to convey the impression that all these operations are solely dependent upon the rooting properties of plants, for besides this, numerous other factors have to be taken into consideration, such as the condition, kind and texture of the soil, the kind and solubility of the fertilizer, etc. But the rooting properties of plants is one important factor, for if a plant is a deep-rooted one, or one that has the majority of its fibrous roots extending to a distance of 8 or 10 inches below the surface of the soil, as in the case of the onion and pea, it is evident that a cultivation to that depth would be desirable for the thorough preparation of the soil. If, however, a large number of the main roots are within a short distance of the surface, say 2 to 4 inches, as in the case of the squash, it shows that when hoeing or cultivating this crop it should never be to this depth. The distance to which the roots extend latterly aids us in determining the space that should be left between the plants or rows.

The New York Agricultural Experimental Station has made a large number of very valuable experiments as to the rooting habits of plants, some of which we present herewith. The soil was a fertile clay loam 6 to 10 inches deep, resting on a tenacious subsoil of gravelly clay.

THE PEA.—The plant examined was a British Queen, about 4½ feet high. The tap root extended nearly perpendicularly downwards to the depth of 39 inches, branches separating from it through its whole length. These branches were most numerous between 4 and 8 inches in depth where they seemed to nearly fill the soil for a distance of about 8 inches on either side, some extending as far as 18 inches from the tap root. They gradually became shorter as the depth increased, but were still 4 in. to 6 in. long at a depth of 2½ feet. An American Wonder Pea, the stem of which was only 6 in. high, had nearly the same extent of root. The deep rooting character of the pea may explain the slight influence that fertilizers seem to have upon it, as seen in some experiments.

THE BEAN.—In a plant of the Scarlet Runner bean in full bloom the vertical roots extended to the depth of 2½ feet, and the horizontal ones were as least 4 feet long. Some roots were within 1 in. of the surface, but the great majority of them where between 2 and 8 in. deep. A Boston Dwarf Bean was found to have roots at 2 feet depth. The lateral ones extended to the same distance on both sides.

THE TURNIP.—The roots of a Purple-Top Globe Turnip, weighing 3 pounds, extended to a depth of 18 inches, and the horizontals reached no farther. The plant on the whole had very few roots, and even these did not divide as much as those in other plants.

THE BEET.—The main root of the Extra Dark Blood Beet divided, at about a depth of 8 inches, into several branches, some of which extended 2 feet downward. The horizontal branches, which were mostly shallow in the soil, extended a distance of 2½ feet.

THE CARROT.—The tap root of the Long Red Altfrichan variety was traced to the depth of 16 inches. The horizontal roots extended about a foot, and were found throughout the whole length of the tap root, some coming nearly to the surface.

THE CABBAGE.—The tap root of the Very Early Etampes Cabbage was found to extend 20 inches deep, and the horizontal roots reached a distance of about 18 in. from the stem. The fibrous roots were chiefly found in the upper layers of soil.

THE ONION.—The roots of a Large Red Onion were found to grow to the depth of 16 to 18 inches, while the horizontals were traced further than one foot. The roots grew from the base of the onion in all directions. The laterals were short and never subdivided. Some roots grew within an inch of the surface. A bulb of this onion planted out the second year was found to have made, as far as ascertainable, about 400 feet of roots in 40 days. The roots of a young plant, the leaves of which were only 8 in. long, and the bulb only the size of a cherry pit, had roots of the same length as the mature plant.

THE SQUASH.—In a plant of the Yellow Scallop Bush Squash, examined Sept. 8, a horizontal root was traced for a distance of 8½ feet without reaching the end. This root grew almost its entire length within 3 in. of the surface. The runners of this plant were about 4 feet long. A root of the Hubbard Squash was traced 10 feet from the plant, where its diameter was about ⅓ of that it had at its starting point. Here the root was evidently broken. In this distance the root had 385 branches.

THE MUSK-MELON.—The tap root of the Montreal Nutmeg went down 4 inches, where it turned at right angles, running almost horizontal with the surface. The main horizontals lay 2 to 3 inches below the surface, some reaching the length of 5 feet. One of the horizontals grew in this direction for 15 in., then suddenly turned down and grew to a depth of fully 2 feet.

Strange to say, the reports have omitted to state whether the soil on which these vegetables grew was drained or not.

More about the Soil Exhaustion Question—"Subscriber" vs. Shaw.

The Editor Farmer's Advocate:

SIR,—I avail myself of the opportunity you give to write a few lines in reply to Mr. Shaw's letter in your May issue, in which he complains of my criticism of his paper on "Robbing the Land."

Mr. S. takes exception to the title given to my communication, but, as you point out, I am in no way responsible for that, neither am I responsible for the report of what Mr. S. said at the meeting referred to. I was not present at the meeting and never saw either Mr. Shaw or Prof. Robertson, nor do I know anything of them but from the public reports. I quoted from the report given in the newspaper mentioned, and the correctness of that report is confirmed by a report of the same meeting given in the April issue of the Journal of Agriculture by the associate editor, thus:

I lately attended a Dairymen's Convention at Huntingdon. The editor of an Ontario stock journal informed us that by dairying and stock raising, where manure was properly saved and employed, the land grew constantly richer and in no way needed additional fertilizers. A professor of dairying, also of Ontario, supported the fertilizing theory of the soil by dairying. Unfortunately such erroneous doctrines seemed to prevail with most, if not all, of the audience.

If, then, Mr. Shaw's lecture has been incorrectly reported, it must be from want of perspicuity on his part, a too common fault—in fact, the great fault of lecturers at farmers' meetings.

Mr. S. says he still believes that the fertility of a farm can be maintained from its own resources while selling beef only or dairy products, and that in that way he had doubled the *producing power* of his farm in eight years, and he believes that even an *exhausted* farm can be *restored* in this way, only it will require longer time, and challenges *any living man* to a discussion of the subject.

Mr. S. may have doubled the produce of his farm in eight years while feeding cattle and selling beef, but that cattle raising was *the means* by which it was done I do not believe. There are thousands of farms in Canada the produce of which could *for a time* be largely increased, if not quite doubled, by thorough cultivation, draining, etc., without the help which Mr. S. claims for cattle raising, but would that indicate increase of fertility? By no means. The reverse would be the case, as the larger the crops, or the more cattle raised and sold off, the quicker the exhaustion. If a farmer grows say 100 tons of hay and 500 bushels grain, etc., and sells that