slender pole to a height of 8 feet or more." He adds: "I was informed by residents on Indian Key that this premature blossoming of a young plant or sucker *while yet attached to the parent root* is not of uncommon occurrence." (Dodge, l.c. p. 18.)

Kew, 16th August 1893. D. M.

[*Note added.*—The plant cultivated in Mauritius, and yielding what is known as Mauritius Hemp is the Green or Fœtid Aloe (*Furcræa gigantea*). The value of the exports are about 50,000*l.* annually. This plant is similar to an *Agave*, both in appearance and habit, and it also produces numerous bulbils or pole-plants after flowering. The experience in Mauritius with regard to poling of the *Furcræa* has a striking resemblance to what has been observed in regard to the Agave in Yucatan. M. de Chazal, who has written an account of "*La fibre d' Aloës*" (Mauritius, 1882) states (p. 21) "that the plants generally pole at the age of seven or eight years; they can, therefore, be cut four or five times before poling and before it is necessary to replace them." On the same subject Mr. John Horne, F.L.S., late Director of Gardens and Forests in Mauritius, writes under date of 4th September 1893, as follows: "The life of *Furcræa gigantea* in Mauritius is from seven to 10 years.....as many of the plants flower three to four years earlier than others, the leaves of the seedlings (or pole-plants) from these are fit for cutting when the late flowering plants are drying out, so cutting once begun on a plantation may be said to be continuous.....Supplying amongst old plants should be done in time so that as the old ones die out cutting from the young ones should begin. Over-cutting the leaves is common in Mauritius. This is generally held to be injurious to the plants, weakening their growth and causing them to flower and die prematurely. People in Mauritius say that by cutting only the mature leaves the growth of the plants is not weakened, and thus large fine leaves are obtained, yielding long fibre of the finest quality. But I have never heard the idea expressed that such a manner of cutting prolonged the life of the plant beyond what I might call the natural limits. It is said in Mauritius that over-cutting weakens the plant and causes them to flower and die prematurely, so it may be also said in Yucatan that cutting only the mature leaves prolongs the life of the plants to its natural limits. It comes to this, that what is said not to shorten the life of the plants in Mauritius is said to lengthen it in Yucatan—a case of arriving at the same place from opposite directions."] —*Kew Bulletin.*

PLANT FOOD IN SOILS.

A very useful contribution to our knowledge upon this important subject has recently been contributed by Dr. Bernard Dyer, to the *Journal of the Chemical Society*, and of which we give a summary.

The chemical analysis of soils, which, in the early days of agricultural chemistry was looked upon as likely to be of very great practical use in agriculture, was soon found to be, as ordinarily practised, of very limited value. Determinations of the total quantities of the most important mineral elements of plant food in the soil have been long recognised as affording useful information only in exceptional cases. Thus, the fact that a soil contains much less phosphoric acid than is contained in average soils is a "probable indication" only that it is in need of phosphatic manure; and the fact that another soil is much poorer in potash than average soils is regarded as a "probable indication" only that it needs potassic manure.

The reason is, that an analysis of soil, as ordinarily made, shows the total percentage of its constituents dissolved by strong mineral acids, without reference to the fact that only a very small proportion of this total may be available for plant use.

For example, it is very usual to find about 0·15 per cent of phosphoric acid in an ordinary average English agricultural soil. An average loamy soil, 9 inches deep, in its dry state, may be said to weigh 1,200 to 1,500 tons per acre. Such a soil, containing 0·15 per cent. of phosphoric acid, would accordingly contain about 2 tons of phosphoric acid to the acre, disregarding the subsoil altogether. Such a soil contains as much phosphoric acid per acre as would be contained in about 17 tons of superphosphate, or in nearly 10 tons of bone-dust; and yet on such a soil the addition of a few hundredweights of phosphatic manure may make the difference between a full crop of Turnips and a bad one. And similar statements would apply to other constituents of the soil.

The obvious explanation of such anomalies is that it is not the total proportion of plant-food that rules a soil's fertility, but the proportion of each constituent that is present in an immediately available condition.

The end that the author has in view, therefore, is to distinguish between matter that a plant can or cannot take up and assimilate as food, and the chief solvent agent for soil minerals he finds is the root-sap of the plants.

Acidity of Root sap.

It has long been accepted as a fact that plants help themselves to a part of their mineral food by means of the solvent action of their acid root-sap on the particles of soil with which the rootlets come into contact. In order, therefore, to obtain some information on this point, the author made determinations of the degree of acidity of root-sap in 100 plants, comprising ordinary agricultural and horticultural plants from twenty different natural orders—annuals, biennials, and perennials—all being taken, as far as was practicable, during active growth.

The results showed that the variations were wide even in plants of the same order, and even of the same species. The average "sap acidity" of the roots of the 100 plants is 0·91 per cent, reckoned as citric acid, which represents very nearly the averages found in each case for the plants included in Ranunculaceæ, Cruciferæ, Caryophyllaceæ Leguminosæ, Onagraceæ, Araliaceæ, and Boraginaceæ, which averages vary between the limits of 0·81 per cent and 1·12 per cent.

Of the remaining orders, we have Tropæolaceæ, Primulaceæ, Umbelliferæ, Compositæ, Campanulaceæ, Chenopodiaceæ, and Gramineæ, ranging from 0·53 per cent to 0·68 per cent Dipsaceæ and Solanaceæ (single species only) fall much below the average (0·44 per cent and 0·34 per cent), and so do the Liliaceæ (0·36 per cent), though one of the only two species comprising the four Liliaceous plants examined gave higher results. On the other hand, the plants examined in Rosaceæ and Plumbagineæ gave exceedingly high results, checked in each case by operating on two distinct plants of each species chosen.

These results appear to be sufficient to indicate that the ratio of the soluble free acid in the roots of plants to the moisture contained in them—which is here called sap acidity—probably generally fall within 1 per cent, calculated as crystallised citric acid.

Citric acid is chosen to express the acidity partly on account of its being an organic acid, and in that sense kindred to other root-sap acids.

Experiments on Rothamsted Barley Soils.

The remainder of the research deals with the question of soil analysis. By permission of Sir John Lawes and Sir Henry Gilbert, the author was enabled to draw a complete set of samples of soil from the world-famed Hoosfield at Rothamsted, on which Barley has been grown for forty years in succession, and on which each plot has been year after year subjected to some one unvarying kind of manurial treatment.

A precise record having been preserved, not only of the manures applied to each plot, but also of its yield of grain and straw year by year, a study of a summary of the field's history is sufficient to show which plots are languishing for phosphoric acid, which for potash, which for nitrogen, and which, in varying degrees, for all.

From a careful consideration of the whole of the results obtained, the author thinks it would not be unreasonable to suggest that, when a soil is found to contain as little as about 0·01 per cent of phos-

phoric acid soluble in a 1 per cent. solution of citric acid, it would be justifiable to assume that it stands immediate need of phosphatic manure.

Potash seems to be one of the constituents of soil most likely to be modified and rendered available by the action of winter, weathering, frost, rain, &c. There is good reason to suppose that the use of nitrate of soda, and possibly, to some extent, of superphosphate, helps to bring about by its solvent action on a part of the main stock in the soil a yearly supply of available potash.

In two sets of field experiments on Cabbages carried out by the author in Sussex and Essex, potash salts, as an addition to phosphatic manure and nitrate of soda, produced an abundant increase, but the substitution of common salt for potash salts on other plots answered just as well, probably owing to the decomposing action of the salt on the compound silicates of potash existing in the soil. It appears that the economy of potash in a soil is more complicated than that of phosphoric acid.—*Gardeners' Chronicle.*

VARIOUS PLANTING NOTES.

The Relative Value of Plants for Green Manuring.—With a view to determining the amount of nitrogen by which various leguminous plants enrich the soil, some interesting and valuable experiments were made last year on the experimental fields at Hohenheim, Wurtemberg. The soil was a heavy loam, on which Rye and winter Peas had been grown in the third year previous, Rape manured with superphosphate and nitrate of soda in the second year previous, and winter Barley in the previous year. After the Barley was harvested, seventeen different kinds of leguminous and other plants were sown for green-manuring on seventeen plots, each containing about 50 square yards separated by uncultivated strips. In September following the crop on each plot was dug under, and Sheriff Wheat drilled on all the plats. The yield of Wheat where different leguminous plants had been used as green-manures (Lupines, Clovers, Field Beans, Peas, Vetch, and Serradella), ranged from 15 to 22 lb., averaging about 20 lb. It was lowest with Serradella and highest with red Clover and white and yellow Lupine. Second to the latter were Field Peas and Beans and scarlet Clover. The yield with Kohl was 16 lb., with white Mustard 15½ lb., and with three varieties of Buckwheat the average yield was 13 lb. per plot. It was noticed that on the plots, especially those with Lupines, many heads of grain were backward in ripening. On examination the roots of such plants were found to be covered with a white fungus. No such fungus was found on the roots where non-leguminous plants were used for green-manure. In how far this occurrence was due to the green-manuring with leguminous plants was not determined. In another series of experiments, the object was to compare the total amounts of nitrogen contained in crops of different leguminous plants, and in the leaves, stems, and roots of the same separately. The soil on which this trial was made had been in grain for three years previous. Whether or not it was manured in any way for the present crop is not stated in the abstract. The seed was broadcasted on the different plots. It was found that the large Field Beans gave the largest yield of nitrogen per square yard of land; but, considering the cost of seeding this crop, it is believed that, from a financial point of view, it does not exceed the Lupines in value. The difference in the nitrogen in the white and blue Lupines raised from native and from foreign seed is very marked, the foreign seed yielding over a third more. It is seen that an acre crop of large Field Beans is able to take from the air and so give to the soil more than 225 lb. of nitrogen, while the same crop of Lupines yields some 165 lb. To supply these amounts of nitrogen in the form of nitrate of soda, would require from a 1000 to 1,500 lb. of that material.—*Gardeners' Chronicle.*

The Internal Temperature of Trees.—M. W. Prinz has been making observations for a period of nineteen months, at the Royal Observatory of Belgium, on the variation of the temperature in the interior of trees. These observations show that the sap contains large quantities of gas, which often escapes with a noise which recalls the murmur of effervescing water. This bubbling is sometimes so intense as to be perceived at a distance of 2 feet. The mean annual internal temperature of a tree is practically the same as that of the surrounding air, but the monthly means differ by two to three degrees. In general, it takes a day for a thermal variation to be transmitted to the heart of a tree. On some days the difference between the internal temperature of a tree and that of the air outside can vary as much as 10° C. Generally the difference is only a few degrees. When the temperature of the air falls below the freezing point and continues to decrease, the interior temperature of the tree descends to a point near that at which the sap freezes, and remains there. The sap freezes at some tenths of a degree above zero. The maximum absolute temperature of the interior of a tree may occur some time before the absolute maximum of the surrounding air, owing to the direct action of the spring sun and of the air upon the tree deprived of its foliage. During the high temperatures of the summer the interior temperature of trees maintain itself near 15° C., with a variation of 20° C. at the most, even when the thermal variations of them are exceptional. Speaking generally, a large tree is warmer than the air in the cold months, and a little colder than the air in warm months.—*Ibid.*

Vitality of Seeds.—The fact that seeds of weeds, especially of annuals, are capable of retaining their vitality for a number of years in the soil, is a circumstance well known to farmers of arable land. An objection often advanced against deep ploughing particularly of light soils, is that it may "bring up the Charlock." To what length of time buried seeds may continue alive is not certainly known, but the following carefully-made observations sent to the *Times* by Mr. S. James A. Slater, F.R.S., of Basingfield, near Basingstoke, are well worth recording:—"Twenty-four years ago I purchased this property (Basingfield), a large portion of which was at that time arable land bearing good crops of grain, which were however in a very weedy condition, the principal weeds being Charlock (*Sinapis arvensis*), red Poppy (*Papaver Rhœas*), and Fumitory (*Fumaria officinalis*). It is important to note that all three of these plants are annuals. In the autumn of that year (1870) I laid the land down to grass, permanent pasture, and it has remained so ever since. I make hay annually with the first crop of grass, and the second I feed off with sheep. From time to time I dress the grass with artificial manure, kainit, and superphosphate. None of the before-named weeds are ever seen unless the soil is disturbed; but directly the surface is broken, and soil some 6 or 8 inches deep is brought up and exposed to atmospheric influences and light, all three of the weeds named appear in abundance, especially the Charlock and Poppy. This occurred conspicuously last year, 1893. The seeds producing these plants had been buried twenty-three years, but at depth beyond vivifying influences, though still retaining vitality. There can be no fallacy in the observation; it has occurred over and over again. Eight years ago, after a very hard frost and a thaw, the surface of the ground being very rotten, I had occasion to take a wagon heavily laden across this pasture; the wheels sank deeply into the soil, and tore up the ground, bringing to the surface much sub-soil. In the spring these furrows were filled with Charlocks, and presently, when they flowered there were two parellel yellow ribands to be seen across the land following the irregular course the wagon had taken. It was a most striking sight. There was not another Charlock to be seen in the field. The seeds producing these beautiful yellow ribands had been buried fifteen years."—*Ibid.*