

Bacteroids and root-tubercles were at one time only associated with the leguminosæ, but further investigations have brought to light the fact that there are other plants which are also capable of fixing nitrogen in this way. In our November number when writing of useful weeds we referred to the action of *Stellaria media* (a caryophyllaceous weed) as an importer of nitrogen into the soil.

Dr. Fream writing in the Royal Agricultural Journal on the German researches into this subject, says:—"In 1891 the experiments were extended to plants other than leguminous species. Plants belonging to several different natural orders, as well as peas representing the papilionaceous division of leguminosæ, were grown under similar conditions throughout.

These diverse plants were:—

Jerusalem artichoke,—nat. ord. Compositæ.

Oats,—nat. ord. Gramineæ.

Tobacco,—nat. ord. Solanaceæ.

Mustard,—nat. ord. Cruciferæ.

Cress

Giant spurrey,—nat. ord. Caryophyllaceæ.

Two series of experiments were made in 1891. In the first series the surfaces of all the soils became covered, to a greater or less extent, with inferior green plants, amongst which were recognised certain Mosses (*Bryum*, *Leptobryum*) and certain Algæ (*Conferva*, *Oscillaria*, *Nitzschia*).

In all these cases absorption of nitrogen took place, save in two instances in which the development of these humble forms of plant-life was very feeble. In one case in which none of the higher plants were present, the soil became clothed with a notable quantity of the lower green plants, and advantage was taken of this circumstance to determine what proportion of the absorbed nitrogen had been taken up by the plants, and what proportion by the soil. It was found that all the nitrogen that had been gained was accounted for by the plants, the underlying soil not showing any gain.

In the second series of the experiments of 1891 measures were adopted to prevent the appearance of the inferior green plants. This was effected by covering the soil, after the seeds had been sown, with a thin layer of calcined quartz-sand, upon which nothing could grow (Mosses and Algæ possess no roots). In this series of experiments there was no fixation of free nitrogen, neither by the soil nor by the plants other than peas.

The investigators arrived at the following conclusions:—

1. The Leguminosæ (division Papilionaceæ), as represented by peas, are able to draw largely upon the free nitrogen of the air for purposes of growth.

2. Some of the inferior green plants possess the same property.

3. In the conditions under which the experiments were conducted, bare soils,—that is, soils devoid of any apparent vegetation—failed to fix free nitrogen in any measurable quantity. Oats, mustard, cress, spurrey likewise failed to fix the free nitrogen under conditions identical with those in which peas fixed it abundantly.

This subject of soil-inoculation, or, as it has also been spoken of, soil-vaccination, though every year sees more light thrown on it, has undoubtedly to be worked out a great deal more.

We have yet to know why it is that certain plants can act, and others cannot act, as fixers of nitrogen in the soil; and further we have yet to know some convenient method of distinguishing the one class from the other. The appearance of tubercles on the roots is not an absolute guide in discovering the desired plants, since we have seen that tubercles may not be found, under certain circumstances, on plants which under other circumstances develop them. We can but speculate as to *Grevilleas*, *Albizias* and *Toons* (these families belonging to three different botanical orders) and other plants being nitrogen fixers, and attribute the beneficial influence which they appear to have on tea to their action as such, when in fact there may be other chemical and mechanical influences we wot not of, which they exert when interplanted on tea estates. Still the matter is well worth looking into, and speculation may, as it has often done, lead to useful discoveries after prolonged research; and in the interests of all agriculturists, from the humble peasant to the extensive tea proprietor, we trust that science will before long reveal the secrets involved in this subject of soil inoculation or vaccination, so that cultivators of land will soon be in a position to control and impress into their service the newly-discovered forces which are capable of fertilizing the soil.

NEW AND OLD PRODUCTS.

A new product has a charm, even from the very fact that we are little acquainted with its habits, and owing to the difficulties of producing a paying crop under given circumstances. There is, of course, always an interest in what is a novelty. Out of a dozen new species of plants that may be introduced into a country, we may say that hardly a single one finds a permanent place in its vegetable economy. It is important, however, that all should have a fair trial, or it would be impossible to say which one will prove a success in the long run. Hence every new product that has any likelihood of growing in our soils deserves attention. It is of greater importance in one respect to look to the development of existing products than to the introduction of new and foreign ones. There are many products which are now uncared for, or which, grown in a careless way, do not produce a remunerative crop, but which could with a little extra attention be made a paying industry.

Systematic work is essential if anything like success is to be attained in the development of some of the products which are already found in the Island, and which are not properly cared for. Among these products we may place cotton as a very good example. Some time back a stir was made about cotton cultivation on the starting of the Ceylon Spinning and Weaving Co. On experimenting with the product, however, the excitement about cotton subsided after one or two seasons,—not that the experiments were failures in all cases, for in some districts the plant thrived well. There was, however, one thing wanting, and that was experience in the management of the crop; and if cultivation was persisted in, this experience would in the course of things have been gained by the cultivators. In India a villager growing cotton would as a matter of course

select the best season; he would know when to plough, when to weed, and how and when to gather in his crop. If, for example, an inexperienced man were given a marshy paddy-field and a stock of seed grain and asked to raise a crop of paddy, the result would be a sad failure. He would not know the time he should conduct certain operations in his land, he would lack the local experience necessary to ensure the safety of his crops from floods and droughts and from insects and cattle. If any of these precautions were neglected, the attempt would naturally result in failure. The great aim in the cultivation of a new crop or a neglected one should be to continue the attempt for three or four successive seasons, till the necessary experience is gained.

There are many other crops which could be profitably grown, if more attention is paid to them. In this paper it is not possible to give more than a mere list of some of these. Sugar-cane is a product, which, if properly cultivated, should succeed in some districts.

Ginger, Turmeric, Coriander, and Spices thrive well in our climate, but no attempt is made to raise them on a large scale. All varieties of grain would form profitable crops. As regards fibre plants no attempt on a proper scale has ever been made to prepare or raise a crop. There is Rhea, Jute, Aloes and other varieties deserving attention. Dye and tanning materials are all neglected though perhaps in their case it might be said that their production will not pay now in competition with mineral dye stuffs.

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SPRAYING MACHINES.

We find that we have omitted to acknowledge receipt of a catalogue issued by the firm of Strawson's Limited, the local agents for which are the Eastern Produce and Estates Company, Limited. The latter firm in sending us the catalogue directs attention to the "Antipest" machine, described as "a sprayer, improved in design and cheapened in price, to be used either with powders or liquids for removing or preventing blights, fly, insects, and fungus on growing plants economically and without injury to the plant." We note that the Eastern Produce and Estates Company introduced the spraying machine which the Assistant Government Agent of Matara used with success on infested paddy. This machine, we are informed, was not an "improved" one, and "cost nearly double the price" of the Antipest, but the report of the successful experiments at Matara is said to have effected the sale of 6 others. We do not know what success has attended the trial which the Assistant Government Agent of Kegalla is reported to have made with this machine, but we have no doubt that the results were satisfactory, provided the insecticides used were judiciously chosen and prepared of the proper strength. On this latter condition depends not only the destruction and prevention of the pests, but also the fact of the plants being directly injured or not by the insecticide.

We have not had the opportunity of inspecting an "Antipest" machine, but from a diagram given in the catalogue it would appear to be very similar to "Vermorel's Eclair Knapsack Spraying Pump" which we have already described in the

pages of the Magazine. This latter has been used with success for some time at the School of Agriculture; in the case of sucking insects, charged with kerosine emulsion, and for biting insects with solutions of Paris green or London Purple. The machine imported for the School was bought of Messrs. Clark & Co., 20, Great St. Helens, London, E.C., and cost 35 shillings in England. We do not quite see the adaptability of a machine like the "Antipest" (also costing 35 shillings in London) for distributing insecticides in the form of powders; but, as we have said, we have had no opportunity of giving the "improved" sprayer a trial, and are therefore unacquainted with the improvements which are claimed for it.

In the last Journal of the Royal Agricultural Society of England we find a report on the trials of Spraying machines at Cambridge. Among the "knapsack" machines entered for trial, were the "Antipest" (£1 15s.), the "Notus" (£1 8s.), the "Coronetta" (£1 10s.), and the "Fruit sprayer" (£5) all from Strawson's Limited. The report referring to these sprayers, remarks that some of these "most useful machines" are well suited for distributing liquids and powders. The "Antipest" is described as "a good instrument, modelled on the lines of the continental knapsack machines."

We note that "Shawson's Limited" are also prepared to supply insecticides such as *Bouillie Bordelaise*, kerosine emulsion, quassia, tobacco juice, hellebore, Paris green, &c., but there should be no difficulty in preparing or locally purchasing most of these.

For powdered insecticides we have been using the "Soufflet" or bellows which is a cheap and handy instrument, costing only 3s. each in England.

We would in conclusion express our gratification that we have a local firm prepared to supply sprayers and insecticides at moderate cost, for we consider that it is of the greatest importance that convenient methods of checking or exterminating insect and fungoid pests should be brought to the notice of, and adopted by, the cultivating classes in Ceylon.

DYSTOKIA IN A COW AND EMBRYOTOMY.

On October 25th a Sind cow belonging to the Government Dairy was reported to be suffering from dystokia. The cow was a well-formed healthy one and imported to the Island early in January. At the time of landing she was believed to have been in calf for four or five months. However, she never showed any signs of labour pains till the 24th of October, i.e., nearly ten months after landing. Taking for granted that the cow was at least 3 months in calf before it was purchased, the period of gestation is shewn to have been over thirteen months in this case.

On the 25th the water bag was ruptured and two limbs were presenting. On exploration per-vagina it was found that the limbs presenting were the hind ones with the hocks bent in. It was a case of breech presentation. The lower jaw was secured with a cord but the fore limbs were so bent down and the size of the foetus was so great that the fore limbs could not be reached. After unsuccessful attempts