that plants of the order Leguminosæ are able to assimilate nitrogen from the atmosphere, and that consequently, during the growth of such plants, there is an actual gain of this element. If a leguminuous crop, *e.g.*, indigo or *san* hemp (*Crotalaria juncea*) be ploughed-in as a manure for the cold weather crop, both organic matter and nitrogen are thereby added to the soil and act as a manure.

At the Experimental Farms at Cawnpore, Nagpur, and Dumraon (Bengal) this subject has engaged attention for some years, and it will be of interest to compare the results arrived at. Indigo has been ploughed-in at Cawnpore in August during the preparation of the land for the cold-weather crop and wheat sown. The average of the results obtained during eight years is 1,544 lbs. of grain from the plot on which indigo was ploughed-in, and 1,052 lbs. of grain from the unmanured plot. Similarly at Cawnpore, Nagpur, and Dumraon *san* hemp has been ploughed-in during seven years as a green crop with the following results. Wheat was the crop cultivated at Cawnpore and Nagpur, and the figures are the mean of the results.

	Cawnpore.		Nagpur.
	lbs. grain.	lbs. grain	lbs. grain.
Hemp ploughed-in	1,206	1,273	803
Nil . . .	1,052	73	802

The experiments made at the Dumraon Farm have been with different crops. In two years potatoes were cultivated, in three years wheat, and in one year paddy. The yield of potatoes was largely increased in each case. The paddy crop was nearly doubled, but in two cases with wheat a smaller yield was obtained from the manured crop than from the unmanured. At Nagpur, too, the results were not uniform. Mr. Fuller, Commissioner of Settlements and Agriculture, refers to this in his Reports of the Farm; and it is probable that much depends on the conditions of weather following upon the ploughing-in of green crops. In four out of seven years an increase was obtained at Nagpur in consequence of the ploughing-in of green hemp. Whilst, however, an increase of the wheat crop has not always been the result, an increase has frequently been obtained with the manure residue when a crop of cotton has been taken off the land in the following hot season.

The evidence in favour of this method of manuring is therefore fairly uniform. It is moreover one which is generally quite feasible for the *rayat*. Its cost may be estimated by that of the seed *plus* the labour required for the cultivation of the green crop.

The experiments at the Farms are being continued, and in a few years more concordant results may be expected.

[It seems likely that the subject of green-soiling may assume much greater importance in the future than it has done in the past, when considered in the light thrown on the subject by the discovery of the great merit of the pea family of plants (*Papilionaceæ*) in taking free nitrogen from the air and imparting it to the soil, specially if such plants be subsequently ploughed-in as green manure. In the Dictionary article (*M. 251*) it will be seen that Tea Planters are reported to frequently sow mustard between the tea plants and to dig the mustard into the soil with the view of green-manuring. In the light of recent investigations it may almost be confidently affirmed that very much better results would be obtained were they to substitute any of the wild papilionaceous weeds of their neighbourhood. What is wanted is a rapid-growing plant that in a given time produces the highest percentage of leaf, and one also which has a readily decomposable stem. In the above experiments *san* hemp (*Crotalaria juncea*) has been most favourably spoken of, but it seems probable one of the wild *Crotalarias* of more rapid growth and less woody texture would be more effectual. For example, *C. striata*, *C. sericea*, and *C. retusa* are fairly prevalent weeds of cultivated regions especially so in Western India. These are smaller and more hardy plants than *C. juncea*. Of course it would not be necessary to confine experiment to the species of *Crotalaria*; so far as at present known, it is probable any papilionaceous plant would serve the purpose. It is, however, frequently stated that any leguminous plant possesses the property of absorbing free nitrogen, but this would seem a mistake, since no member of the *Mimoseæ* nor of the *Cæsalpineæ* has as yet been proved to have any such property.

FODDER CROPS AND CATTLE KEEPING IN CEYLON.—V.

(Concluded.)

I have already in this series of contributions referred to cultivated fodder crops, but it has to be noted, that a variety of plants which now grow wild are, if properly cultivated, capable of being made very useful fodder plants. Of plants that are likely to be successful, if properly grown, a few that are indigenous to Ceylon shall be noted below.

Cattle eat greedily the leaves of many leguminous plants, notably the *Desmodium* (Sing. Undupiyali), *Cajanus* (Rata tora), *Phaseolus* (Mè, Mun) &c., and *Cassia* (Tora). According to Thwaites there are five species of indigenous Desmodium growing in the Island. These are:—*D. trifolium* (Hinundupiyali), *D. Heterophyllum* (Maha-undupiyali), *D. parvifolium*, *D. gyrans* and *D. gyroides*. All these are more or less perennial herbs with a fair amount of leafage. Their leaves are generally obovate and are green and thin, being neither very succulent nor dry. In the fresh state the leaves are readily eaten by all kinds of stock especially when given along with grass. It may be noted in passing that the leaves of Desmodium are specially relished by hares and rabbits. When partially dry they have a fine sweet aroma. The plants respond very readily to cultivation, and regular crops could be easily taken every month or five weeks. The leaves in a partially dry state cannot but be a very nutritrious article of diet for animals.

Of Cajanus we have so far only one species that may be useful as a fodder. *C. indicus* (S. Rata tora) cannot be said to be regularly grown in Ceylon, though of late it is common to find patches of land laid under it in different localities. Owing, no doubt, to ignorance of the manner of preparing its seeds for use as human food, its culture has not extended. If, however, the plant be grown as a fodder crop, the leaves which are used as fodder will require no other preparation than drying. All stock take to this readily. It grows without much trouble, and in a rich soil a crop of leaf twigs could be obtained once in six weeks. Of Phaseolus, Dr. Trimen enumerates eight species. These are more or less bushy creepers, some large and others small. The leaves are more succulent than any of the other species of leguminous plants just mentioned, and hence would require thorough drying before being given to stock.

Of the Cassias the *C. Occidentale* (S. Petitora) grows largely in uncultivated places, bearing smooth green leaves. The leaves are much relished by stock in a green state.

The natural order Convolvulaceæ also gives a few species of plants relished by stock. The plants belong to the genus Ipomœa.

I. Uniflora Sing. (Potupala), *I. Tridentata* (Havarimadu), *I. Obscura* (Mahamadu), *I. Cymosa* (Kirimadu). These four species of plants are well-known favourites of animals. In their green state the leaves of the Ipomœas are slightly succulent, and if they are cultivated regularly and properly cropped should form a valuable addition to our fodder supply. There is another natural order in which we have a few plants of the nature described. I refer to the various species of Amaranthus of the natural Amarantaceæ, *A. Paniculatus* (Ranatampala), *A. Spinosa* (Katutampala), *A. Gangeticus* (Sudutampala), *A. Polyganus* (Walutampala), and *A. Polygonoides* (Kuratampala) are more or less well known in all parts of the Island.

W. A. D. S.

WATER TESTING.—(*Continued.*)

A sample of water could be tested for its impurities in four different degrees, viz:—

1. Physical.
2. Chemical (qualitative).
3. Do (hardness).
4. Do (quantitative).

By the first method, *i.e.*, physical examination, we determine colour, turbidity, sediment, lustre taste, and smell. Water containing no taste, smell or colour with a slight sediment, and of good lustre may be considered as fairly good water. But this method of testing is a rough one and cannot always be relied upon. The second or qualitative chemical analysis is of more importance, and in fact if properly determined is quite sufficient, except under very exceptional circumstances. The third, the determination of hardness, is important in any examination of a water for industrial use. The fourth, that of quantitative analysis, is more within the province of the professional chemist, and while it entails much labour, requires the aid of a well-fitted laboratory. We shall dwell in this paper only on the first three kinds of tests.

The selection of a sample for analysis should be done with some care. It should be taken in a clean glass vessel and never in an earthenware one, while the vessel in which the sample is taken should be washed repeatedly with the water to be examined. The vessel, preferably a Winchester quart bottle, should also be provided with a well-fitting glass stopper; and the sample obtained should be examined as early as possible; at any rate a sample should not be left more than forty-eight hours, and in the interval should be kept in a dark cool place.

The following table would represent what we should determine in the course of testing the sample, and may be adopted as the form in which a report of testing should be recorded:—

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1. *Physical Characters:*—

(a.) Colour (b.) Turbidity.
(c.) Lustre (d.) Sediment
(e.) Taste (f.) Smell

2. *Chemical Qualitative Analysis.*

(a.) Lime
(b.) Magnesia (c.) Iron
(d.) Lead (e.) Copper
(f.) Zinc (g.) Chlorine
(h.) Sulphuric acid (i.) Phosphoric acid
(j.) Nitric acid (k.) Ammonia
(l.) Organic matter

3. *Hardness.*

(a.) Total (b.) Fixed (c.) Removable.

REMARKS:—*Colour.*—To determine the colour of water two glass jars at least 18 inches high should be placed on two pieces of white paper, one should be filled with distilled water and the other with the sample of water to be examined. When viewed from the top the colour of the sample could be distinguished, the distilled water jar constituting a means of ready comparison. The normal tint of water when viewed as above should be blueish white. If yellow it shows the presence of fine particles of clay and sand. A brownish colour marks the presence of organic impurities.

Turbidity.—The degree of turbidity, or we may say of clearness, is also seen by the above examination.

Sediment, or the amount of suspended matter is ascertained by allowing the sample in the glass jar to remain for six to twelve hours, and observing the deposit if there be any.

Lustre.—The lustre or the brilliancy of a sample of water depends on the amount of carbonic acid gas present. The brilliancy may be great, slight or nil.

Taste.—No good water should have a decided taste. The presence of iron gives a slightly bitter taste, other metals in small quantities do not impart any taste whatever. Dissolved carbonic acid is the chief cause of taste in water.

Smell.—To determine the smell of water a small quantity should be heated in a test-tube over a spirit lamp. A smell of rotten eggs indicates the presence of sulphuretted hydrogen and other organic impurities.

Any conclusions drawn solely from a physical examination like the above may often prove to be misleading, but if there be an absence of colour, taste, or smell with only a slight sediment, the sample of water may be pronounced fairly good.

Coming to the qualitative analysis we should first filter the sample through bibulous paper (white blotting paper would serve as well) which has been carefully washed several times with water from the sample.

Lime.—Lime is the most common dissolved mineral substance we come across in water. A quantity of water, say half a test tube full should be taken; a little of a solution of ammonium oxalate added to it will cause a turbidity if 6 grains of lime per gallon be present; sixteen grains would give a considerable precipitate. Water containing less than 6 grains of lime