Original Articles.

Cover Crops at Peradeniya in Relation to Soil Moisture.

A. W. R. JOACHIM, B.Sc., Dip. Agr. (Cantab.),

Agricultural Chemist

and

T. H. HOLLAND, M.C., M.S.E.A.C.,

Manager, Experiment Station, Peradeniya.

THE use of cover crops on tea and rubber estates as a prevention against soil erosion has been strongly advocated by this Department, and as a result many estates in Ceylon have adopted the practice of growing covers of leguminous crops. While it is admittedly true that by the growth of such covers on a soil, the latter's store of nitrogen and humus would in time be increased, the question has been asked whether in view of the large amounts of water transpired by cover crops, soils on which covers are grown would not suffer from excessive loss of moisture during periods of prolonged dry weather.

To ascertain the effects of cover crops on soil moisture under these conditions, moisture determinations were made in the Chemical Laboratory, of soil samples taken at the Experiment Station, Peradeniya, at various depths, from (a) soil under a thick cover of *Indigofera endecaphylla*, (b) soil under a thick cover of *Centrosema pubescens*, (c) bare soil weeded monthly. The samples were all taken within a few yards from one another in the New Avenue Rubber. The covers had been established just over two years on the date the determinations were made. The sampling was made on the 19th February, 1926, at the end of a prolonged drought of 21 days. The rainfall in the month of

January, 1926, was 1:84 inches. The results are tabulated below:—

	Depths.	Moisture. On Soil as received. %	On Soil at 100°C. %
A. Under Indigofera.	0- 3'' ...	8·03 ...	8·75
	3- 6'' ...	8·99 ...	9·88
	6- 9'' ...	8·70 ...	10·07
	9-12'' ...	10 48 ..	11·31
	12-18'' ...	10·49 ..	11·70
B. Under Centrosema.	0- 3'' ...	8·55 ...	9·35
	3- 6'' ...	12·10 ...	13·20
	6- 9'' ...	12·30 ...	14·03
	9-12'' ...	13·13 ..	15:12
	12-18'' ...	13·43 ...	15·41
C. Bare Soil scraped Monthly	0- 3'' ...	5 98 ...	6·36
	3- 6'' ...	10·40 ...	11·61
	6- 9'' ...	13·98 ...	16·27
	9-12'' ...	15·23 ..	17·97
	12-18'' ...	16·23 ...	19·37

An examination of these figures would show that, as was to be expected, less moisture is to be found in the first six inches of the bare soil than in the soils under cover crops, but more moisture at greater depths in the latter The soil under *Centrosema* has retained considerably more moisture at all depths than the soil under *Indigofera*. This can be attributed to the greater amount of organic matter derived from the *Centrosema*. The greatest total moisture in the top 18 inches is found in the case of the bare soil. This clearly indicates that more moisture is lost during dry weather by transpiration from the plots with cover crops, than is conserved by the humus and surface mulch formed during a period of two years on these plots. The bare soil plot, on the other hand, loses moisture only by surface evaporation, the mulch on its surface preventing excessive loss of moisture through capillarity.

The view was however advanced and apparently rightly, that if the cover crop was given a chance of establishing a sufficiently thick surface layer of humus and organic matter, the losses of moisture during a period of drought from soils under cover crops would not be as great as from bare soils, despite the losses by transpiration. On the 10th September this year at the end of a drought of 29 days barring two on which light rain had fallen, soil samples from the identical cover crops were again taken, but this time to a depth of 24 inches. The covers had by then

been established nearly 3½ years during which time they could be expected to have formed a fair surface layer of humus and organic matter. The rainfall figures previous to sampling were as follows:—

July	...	6·91 inches.
August, 1st—11th	...	·97 inches.

It will be noted that though the period of the drought was longer this year, there were two days on which rain amounting to ·33 inches had fallen in the interval. The rainfall for the month previous to the start of this year's drought was also greater than that previous to the drought in February, 1926. These two facts would probably account in part at least for the greater amounts of moisture found in the samples taken this year. The results of the second series of moisture determinations in the soils are as follows:—

	Depths.	Moisture. On Soil as received. %	On Soil at 100°C. %
A. Under Indigofera.			
(1)	0- 3'' ...	9·82 ...	10·89
(2)	3- 6'' ...	12·86 ...	14·71
(3)	6-12'' ...	13·64 ...	15·80
(4)	12-24'' ...	15·32 ...	18·09
B. Under Centrosema.			
(5)	0- 3'' ...	12·15 ...	13·83
(6)	3- 6'' ...	14·44 ...	16·88
(7)	6-12'' ...	16·12 ...	19·22
(8)	12-24'' ...	17·32 ...	20·94
C. Bare Soil.			
(9)	0- 3'' ...	7·38 ...	7·97
(10)	3- 6'' ...	10·94 ...	12·28
(11)	6-12'' ...	13·53 ...	15·64
(12)	12-24'' ...	15·64 ...	18·54

It will be observed that as in the previous determination, the soil under *Centrosema* contained considerably more moisture than soil under *Indigofera* at all depths. But while the soils under covers were found previously to have more moisture in the top 6 inches of soil and less moisture at lower depths than the bare soil at the corresponding depths, in the present determinations the bare soil has less moisture at all depths than soil under *Centrosema* and at all but the 12-24 inches layer than soil under *Indigofera*. In this latter layer too the difference in moisture contents between the two is hardly appreciable. Again, while previously the bare soil had the greatest moisture content in the top

18 inches of soil, it is noted now to have the least moisture content up to a depth of 24 inches. This may be attributed to the decomposing leafy material on the surface of the covers acting as a mulch, and to the absorption and retention of moisture by the humus formed as a result of the decomposition of the leaves and stems of the covers.

Summary.

These results would appear to indicate that when cover crops have been grown on soils, in the early stages of their growth up to a period of at least two years, the total moisture lost from these soils up to a depth of 18 inches is greater than from the same depth of bare soil, during a period of drought. This is due to a greater amount of moisture being lost through transpiration from the leaves of the covers, than is retained by the mulch of decomposing organic matter and humus formed by the latter. When the cover has been established for a longer period, the reverse appears to take place, *i.e.*, less moisture is lost from soils under cover crops than from bare soil. The amount of moisture retained by soils under covers in excess of what is lost through the leaves by transpiration is greater than that retained by the bare soil which loses a large proportion of its moisture through surface evaporation and capillarity.

Peradeniya, 10th October, 1927.