PART III.

A PRELIMINARY NOTE ON POT-CULTURE EXPERIMENTS WITH CAJANUS INDICUS AS HOST-PLANT.

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Field experiments having shown that considerable differences exist among individual plants of the same species of host in their response to inoculation by the lac-insect. a series of pot-cultures were made in order to ascertain the cause of these variations. The plant chosen for this purpose was *Cajanus indicus* or pigeon pea, which grows readily and is used successfully as a host-plant for lac in Assam and Indo-China. The seeds were obtained from the Assam Agricultural Department. By the kindness of Dr. Coleman, Director of Agriculture in Mysore, the experiments were conducted in the pot-culture house attached to the Agricultural Laboratories. Dr. Narasimha Iyengar gave helpful suggestions as to the details of the manurial ingredients used, and supervised the daily watering and necessary care of the cultures.

EXPERIMENTAL.

The host-plants were grown in pots of pure zinc, 10" in height and 10" in diameter, tared to a uniform weight of 5·5 kilos. A mixture of red earth and sand, from which stones and lumps had been removed by sieving was prepared in quantity. Each pot received 15 kilos of manured soil and was finally covered with 2 kilos of unmanured soil.

Nine sets of experiments in quadruplicate were conducted as follows, the first three sets being designed to study the water requirements of the plant, while the next six sets were devoted to a study of the effect of various types of phosphatic manures.

A. Moisture Series.

$\frac{1-4}{17}$ Manured with mono-calcium phosphate (7·5 gms. P_2O_5), potassium sulphate (3 gms. K_2O) and ammonium nitrate (0·25 gm. N), kept at 60 per cent. water-holding capacity (w.h.c.)

$\frac{5-8}{17}$ Similarly manured, kept at 70 per cent. w.h.c.

$\frac{9-12}{17}$ do. kept at 80 per cent. w.h.c.

B. Phosphate Series (did not receive any potash and all kept at 70 per cent. w.h.c.)

$\frac{1-4}{18}$ No phosphate ; ammonium nitrate (0·25 gm. N).

$\frac{5-8}{18}$ Mono-calcium phosphate (7·5 gms. P_2O_5) ; ammonium nitrate (0·25 gm. N).

$\frac{9-12}{18}$ Tricalcium phosphate (7·5 gms. P_2O_5) ; ammonium nitrate (0·25 gm. N).

$\frac{1-4}{19}$ Superphosphate (7·5 gms. P_2O_5) ; ammonium nitrate (0·25 gm. N).

$\frac{5-8}{19}$ Basic slag (7·5 gms. P_2O_5) ; ammonium nitrate (0·25 gm. N).

$\frac{9-12}{19}$ Bone meal (7·5 gms. P_2O_5) ; ammonium nitrate (0·25 gm. N).

On September 28, 1921, the *Cajanus* seeds were sown 0·5″ deep in the pots ; they began to germinate after 5 days. On February 22, 1922, two of each series (even numbers) were inoculated with selected sticks of brood-lac ; the sticks were removed after a fortnight. On April 23, 1922, the males, some of them winged, began to emerge. The plants were allowed to flower, and on May 29, 1922, a number of seedpods were removed. This was probably not without effect on the analytical figures ultimately obtained.

On June 29, 1922, shortly before swarming was anticipated, and in order to determine the number of larvæ from each cell, 4 typical healthy cells were removed from each growing plant by means of a pair of forceps, and transferred to a test-tube plugged with cotton wool. The insects were allowed completely to emerge, and ultimately counted, an average of 8 cells being thus obtained.

The larval swarming began on July 3, 1922, on which date the plants were cut down, close to the soil, and dried in muslin bags. At the same time occasion was taken to estimate the percentage of parasitised cells by actual observation of about 20 individual cells. The lac-bearing plants were carefully freed from incrustation, and the stick-lac dried in a vacuum desiccator over sulphuric acid, and weighed. The whole plants, thus freed from lac, were then further dried, powdered to pass through a sieve of 30 meshes to the inch, and preserved for analysis.

The methods of analysis used call for little remark, being for the most part those described by the A.O.A.C. The results are recorded in tabular form at the end of the paper.

INTERPRETATION OF RESULTS.

1. *Total dry matter.*—There is a decrease in the total dry matter in the case of inoculated plants.

2. *Total Nitrogen.*—The nitrogen content of the attacked plant decreases. The highest nitrogen content is found in plants which have received basic slag, next are those manured with tricalcium phosphate, showing that lime favours nitrogen fixation.

3. *Total Ash.*—A higher percentage of inorganic ash is shown by attacked plants.

4. *Crude Fibre.*—An increase in the crude fibre value is evident in the case of those plants which were inoculated.

5. *Total Water Extract.*—The total water extract of the control plants is generally higher than that of the attacked plants.

6. *Petrol and Ether Extracts.*—These have not given concordant values, due probably to the fact that some of the plants seeded out.

7. *Yield of Stick-lac.*—This is highest with superphosphate.

8. *Parasitism and larval production.*—It is in relation to these two factors as set out in the last two columns in the table that the experiments show the most significant results. A high percentage of moisture, as evidenced by the plants kept at 80 per cent. w.h.c., appears as effective in reducing the percentage of parasitism as either mono-calcium phosphate or superphosphate. This result is of interest in view of the recent work of the Howards on the physical effect of superphosphate on soil. The number of larvæ per cell is larger in the case of plants receiving superphosphate than in those supplied only with 80 per cent. moisture. High moisture, however, gives better results than mono-calcium phosphate. The favourable effect of moisture is borne out in practice, the rainy season crop yielding the highest percentage of resin, and also the greatest number of larvæ per lac-cell.

General Observations.—The above conclusions, though fairly definite so far as they go, must be considered as tentative only. It is

unfortunate that the pots proved too small for the extensive root system of the plant, with the result that towards the end of the experiment, systematic watering of the plants became very difficult, owing to the slow rate of percolation, and had to be abandoned. As a matter of fact *Cajanus indicus*, although useful for comparative experiment, is a poor host for the Mysore lac-insect. A new host-plant, *Acacia Farnesiana*, which can also be grown in culture solutions, has since proved much more satisfactory. Plot-culture experiments are now in progress with this plant, with the object of checking and extending the conclusions drawn from the pot-culture results here described. An account of these new trials will be published in due course.

Our best thanks are due to Dr. Coleman for allowing us the facilities of the Agricultural Laboratories, and to Dr. Narasimha Iyengar for his helpful suggestions and for his careful supervision of the growing plants.

ANALYTICAL RESULTS OF POT-CULTURES

(Averages of

Nos.	Character of additions	Inoculated or not	Total dry matter	Total nitrogen	Total ash
			In grams	Per cent.	Per cent.
$\frac{1+3}{17}$	60 per cent. moisture*...	Control ...	158	1·44	6.57
$\frac{2+4}{17}$	Do.	Inoculated ...	87	1·04	8·23
$\frac{5+7}{17}$	70 per cent. moisture ...	Control ...	154	1·4	7·03
$\frac{6+8}{17}$	Do.	Inoculated ...	116	1·28	7·72
$\frac{9+11}{17}$	80 per cent. moisture ...	Control ...	139	1·43	7·9
$\frac{10+12}{17}$	Do	Inoculated ...	85	1·46	8·42
$\frac{1+3}{18}$	No phosphate. 70 per cent. moisture.	Control ...	82	1·36	4·6
$\frac{2+4}{18}$	No phosphate. 70 per cent. moisture.	Inoculated ...	45	1·27	6·92
$\frac{5+7}{18}$	Mono-calcium phosphate. 70 per cent.	Control ...	136	1·47	5·62
$\frac{6+8}{18}$	Mono-calcium phosphate. 70 per cent.	Inoculated ...	106	1·49	6·73
$\frac{9+11}{18}$	Tri.-cal. phosphate. 70 per cent. moisture.	Control ...	112	1 64	6·42
$\frac{10+12}{18}$	Tri.-cal. phosphate. 70 per cent. moisture.	Inoculated ...	84	1·13	6·34
$\frac{1+3}{19}$	Superphosphate. 70 per cent. moisture.	Control ...	144	1·51	7·5
$\frac{2+4}{19}$	Superphosphate. 70 per cent. moisture.	Inoculated ...	66	1·18	9·45
$\frac{5+7}{19}$	Basic slag. 70 per cent. moisture.	Control ...	76	1·81	6·6
$\frac{6+8}{19}$	Basic slag. 70 per cent. moisture.	Inoculated ...	85	1·40	7·7
$\frac{9+11}{19}$	Bone meal. 70 per cent. moisture.	Control ...	140	1·42	6·01
$\frac{10+12}{19}$	Bone meal. 70 per cent. moisture.	Inoculated ...	85	1·09	6·78

* Moisture is stated in percentage

WITH *Cajanus indicus.*

2 plants).

Crude fibre	Total water extract	Petrol extract	Alcohol extract	Total weight of stick lac	Percentage of parasitised cells	Average number of larvæ per lac-cell
Per cent.	Per cent.	Per cent.	Per cent.	In grams		
31·1	18·4	5·0	18·0			
35·9	15·1	2·5	13·4	1·82	57	72
31·5	19·9	3·6	11·2			
35·0	18·4	4·0	14·0	6·18	67	197
35·1	20·1	11·1	17·1			
39·0	17·6	2·7	14·3	4·77	17	275
35·5	22·7	2·0	11·6			
34·3	18·4	2·35	10·0	3·00	39	184
32·9	15·7	1·2	11·9			
29·3	20·3	4·0	15·3	8·26	29	270
36·6	16·7	2·4	18·2			
32·3	19·4	2·7	12·3	4·08	60	203
29·2	19·6	3·2	11·8			
32·3	16·2	3·8	9·7	9·72	32	297
32·2	17·5	2·4	16·1			
26·1	19·1	3·7	20·5	4·49	50	176
31·0	19·6	2·08	12·2			
30·9	17·8	1·47	15·7	3·52	54	225

of water holding capacity of soil.