32. Chemical studies of the leaf and root (wilt) diseases of coconuts in Travancore-Cochin

VI. Chilean Nitrate as a curative for diseased palms and as a fertilizer for coconut seedlings

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INTRODUCTION

THE Coconut Leaf and Root (Wilt) diseases of Travancore-Cochin have been studied in great detail by many workers. The numerous investigations on the pathological, chemical and physiological aspects of the problem have been reviewed by Menon and Pandalai (1958). Results of subsequent work are given in a series of papers presented at the Coconut Research Workers' Conference, Trivandrum, 1959. The present paper is the sixth in this series on chemical investigations.

Several trials were carried out at the Central Coconut Research Station, Kayangulam to remedy the diseased condition of the palms by the application of organic manures and mineral fertilizers, singly and in combination. Chilean nitrate was one of the fertilizers tried. It is not necessary here to review the extensive literature on sodium nutrition of plants. Reference may, however, be made to "*Sodium in Agriculture*" (1943-50), and *Sodium Symposium* (1950) and to some of the subsequent work - *vide* Mc Lean (1956), Wehunt *et. al.*, (1957), Sowell and Rouse (1958) and Pearson and Bernstein (1958) - which contain detailed data, discussions and references to literature relating to most of the known facts of the role of sodium in plant nutrition. A study of the literature disclosed that natural sodium nitrate, i. e., chilean nitrate in addition to supplying sodium and nitrate ions also furnished small quantities of micro nutrients and that it is an alkaline agent tending to reduce the acidity of soils of humid regions. The fertilizer was also found to help plants to get over certain deficiency or disease symptoms, e.g. abnormal purple spots and marginal scorch of foliage in beets, and rust of cotton. For these reasons it was felt worthwhile to find out if it has any curative effect on diseased coconut palms.

The coconut soils are poor in nutrients due to continuous cropping and inadequate manuring. Regular manuring commenced from the seedling stage itself as recommended by Cooke (1954) is, therefore, necessary to promote early bearing and high yield. Among the primary plant nutrients, nitrogen aids good vegetative growth which is of great importance in seedlings. Nitrate is the normal form in which nitrogen is absorbed by plants though ammonia can also be utilized by them. Further, a proper supply of nutrients at the seedling and pre-bearing stage may help the plants to withstand disease infection. A manurial trial was also, therefore, conducted with two to three year old underplanted seedlings to study the effect of Chilean Nitrate combined with suitable quantities of phosphatic and potassic manures on vegetative growth and disease-resisting capacity of the seedlings.

The results of these investigations are reported in this paper.

Plan of the Experiment

Trees

A group of ten trees in the middle stage of Leaf disease and another group of ten trees in the middle stage of Root (Wilt) disease were treated with Chilean Nitrate to supply 2.0 lb. nitrogen, with a basal application of 0.75 lb. of phosphoric acid as bone meal and 1.5 lb. of potash as muriate of potash, per tree per year. The manures were applied in basins. The nitrate was applied in three equal doses during August, December and April, and during the latter two applications the trees were also watered. Observations on the yield characters of the trees and the visual disease symptoms such as yellowing, leafrot flaccidity, tip burn were recorded every year.

Underplanted seedlings

Treatments—

I.	Chilean nitrate to supply ½ lb. nitrogen	Over a basal application of 0.25 lb. P_2O_5 as bonemeal and 0.5 lb. K_2O as muriate of potash per seedling, per year.
II.	Groundnut cake ,,	
III.	Ammonium sulphate ,,	

To compare the effect of manuring on the seedlings a fourth treatment of ash alone at 10 lb. per seedling was also included.

The seedlings were watered during summer.

Lay out

Single seedling treatment randomised and repeated 50 times.

Cultural operations

The plots under both experiments received the usual cultural operations viz. forming of mounds in September-October and levelling them in December-January. A green manure crop of Sunnhemp *(Crotalaria juncea)* was also grown *in situ*.

The quantitative vegetative characters relating to growth viz. number of leaves, length of leaves and girth of collar of each of the 200 seedlings were measured every year for four years.

Soil samples were drawn from the plots to determine the initial fertility status and were analysed according to the methods of Piper (1944).

Results and Discussion

The soil of the plots under the experiment is coastal sandy. Composite samples were analysed for fertility status and the average results are given in Table 1.

Table 1

Showing fertility status of the soil - Chilcan Nitrate experimental plots

Depth	Moisture %	Loss on ignition %	N %	Hydrochloric acid soluble					Available		pH
				P_2O_5 %	K_2O %	CaO %	MgO %	Fe_2O_3 %	P_2O_5 %	K_2O %	
0"—8"	0.53	1.13	0.09	0.02	Trace	Trace	Trace	0.71	0.004	Trace	5.5
8"—17"	0.72	1.12	0.07	0.02	Trace	Trace	0.08	0.86	0.004	Trace	5.5
17"—72"	0.71	1.09	0.07	0.03	Trace	Trace	0.10	0.75	0.010	Trace	6.0

It will be seen from the above data that the soil is of low fertility according to the standard fixed for Travancore-Cochin. The nitrogen content, however, is not so low as compared to phosphoric acid and potash. The soil contains only traces of calcium and is acidic.

Diseased conditions

General

The summary of observations on foliar disease symptoms and the yield capacity of palms are given in Table 2.

TABLE 2

Showing the summary of observations on disease symptoms and yield capacity of trees – Chilean Nitrate experiment

Tree No.	No. of leaves			Yield capacity: Total No. of bunches			Yield capacity: Total No. of nuts			Foliar disease symptoms: Severe yellowing			Partial yellowing			Withered tips			Total Number of leaves with: Severe leafrot			Partial leafrot			Flaccidity		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Root Disease																											
223	27	25	20	10	8	10	34	8	8	—	—	—	16	20	8	13	15	9	—	—	—	1	—	—	6	7	—
384	16	17	15	3	4	—	1	1	—	5	5	6	3	7	4	10	—	10	—	—	4	—	—	—	10	14	2
246	27	23	17	5	3	7	9	1	3	6	5	—	12	17	11	—	9	10	—	—	2	—	—	—	—	—	—
89	22	26	—	10	7	—	27	7	—	4	2	—	6	12	—	6	12	—	—	—	—	—	—	—	—	10	—
29	17	21	20	6	9	7	41	11	10	5	10	6	7	10	—	—	9	6	—	—	2	—	—	—	—	2	3
6	25	26	23	10	8	10	38	15	25	—	—	—	2	13	9	6	12	20	—	—	—	—	—	—	8	11	4
68	29	27	—	14	9	—	25	22	—	16	9	—	12	13	—	10	8	—	1	—	—	3	—	—	10	9	—
299	26	21	18	10	11	8	15	15	10	—	3	5	12	17	4	26	14	8	—	—	—	1	1	—	6	7	2
273	24	26	19	13	11	8	85	33	20	5	5	1	8	20	18	12	17	5	—	—	—	—	—	—	—	9	—
304	24	22	19	11	9	8	8	9	9	—	3	3	15	19	5	7	22	7	—	—	—	3	3	—	5	16	4
Leaf disease																											
319	25	22	22	14	14	8	30	33	11	—	—	—	8	11	7	25	9	20	—	—	—	4	4	—	6	2	2
301	29	29	28	11	9	9	21	20	9	—	—	4	8	16	12	26	9	28	—	—	—	—	3	—	—	—	—
299B	23	24	23	11	8	7	30	13	7	8	—	—	12	15	10	8	—	20	—	1	3	5	16	—	—	2	4
238	34	23	23	12	7	4	9	4	1	10	—	13	3	23	10	34	23	23	1	1	—	5	—	—	—	—	—
187	27	22	21	11	5	6	9	3	6	13	5	11	7	10	—	10	17	21	1	1	—	3	5	—	10	13	3
18	23	21	18	7	8	10	6	12	16	5	5	2	4	16	10	8	7	10	—	—	—	—	—	—	3	9	1
26	23	20	12	10	7	3	33	5	—	—	—	4	—	20	8	—	20	10	1	1	—	2	2	—	6	11	—
19	22	19	20	11	9	10	21	18	9	—	—	4	14	15	5	22	14	13	1	1	—	3	3	—	3	6	5
38	34	38	—	15	10	—	68	24	—	—	—	—	8	10	—	10	9	—	8	—	—	—	—	—	—	—	—
5	23	22	19	13	5	12	61	12	74	—	—	—	8	20	8	—	11	6	—	—	—	—	—	—	—	5	—

I = First year II = Second year III = Third year.

It will be seen from Table 2 that the application of chilean nitrate for three years has no appreciable effect on reducing the severity of disease. The general appearance of the trees did not indicate any distinct improvements over the original condition. Tree Nos. 89, 68, and 38 badly deteriorated in condition by the end of the third year that they were cut and removed.

Production of leaves

According to Menon and Nair (1951) the presence of a large number of leaves in a coconut palm is an index of its health, vigour and productivity. After a palm gets infected, the leaves that are subsequently produced get smaller. The leaves are also shed quickly and the crown gets greatly reduced in size. According to these standards, the trees under investigation may be said to have deteriorated in condition. Fifteen out of the 17 remaining trees had fewer number of leaves at the end of the three year experimental period. The over-all reduction amounted to 22.38 per cent.

Yield capacity

The reduction in the number of leaves is accompanied by a lowering of the yield capacity of the palm. Thus 12 out of the 17 trees had a total of 130 bunches in the beginning. This number was reduced to 83 corresponding to a decrease of 36.20 per cent. Fourteen of the trees which had a total of 373 nuts (including tender nuts) had the number reduced to 117 corresponding to a percentage decrease of 68.63.

Foliar disease symptoms

The observations on the number of leaves with severe yellowing, partial yellowing, withered tips, severely affected by leaf-rot, partially affected by leaf-rot and having flaccidity, summarised in Table 2, show that some of the trees had a decrease in the severity of these symptoms. But it cannot be said definitely that this curative effect is due to the chilean nitrate since in some trees the conditions have worsened while some of the healthier trees have developed disease symptoms. Whether chilean nitrate has only a curative effect and cannot prevent the development of disease in trees which have already got infected only further experiments can prove.

Seedlings

The quantitative characters relating to growth of the seedling are shown in Table 3.

TABLE 3

Showing the growth characters of seedlings - Chilean Nitrate experiment

		Chilean Nitrate	Groundnut cake	Ammonium sulphate	Ash
First year	Number of leaves	7	7	7	7
	Length of leaves	3'—4"	3'—4"	3'—2"	3'—4"
	Girth at collar	1'—5"	1'—4"	1'—4"	1'—5"
Second year	Number of leaves	9	10	9	10
	Length of leaves	5'—0"	5'—8"	5'—0"	5'—9"
	Girth at collar	2'—10"	2'—11"	2'—8"	2'—10"
Third year	Number of leaves	10	10	10	10
	Length of leaves	12'—5"	12'—3"	12'—5"	12'—8"
	Girth at collar	3'—5"	3'—4"	3'—3"	3'—4"
Fourth year	Number of leaves	12	12	12	12
	Length of leaves	14'—5"	14'—0"	14'—1"	13'—10"
	Girth at collar	3'—11"	3'—9.8"	3'—9.5"	3'—9.5"
	Number of seedlings infected by disease	16	8	7	9

It is seen from the data presented above that chilean nitrate has a beneficial effect on two of the important vegetative growth characters of the seedlings viz. length of leaves and girth at collar. Similar findings have been found by other workers. Mariakulandai (1957) has reported that chilean nitrate is better than ammonium sulphate or groundnut cake as a fertilizer for sugarcane. It gave better cane yield and sucrose content per acre. Rayappa Pillay and Purushothaman (1958), comparing the performance of chilean nitrate and ammonium sulphate on ragi have found that though ammonium sulphate recorded increased yields over chilean nitrate, the yield difference is slight and not significant. Bayens (1948) in his investigations with chilean nitrate and other fertilizers on fodder beet has indicated that the superiority of chilean nitrate over other fertilizers may be due to the micronutrients present in it. The results of the present study are generally in agreement with the findings of these and other workers, who have reported beneficial effects of chilean nitrate on barley, beet, corn, cotton, millet, pepper, sweet potato, wheat and other crops.

It is also interesting to note that ash alone gives a fair response with regard to growth characters of the coconut seedlings under study. This may be due to the effect of the potash when it is remembered that the coconut is a potash loving plant and that the initial nitrogen status of the soil is fairly satisfactory.

The experiments were discontinued after three years since it was felt that continuous application of chilean nitrate may have injurious effects. But the seedlings were kept under observation to study the incidence of disease in them. The number of seedlings infected under each treatment is given in Table 3. It may be seen that, as in the case of trees, chilean nitrate has no effect in preventing development of the diseases.

The healthy seedlings have now been brought under a new experiment to study the effect of applying higher doses of N. P. K. manures at the most critical stage in the growth of the palm - viz. the pre-bearing stage and see if such treatment would prevent develcpment of disease in them. This will form the subject of a future communication.

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