

## NUTRITIONAL STATUS OF SOILS AND THE INCIDENCE OF "BUNCHY TOP" DISEASE OF BANANA (VAR. JAVA)

P. BALAKRISHNA PILLAI and C. K. N. NAIR

*College of Agriculture Vellayani*

Though it is widely accepted that the disease "Bunchy Top", threatening one of the important horticultural crops of India is caused by a virus, it has to be admitted that the environment and soil characteristics do exert a certain influence on the incidence and spread of the disease. In the present investigation detailed studies were made on the effect of application of calcium oxide and magnesium oxide in the ratio of 3:1 at different rates in the soil on the incidence of Bunchy Top disease and the CaO/MgO ratio within the plants was studied under partially controlled field conditions.

### Materials and Methods

The experiment was conducted at the College of Agriculture, Vellayani. Thirty reinforced cement concrete rings (1.5 metres long with a radius of 2.5 meters) each with a capacity to hold one ton of soil, were implanted in the experimental plot at a distance of 2.5 metres, centre to centre either way, for planting the banana suckers. Each pit was filled with one ton of soil mixed with NPK fertilisers, slaked lime and magnesium carbonate.

The Treatments for the experiment consisted of four levels of calcium (0, 0.15%, 0.30% and 0.60%) and four levels of Magnesium (0, 0.5%, 0.10% and 0.20%) with CaO/MgO ratio of 3:1. These four treatment combinations replicated seven times were tried in the randomised block design of layout. CaO and MgO were applied on the basis of the above percentage in one ton of soil used in each pit. The entire quantity of muriate of potash (2930 gms per plant) slaked lime and magnesium carbonate (according to treatments) were applied to the soil thoroughly mixed and allowed to lie over for a week.

One fourth of the ammonium phosphate (272 gm per plant) was then mixed with the soil and the pits were filled. The remaining quantity of ammonium phosphate (816 gm per plant) and ammonium sulphate (480 gm per plant) were applied in three equal weekly instalments.

Infective banana aphids *Pentalonia nigronervosa* at the rate of 100 per plant were released in the axils of the top most leaves of all the plants when

the plants were three months old. All plants were sprayed with folidol E. 605 (0.02%) at an interval of 10 days to prevent any natural infection through aphids, till 10 days before inoculation.

Estimations of growth characteristics of the plants, N, P, K, Ca and Mg content of leaf before the transmission of the virus and after the incidence of the disease were used as criteria for treatment evaluation.

### Results and Discussion

#### *Number of days taken for the appearance of disease symptoms.*

The number of days taken for the appearance of disease symptoms on the plants are given in Table 1. There is significant difference between the treatments. The control plants contracted the disease earlier than the treated plants. The number of days taken for infection varied from 3042 for control and 32 to 75 for treated plants. Some plants in treatments 2, 3 and 4 gave normal bunches.

The daughter sucker of treatment No. 1 had primary infection and showed bunchy top symptoms. The suckers of treatment No. 2 and 3 showed no symptoms of disease, like their mother plants.

#### *Nutrient content of leaf samples*

**Nitrogen:** The data on the mean nitrogen content of the leaf samples before the transmission of the virus and after the incidence of the disease are presented in Table 2. The results indicate that before the inoculation of the virus there was significant variation in the uptake of N due to treatment effects. The control plant showed a maximum absorption of N viz 3.434% which decreased with increase in the levels of calcium and magnesium.

The data after the incidence of the disease showed that the uptake of N was decreasing with increase in the levels of CaO and MgO.

**Phosphorus:** The data on the absorption of P by the banana plant before and after the transmission of virus are presented in Table 2. The absorption of P was not significant between the treatments before the inoculation of the virus and after the incidence of the disease. The maximum absorption was found for treatment 4.

**Potassium:** Data relating to the uptake of K before and after the incidence of the disease are presented in Table 2. There was no significant difference in the uptake of K in the CaO and MgO treated plants over the control before and after the incidence of the disease. The application of CaO and MgO in increasing doses showed a trend in reduction of the absorption of K. in all treatments.

Table 1

Number of days taken for the appearance of disease symptoms after the release of aphids

Blocks	Tr. 1.	Tr. 2.	Tr. 3.	Tr. 4.
I	30	42	48	58
II	32	32	54	58
III	34	38	48	H
IV	34	H	42	H
V	42	H	H	54
VI	34	62	68	H
VII	34	48	75	58

Table 2

Nutrient content (expressed as % on oven dry basis), **CaO/MgO** ratio and **CaO+MgO/K<sub>2</sub>O** ratio of leaf samples before the transmission of virus and after the incidence of the disease

Treatments		Tr. 1.	Tr. 2.	Tr. 3.	Tr. 4.	C. D. at $5\%$
Nitrogen	Before the transmission of virus	3.434	2.986	2.781	2.821	0.304
	After the incidence of the disease	3.488	3.283	2.843	2.709	
Phosphorus	Before the transmission of virus	0.409	0.377	0.419	0.461	
	After the incidence of the disease	0.421	0.391	0.414	0.479	
Potash	Before the transmission of virus	4.769	4.186	4.287	4.099	
	After the incidence of the disease	4.447	4.796	4.552	4.517	
CaO	Before the transmission of virus	0.509	0.554	0.633	0.646	0.084
	After the incidence of the disease	0.466	0.496	0.571	0.598	0.025
MgO	Before the transmission of virus	0.405	0.430	0.468	0.563	0.105
	After the incidence of the disease	0.386	0.468	0.443	0.576	0.134
CaO/MgO	Before the transmission of virus	1.446	1.357	1.361	1.193	
	After the incidence of the disease	1.337	1.109	1.217	1.102	
CaO MgO K <sub>2</sub> O	Before the transmission of virus	0.199	0.234	0.258	0.309	0.049
	After the incidence of the disease	0.184	0.205	0.221	0.271	

*Calcium:* The data in Table 2 reveal that the difference in the uptake of Ca by the CaO and MgO treated plants over control was significant before and after the incidence of the disease. Treatment 4 had the maximum content of Ca before and after the incidence of the disease (0.646%) and 0.598% respectively). The lowest Ca percentage was for control (0.509% and 0.466% respectively).

*Magnesium:* The results in Table 2 reveal that the absorption of magnesium was significantly higher in the Ca and Mg treated plants as compared to control before and after the incidence of the disease. The maximum content of 0.576% MgO was in treatment 4 and the lowest of 0.386% in the control after the incidence of the disease.

*CaO/MgO ratio:* The data in Table show that there was no significant difference between the treatments before the transmission of the virus and after the incidence of the disease. The highest ratio of 1.466 was obtained in the control and there is a gradual decrease of the ratio in the CaO and MgO treated plants (1.193 in treatment 4) before the transmission of virus. After the incidence of the disease, the highest ratio of 1.337 was in control.

*CaO + MgO/K<sub>2</sub>O ratio:* The data in Table 2 reveal that the CaO x MgO/K<sub>2</sub>O ratio in the leaf before the transmission of virus was significantly lowest value of 0.199 was in treatment 1 and 0.309 was the highest value in treatment 4.

There is no significant difference between the treatments for the ratio after the incidence of the disease. The maximum value of 0.271 was for treatment 4 followed by treatment 3. The lowest value of 0.184 was for the control.

The present studies have shown that the control plant contracted the disease earlier than in all other treatments. A notable observation is that the daughter suckers in calcium-Magnesium treatment had no primary infection. The daughter sucker in the control had primary infection. It would thus appear that a sufficiency of Ca and Mg in the soil may reduce the occurrence of primary infection in suckers of diseased plants. Similar observations had been recorded from Australia earlier (Goddard, 1923).

On the absorption of nutrients from the soil, the present studies had indicated that there is a decrease in the uptake of N by the plants with increasing Ca and Mg in the soil. It is interesting to note that cases of lowest incidence of the disease or the longest delays observed were in the case of plants which had lowest nitrogen. It is therefore possible that Ca and Mg may have, besides a direct role in the plant tissue, an indirect effect also in the control of the disease through their influence on the absorption of other nutrient elements. In the case of K, maximum absorption by the plant was noticed in the absence

of Ca & Mg before the transmission of virus. Plant receiving highest level of Ca & Mg had the lowest content of K, after the incidence of the disease, the lowest value was observed in the case of control plants. There was no significant difference in tissue phosphorus between control and treated plants. The absorption of Ca and Mg by the plant was also directly correlated to the soil content of Ca and Mg.

The CaO/MgO ratio in the leaf in the various treatments showed no significant difference before the transmission of virus and after the incidence of the disease. But all healthy plants which withstood infection had a CaO/MgO ratio of slightly above 1 irrespective of treatments.

Although CaO/MgO ratio in the soil was maintained at 3:1, the absolute quantity of CaO/MgO had an effect in causing a higher ratio of CaO+MgO/K<sub>2</sub>O in the leaves. The lowest value was noticed in the case of control and the highest value in the case of treatment 4. It is significant to note in this connection that the longest delay in the incidence of the disease was noticed in the case of plants with the highest CaO+MgO/K<sub>2</sub>O ratio. The present studies would therefore indicate that the CaO+MgO/K<sub>2</sub>O ratio in the plant tissue is related to the resistance of the plant to Bunchy top disease.

**Summary**

All the plants in the control contracted the disease earlier than the treated plants. The uptake of N by the plant decreased with increasing levels of Ca & Ms There was an increase in the N content of leaves after the incidence of the disease. The present studies have indicated that the CaO+MgO/K<sub>2</sub>O in the plant tissue exerts some influence on the resistance of the tissue to infection by the Bunchy top virus.

**സംഗ്രഹം**

വാഴയിൽ **rbtjrijajrtBOrt**) കൂമ്പപ്പുഴ രോഗത്തെ തടയുവാനായി മണ്ണിന്റെ പോഷകഘടനാ നിലവാരം ഏതു വിധത്തിലായിരിക്കണമെന്ന് കണ്ടുപിടിക്കുവാൻ പല പഠനങ്ങളും നടത്തിയതിൽ നിന്നും ക്യാൽസിയം ഓക്സൈഡും, മെഗ്നീഷ്യം ഓക്സൈഡും **3:1** എന്ന അനുപാതത്തിൽ മണ്ണിൽ ചേർത്താൽ രോഗത്തെ തടയുവാനോ അതിന്റെ ആരംഭത്തിന് കാലതാമസം ഉണ്ടാകുവാനോ കഴിയുമെന്ന് കണ്ടു. CaO-ഉം MgO-ഉം ഉയർന്ന നിരക്കിൽ മണ്ണിൽ ചേർത്തിരുന്ന ആരോഗ്യമുള്ള ചെടികളിൽ നൈട്രജൻ കുറവായും ക്യാൽസ്യവും മഗ്നീഷ്യവും കൂടുതലായും കണ്ടു. കൂടാതെ ഈ ചെടികളിൽ **CaO + MgO/K<sub>2</sub>O** അനുപാതം വളരെ പ്രകടമാംവിധം കൂടുതലായും കണ്ടു. ഈ പഠനത്തിൽനിന്നും വാഴയിലെ കലകളിലെ CaO+MgO/K<sub>2</sub>O അനുപാതം അവയ്ക്ക് കൂമ്പപ്പുഴ രോഗത്തെ ചെറുത്തുനില്പാനുള്ള കഴിവുമായി ബന്ധപ്പെട്ടിരിക്കുന്നു എന്ന് തെളിഞ്ഞിട്ടുണ്ട്.

**REFERENCE**

Goddard, E, J 1925 'Bunchy Top' in Bananas. *QuernslandAgric. J*, 24, 424-429.

(M.S. received: 6-7-1974)