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Effect of cytozyme granules on the availability of nutrients in soil

K. VIJAYALAKSHMI AND K.K. MATHAN
Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agril. University, Coimbatore - 641 00

Abstract : A filed experiment was conducted (1995-96) to study the influence of cytozyme growth regulator on Banana cv. Nendran. The experiment consisted of eight treatments (Cytozyme granules alone at 6, 12 and 18 kg levels and in combination with foliar spray of cytozyme Crop* at 0.1 per cent) with four replications in Randomized Block design. Results indicated that the application of cytozyme granules @ 18 kg ha^{-1} along with 0.1 per cent foliar spray increased the availability of 'N' in soil (22.2%) at 30 days after treatment (DAT) (22.2%) and the 'P' was not at all influenced. Available 'K' and exchangeable 'Ca' was increased by cytozyme application towards the maturity stage, while the influence of exchangeable 'Mg' was noticed only on 90 DAT (flowering). The combined effect of soil plus foliar spray also significantly increased the DTPA extractable Zn, Cu and Fe in soil. (*Key Words : Cytozyme granules, Banana, Nutrient availability, Soil).*

In the recent past, the crop yield has been maximised by employing appropriate genetic methods, better management practices and increasing various inputs. Further increase in crop yield may be possible by physiological manipulations through applications of plant growth regulators at an appropriate time with effective concentrations. Cytozyme, a biologically derived plant growth regulator produced by Southern Petrochemical Industries Corporation Limited, Tamil Nadu is reported to act synergistically with plant natural hormones to increase the production efficiency, yield and quality of crops. Separate product forms of cytozyme are made available for applications to seeds (Seed*), soil (Soil*) and crop (Crop*). Of these, cytozyme granules now being commercially marketed, new formulation consist of biologically derived protein extract which contains micronutrients, enzymes, hydrolysed protein complexes, hormones such as gibberellic acid 0.006 per cent, indole acetic acid 0.002 per cent cytokinin and process fluid (Singh *et al.*, 1978).

Application of cytozyme granules to soil increased the availability of 'N' at earlier stages of crop growth due to increased microbial activity and mineralization of soil organic pool (Girija, 1996) on sunflower. With a view to elucidate the information on soil properties and productivity using cytozyme granules, the present investigation was undertaken to evaluate the availability of nutrients in soil at different stages of banana cv. Nendran.

Materials and Methods

A field trial was laid out during 1995 in a farm soil at Noyyal Series (Typic Ustropept) at Telungupalayam, Coimbatore with the test crop of Banana cv. Nendran. The characteristics of the soil (Typic Ustropept) used for the study are furnished in Table 1. At 6th month of crop establishment cytozyme treatments were given along with the recommended doses of NPK (210:35:450 g $plant^{-1}$). The following treatments were imposed in Randomized Block Design and replicated four times. T1 = NPK@1.4 : 0.68 : 2.3 t ha^{-1}, T2 = T1+ Cg 6 kg ha^{-1}, T3 = T1+ Cg 12 kg ha^{-1}, T4 = T1+ Cg 18 kg ha^{-1}, T5 = T1+ 0.1% Cs Crop plus, T6= T1+ Cg 6 kg ha^{-1} + 0.1% Cs, T7 = T1+ Cg 12 kg ha^{-1} + 0.1% Cs, T8 = T1+ Cg 18 kg ha^{-1} + 0.1% Cs, (Cs - Cystosyme spray ; Cg - Cytosyme granules)

All the other cultural practices were commonly followed as per recommendations. Surface soil samples (0-15 cm) were collected before cytozyme treatment (0 day), 30, 60, 90 and 120 days after treatment. The available 'N' was estimated by alkaline permanganate method (Subbiah and Asija, 1956), available 'P' by Olsen's method (Olsen *et al.*, 1954). Available potassium by neutral normal ammonium acetate (Hanway and Heidal, 1952). Calcium and magnesium in the above extract was estimated by versenate titration method (Jackson, 1973) and available Fe, Zn, Cu and Mn by DTPA extractable method using AAS (Lindsay and Norvell, 1978). The data were subjected to statistical scrutiny.

Results and Discussion

Major Nutrients

The influence of cytozyme on available 'N' content was effective only upto 60 DAT, the kind of influence being that with increasing does of

cytozyme application, availability increased (Table 2). On 30 DAT, the increase in available nitrogen content with cytozyme @18 kg ha^{-1} was (22.6%) over control, whereas on 60 DAT, the increase of 11.2 per cent was observed with cytozyme 12 kg ha^{-1} over control. Similar trend was observed at 90 and 120 DAT but the difference was not significant. The availability of N particularly at 30 DAT (i.e. earlier stage of treatment) was higher, since greater portion of 'N' was utilized by the crop during its subsequent growth. The increase in available 'N' at the earlier stages might be due to added 'N' fertilizer and cytozyme treatments resulting in increased microbial activity and an early mineralization of soil organic 'N' pool. This was in accordance with findings of Ramanathan (1990) on groundnut, Baskar (1992) on rice and Girija (1996) on sunflower.

Available 'P' content was not at all influenced by the treatment (Table 2). This is in agreement with earlier works on soil 'P' in rice (Syed Nazeer Peeran, 1989). Towards the crop maturity stage, cytozyme application influenced the available 'K' content significantly. The increase of available 'K' was 24.1 and 51.1 per cent over control on 60 and 90 DAT respectively (Table 2). At every stage, the trend of influence was not the same but in all the three stages (60, 90 and 120 DAT) T_1 registered the lowest and significantly lower than the rest. Since, a greater portion of available 'K' was utilized by the crop and transported to the forage organs during flowering and fruit formation stage, the availability of potassium during 90 DAT was lesser compared to other stages.

Exchangeable Ca was observed to increase significantly with increasing cytozyme on 120 DAT. The highest being at 18 kg ha^{-1} (23.5 c mol (P^+) kg ha^{-1}) (Table 3). Similarly, exchangeable 'Mg' was also influenced by cytozyme during the flowering stage of the crop only (90 DAT).

In all the stages of banana growth, cytozyme application registered significantly higher DTPA extractable Zn than the control with a tendency for higher Zn availability at higher doses of application (Table 4). Availability of Cu was significant at 90 DAT; progressive increase upto 90 DAT and then decrease. DTPA extractable iron due to cytozyme application was significant only after 90 DAT. The higher availability of Zn, Cu and Fe obtained at 18 kg ha^{-1} cytozyme granular application along with 0.1 per cent foliar spray. The favourable influence of cytozyme in soil, on the availability of micronutrients, was possible due to the presence of micronutrients in cytozyme granules and in solution. Similar results were reported by Thiageswari (1991), Basker (1992) and Girijia (1996).

Table 1. Physico - chemical properties of the initial soils of the experimental site

	Properties	Content
	Physical properties	
1.	Clay (per cent)	26.4
2.	Silt (per cent)	21.1
3.	Sand (per cent)	51.0
4.	Texture	Fine clay loam
	Physico-chemical properties	
1.	pH	8.4
2.	EC (d S m-1)	0.64
3.	CEC [c mol (p^+) kg^{-1}]	25.9
4.	Organic carbon (per cent)	0.47
5.	Available nitrogen (kg ha^{-1})	176.0
6.	Available phosphorus (kg ha^{-1})	21.8
7.	Available potassium (kg ha^{-1})	315
8.	Exchangeable calcium [c mol (p^+) kg^{-1}]	21.1
9.	Exchangeable magnesium [c mol (p^+) kg^{-1}]	14.2
10.	Available Zn (ppm)	0.20
11.	Available Cu (ppm)	0.20
12.	Available Mn (ppm)	8.16
13.	Available Fe (ppm)	18.8

Table 2. Effect of cytozyme on the availability of Nitrogen, Phosphorus and Potassium in the soil at different stages of crop growth (kg ha^{-1})

Treatments / Days after treatement	Nitrogen				Phosphorus				Potassium			
	30	60	90	120	30	60	90	120	30	60	90	120
T_1	180	240	204	200	11.0	13.2	15.1	17.2	717	679	303	644
T_2	187	243	202	201	9.0	13.8	17.7	17.7	740	805	423	686
T_3	196	257	201	193	14.7	13.2	17.7	15.4	802	843	458	746
T_4	220	257	203	229	14.2	13.9	15.3	15.5	740	757	358	714
T_5	200	239	213	209	12.5	12.3	18.3	16.7	712	658	377	719
T_6	207	267	205	204	11.7	13.0	17.2	16.7	747	785	385	695
T_7	210	263	221	207	14.5	13.3	16.0	16.3	705	748	380	695
T_8	230	280	226	209	12.0	14.3	17.7	18.3	757	825	427	739
SEd	14.45	4.84	6.32	7.21	3.57	0.56	0.63	0.39	24.67	10.01	12.0	16.73
CD (P=0.05)	34.2	10.1	NS	NS	NS	NS	NS	NS	NS	21.00	26.00	35.00

Table 3. Effect of cytozyme on the exchangeable calcium and magnesium in the soil at different stages of crop growth [c mol (p$^+$) kg^{-1}]

Treatments / Days after treatement	Calcium				Magnesium			
	30	60	90	120	30	60	90	120
T_1	19.9	20.8	20.7	17.2	11.8	10.9	10.2	9.5
T_2	20.9	21.0	21.8	18.4	10.8	11.5	12.6	9.0
T_3	19.8	20.9	21.5	18.3	11.5	12.0	12.7	9.4
T_4	19.0	20.6	20.6	20.0	11.7	12.5	12.5	12.8
T_5	19.8	20.8	20.7	18.3	11.3	12.4	11.5	9.4
T_6	19.7	20.8	20.2	20.2	12.5	12.7	12.4	10.5
T_7	19.0	19.0	20.3	20.8	13.5	12.4	12.7	9.8
T_8	20.1	19.6	20.9	23.5	12.6	13.8	14.1	10.3
SEd	0.38	0.46	0.43	0.29	0.37	0.51	0.92	2.00
CD (P=0.05)	NS	NS	NS	0.60	NS	NS	1.91	NS

Table 4. Effect of cytozyme on the DTPA extractable micronutrients in the soil at different stages of crop growth (ppm)

Treatments	Zinc				Copper				Iron			
Days after treatement	30	60	90	120	30	60	90	120	30	60	90	120
T_1	1.09	1.13	1.55	1.77	2.23	3.93	5.02	3.20	4.60	6.20	13.4	9.13
T_2	1.44	1.37	2.27	2.13	2.55	4.34	5.08	3.45	5.32	6.98	14.0	9.96
T_3	1.42	1.30	2.15	3.11	2.39	4.06	5.20	3.41	5.86	7.77	14.8	9.59
T_4	1.45	1.39	2.09	3.92	2.16	4.18	5.07	3.58	5.42	8.98	14.9	12.2
T_5	1.91	1.58	1.94	3.34	2.18	4.20	5.20	3.20	5.27	6.35	14.7	10.9
T_6	2.00	1.52	2.19	4.43	1.89	4.19	5.62	3.56	5.32	8.12	14.3	11.4
T_7	2.28	1.69	2.34	4.56	3.15	4.02	5.45	3.57	5.03	7.84	15.5	12.4
T_8	2.38	1.78	2.75	4.35	2.50	4.24	6.12	3.95	5.83	8.39	16.0	13.2
SEd	1.10	0.06	0.12	0.07	0.26	0.20	0.18	0.17	0.24	0.49	0.33	0.28
CD (P=0.05)	0.20	0.12	0.26	0.16	NS	NS	0.38	NS	NS	NS	0.68	0.58

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