

## UPTAKE OF ZINC, MANGANESE, IRON AND COPPER BY POTATO AS AFFECTED BY APPLIED POTASSIUM

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### ABSTRACT

Field Studies on the effect of potassium on the uptake of Zn, Mn, Fe and Cu by potato revealed that increase in the level of applied potassium enhanced the uptake of Zn, Mn, Fe, and Cu of tubers and haulms (tops) of potato. FYM increased the uptake of micronutrient at lower rates of potassium. Significant increase in the total uptake (tuber and haulms) of micronutrient was found, invariably, up to the application of 100 kg K<sub>2</sub>O/ha in the absence as well as presence of FYM.

It was become necessary to study the extent of removal of micronutrient with various rates of soil applied nutrients. Scanty information is available on the influence of soil applied K on the uptake of various micronutrient by potato of soil applied K on the uptake of various micronutrient by potato (*Solanum tuberosum L.*). The objective of the study was to investigate the effect of different rates of K application on the uptake of Zn, Mn, Fe and Cu by potato crop.

### MATERIALS AND METHODS

Two field experiments were conducted during autumn 1982-83 and 1983-84 on a sandy loam soil to study the effect of different rates of K application, in the absence and presence of FYM, on the Zn, Mn, Fe and Cu

uptake of potato. K was applied through muriate of potash at the rates of 0, 50, 100, 150 and 200 kg K<sub>2</sub>O, in the absence of FYM and presence of FYM (30 t/ha). N and P<sub>2</sub>O<sub>5</sub> were applied at the rate of 150 and 60 kg/ha, respectively. The experimental soil was low in available (80 and 78 kg K<sub>2</sub>O/ha during 1982-83 and 1983-84, respectively). DTPA (diethylenetriamine pentaacetic acid) extractable Zn, Mn, Fe and Cu content of the soil was, respectively, 0.30, 9.2, 15.6 and 0.48 ppm during 1982-83 and 0.30, 8.9, 14.5 and 0.45 ppm during 1983-84. DTPA extractable Zn, Mn, Fe and Cu content of the soil was determined by Lindsay and Norvell's method (1978) and basic analysis was done as per procedure outlined by Jackson (1958). The tubers of potato Cv. Kufri Chandramukhi were planted in plots in plots measuring 5.4m x 4m at a spacing

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of 60 x 20 cm and treatments replicated four times in a randomized block design. Yields of haulms and tubers were recorded at harvest and samples were taken for micronutrient analysis.

The samples were dried in hot air oven at temperature varying between 65 to 70°C and ground in a stainless steel wiley mill. The samples were digested in triple acid mixture (HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub> in the ratio of 9 : 2 : 1, respectively) and Zn, Mn, Fe and Cu in the extracts were determined in atomic absorption spectro-photo-meter. 100 g of fresh samples of tubers and haulms were dried in hot air oven till constant weight was obtained and dry matter content was determined.

## RESULTS AND DISCUSSION

### Dry matter

Dry matter production of tubers increased significantly upto the application of 150 kg K<sub>2</sub>O/ha in the absence and 100 kg K<sub>2</sub>O/ha in the presence of FYM, whereas in case of haulms significant increase was recorded upto the application of 100 kg k<sub>2</sub>O/ha with and without FYM (Table 1). The average maximum increase in the total dry matter produced with potassium application over control was 99.4% in the absence and 48.8% in the presence of FYM. It showed that response of potato to potassium application was less in the presence than in the absence of FYM. Application of FYM increased the dry matter yield at lower rates of applied potassium, max-

TABLE 1 : Effect of K application with and without FYM, on the dry matter production of potato (t/ha).

K <sub>2</sub> O (Kg/ha)	Tubers		Haulms	
	F <sub>0</sub> *	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>
1982 - 83				
0	3.09	4.27	0.54	0.69
50	4.29	5.58	0.80	0.88
100	5.75	6.22	1.02	1.04
150	6.09	6.01	1.04	1.03
200	5.95	6.05	1.06	1.07
C.D. (5%)		0.49		0.19
1983 - 84				
0	2.93	3.91	0.58	0.71
50	2.93	3.91	0.58	0.71
50	4.26	5.16	0.73	0.88
100	5.44	6.07	1.03	1.07
150	6.04	6.04	1.06	1.07
200	5.96	6.08	1.07	1.06
C.D. (5%)		0.41		0.13
F <sub>0</sub> * - No FYM		F <sub>1</sub> - FYM (30 t/ha)		

imum being 36.6% in 1982-83 and 24.0% in 1983-84 in its absence.

### Zn Uptake

Significant increase in the uptake of Zn by tubers was invariably upto the application of 100 kg K<sub>2</sub>O/ha in the absence and 50 kg K<sub>2</sub>O/ha in the presence of FYM. Maximum increase in Zn uptake with applied potassium was found to be 79.3 and 115.7% in the absence and 39.3 and 53.2% in the presence of FYM during 1982-83 and 1983-84, respectively over control. Significant increase in Zn uptake of haulms was only upto the application 50 kg K<sub>2</sub>O/ha, both in the absence and the presence of FYM. Application of FYM significantly increased the Zn uptake at low rates of applied potassium. Increase in Zn uptake was found to be associated with increase

in dry matter production as a result of potassium application. Similar results were reported by Sharma and Arora (1986) with P application.

### Mn Uptake

Mn uptake of potato tubers increased significantly with successive levels of applied K upto 150 kg K<sub>2</sub>O/ha in the absence and 100 kg K<sub>2</sub>O/ha in the presence of FYM (Table 3). In haulms, significant uptake was upto 100 kg K<sub>2</sub>O/ha, with and without FYM. Maximum total (tubers and haulms) uptake of Mn with the application K over zero level was 100.6 and 90.2% in the absence and 54.0 and 62.3% in the presence of FYM during 1982-83 and 1983-84, respectively. FYM increased the Mn uptake upto 100 kg K<sub>2</sub>O/ha and no significant effect was found at high

TABLE 2 : Effect of K application with and without FYM, on the uptake of Zn by potato (t/ha).

K <sub>2</sub> O (Kg/ha)	Tubers		Haulms		Total	
	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>
1982 - 82						
0	77	107	20	25	98	132
50	105	135	27	26	133	162
100	132	149	28	28	160	177
150	138	129	28	26	166	156
200	133	136	27	27	160	163
C.D. (5%)	13.2		2.4		25.2	
1983 - 84						
0	70	97	22	25	92	122
50	101	132	26	27	127	159
100	141	149	26	27	127	159
150	151	139	28	27	180	166
200	139	148	28	27	167	175
C.D.(5%)	16.3		3.0		20.7	

TABLE 3 : Effect of K application with and without FYM on the uptake of Mn by potato (g/ha)

K <sub>2</sub> O (Kg/ha)	Tubers		Haulms		Total	
	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>
1982 - 83						
0	79	114	150	184	229	298
50	115	143	216	232	331	376
100	140	176	280	283	420	459
150	164	147	295	279	460	427
200	144	151	294	286	438	437
C.D. (5%)	20.1		27.0		37.2	
1983 - 84						
0	74	104	175	214	250	318
50	116	127	212	263	328	390
100	141	167	309	350	451	517
150	165	161	310	325	475	487
200	143	166	320	317	463	484
C.D.(5%)	21.5		31.0		35.1	

TABLE 4 : Effect of K application, in absence and presence of FYM, on the uptake of Fe by potato (t/ha).

K <sub>2</sub> O (Kg/ha)	Tubers		Haulms		Total	
	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>
1982 - 83						
0	0.94	1.33	1.06	1.38	2.00	2.71
50	1.33	1.75	1.50	1.59	2.83	3.34
100	1.78	2.00	1.90	1.93	3.68	3.93
150	1.85	1.86	1.96	1.90	3.81	3.76
200	1.83	1.82	1.94	1.93	3.77	3.75
C.D. (5%)	0.22		0.16		0.30	
1983 - 84						
0	0.95	1.29	1.20	1.46	2.15	2.75
50	1.37	1.67	1.42	1.68	2.79	3.35
100	1.80	2.09	1.97	2.27	3.77	4.36
150	2.05	1.96	2.02	2.05	4.07	4.01
200	2.00	2.12	2.00	2.02	4.00	4.14
C.D. (5%)	0.24		0.19		0.41	

levels of K application. The results are in agreement with those obtained by Mandal (1958) who reported an increase in Mn uptake by peas with increase in K application.

### Fe uptake

Uptake of Fe by tubers increased significantly upto 100 kg K<sub>2</sub>O/ha in the absence of FYM (Table 4.). A similar trend in the Fe uptake of haulms was observed. Maximum total Fe uptake (tubers and haulms) increased by 90.5 and 89.3% in the absence and 45.0 and 58.5% in the presence of FYM during 1982-83 and 1983-84, respectively, with the application of potash over control. FYM increased Fe uptake at low rates of applied K. Uptake of Fe was found to be mainly associated with the dry matter produced by potatoes as a result

of K application. Since dry matter production by the FYM increased at lower rates of applied K, the Fe uptake also registered an increase. The Fe uptake by tubers and haulms remained fairly constant at high rates of applied K.

### Cu Uptake

Accumulation of Cu by tubers was found to be more than by haulms (Table 5). Significant increase in Cu uptake of tubers was observed upto 150 kg K<sub>2</sub>O/ha in the absence and 100 kg K<sub>2</sub>O/ha in the presence of FYM. In haulms, significant increase was upto 100 kg K<sub>2</sub>O/ha in the absence as well as the presence of FYM. Application of FYM resulted in significant increase in Cu uptake at low rates of applied K and no effect was found at high rates. Cu uptake increased by 41.1 and 29.3%

TABLE 5 : Effect of K application, in absence and presence of FYM, on the uptake of Cu by potato (g/ha)

K <sub>2</sub> O (Kg/ha)	Tubers		Haulms		Total	
	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>	F <sub>0</sub>	F <sub>1</sub>
1982 - 83						
0	15.2	22.2	7.4	9.7	22.6	31.9
50	20.4	28.0	11.3	13.0	31.7	41.0
100	28.7	32.1	15.7	14.6	44.4	46.7
150	31.4	30.8	14.6	14.8	46.0	45.6
200	28.4	30.9	16.0	15.8	44.4	46.7
C.D. (5%)	3.8		0.22		4.7	
1983 - 84						
0	14.1	18.6	7.7	11.0	21.8	29.6
50	20.9	26.4	11.0	13.3	31.9	39.7
100	27.0	29.8	14.4	17.0	41.4	46.8
150	30.9	30.5	13.9	15.9	44.8	46.4
200	27.8	30.7	18.1	16.2	45.9	46.9
C.D. (5%)	4.1		0.24		4.9	

in 1982-83 and 35.7 and 24.4% in 1983-84 with the application of FYM at zero level and 50 kg K<sub>2</sub>O/ha, respectively. The increase in Cu uptake with FYM application might be due to

the addition of Cu and presumably by supplying soluble complexing agents which decreased its fixation. The results are in conformity with those obtained by Datta Biswas (1964).

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## EFFECT OF METHODS AND INTERVALS OF IRRIGATION OF WATER REQUIREMENT AND WATER USE EFFICIENCY IN SESAMUM

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#### ABSTRACT

A study was conducted with sesamum cvs. TMV 3 AND Co 1 at Tanjore and Bhavanisagar respectively to find out suitable method and interval of irrigation to use water economically without affecting the yield. Irrigating in alternate furrows once in 20 days recorded the highest water use efficiency. High seed yield was recorded in alternate furrows - irrigating once in 30 days. Hence, irrigating in alternate furrows once in 20 days may be considered as optimum for sesamum.

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