Madras Agric. J. 78, (5-8): 230-232 (1991). https://doi.org/10.29321/MAJ.10.A01854

STUDIES ON THE EFFECT OF COMPACTION AND GRADED DOSES OF NITROGEN ON THE AVAILABILITY OF NITROGEN AND POTASSIUM AND YIELD OF MAIZE (DECCAN)

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ABSTRACT

The mobility of nitrogen and potassium in soils with sub soil compaction of bulk densities 1.5, 1.7 and 1.9 g/cc in red sandy loam soils with deccan maize as test crop was studied.

The movement of nitrogen and potassium was observed to be reduced at higher bulk densities of 1.7 and 1.9 g/cc. The higher levels of nitrogen did not influence the yield of grain as well as uptake of N and K nutrients beyond an optimum bulk density of 1.7 g/cc. N at 135 kg/ha increased the yield and uptake of N and K.

Key Words : Compaction, Nitrogen, Availability to Maize.

Soil fertility loses significance without optimum physical condition of soil. Many dynamic processes are controlled by differing dimensions of porespaces of the soil and their distribution pattern. Kayambo *et al.* (1986) reported that high bulk density soils reduced maize nutrient content of P, Ca, Mg and Mn. Greater dry matter and biological yields of rice due to a higher uptake of P, Ca, Mg, K, Na, Fe, Mn and Zn resulting from different tillage methods was reported by Ogunremi *et al.* (1986). Somani and Kumawat (1986) observed higher N,P,K uptake by wheat due to clay mixing and compaction of sandy soils. Little information is available on plant nutrients especially of nitrogen and potassium. The present study is an attempt to elucidate information on this aspect.

MATERIALS AND METHODS

Field experiment was laid out in micro-plot of 1 x 1 metre size in a red sandy loam soil. The soil upto 30 cm depth was dug out and three levels of sub soil bulk densities viz., 1.5, 1.7 and 1.9 g/cc were created at 15-30 cm. In the surface layer, a uniform bulk density of 1.4 g/cc was created. Three compaction levels and four nitrogen levels were introduced into the treatments as follows in a randomised block design, replicated thrice. A common dose of 68 and 45 kg/ha of P_2O_5 and K_20 were applied basally (superphosphate and muriate of potash respectively).

Main treatments: Bulk density

D_1 -1.5 g/cc
D_2 - 1.7 g/cc
D_3 - 1.9 g/cc

Sub-treatments: Nitrogen levels

N_1 - 405 N/ha
N_2 - 270 N/ha
N_3 - 135 N/ha
N_4 - 0 N/ha

Nitrogen was applied as urea in split doses viz., 50% as basal, 25% as top dressing on 30th day after sowing and the balance 25% on the 50 th day after sowing. Irrigations were given at uniform level of 7.5 cm for all the plots. Maize (Deccan) was the test crop.

Soil samples were collected from two depths viz., 0-15cm and 15-30 cm at four stages

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viz., 20, 40, 70 days after planting and at post harvest stage and analysed for available nitrogen by alkaline permanganate method (Subbiah and Asija, 1956) and available K with neutral ammonium acetate extract using Flame photometer (Toth and Prince,1949). After harvest the grain and straw yields were recorded. The grain samples were analysed for the uptake of nitrogen and potassium.

RESULTS AND DISCUSSION

The results of analysis of available nitrogen (Table 1) indicated that mobility of N was more at bulk density of 1.5 g/cc which was indicated by higher available nitrogen status in the 15-30 cm depth of compacted subsurface layer and the movement of nitrogen was reduced at higher compaction levels of 1.7 and 1.9 g/cc. Similar

Table 1. Available nitrogen of soil at different stages of crop growth (kg/ha)

Treatment		20th day		40the day		60th day		At harvest	
		0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
1. D_1	N_1	75	96	125	196	230	277	214	256
2.	N_2	54	88	92	133	231	252	210	231
3.	N_3	79	100	92	117	216	237	195	214
4.	N_4	67	46	71	50	66	47	62	45
5. D_2	N_1	96	79	133	110	231	252	205	235
6.	N_2	92	71	104	71	233	237	208	214
7.	N_3	75	54	92	67	233	214	214	193
8.	N_4	67	50	71	50	66	43	57	40
9. D_3	N_1	168	104	225	146	237	233	214	216
10.	N_2	108	63	179	108	239	218	218	199
11.	N_3	96	58	133	96	213	197	212	184
12.	N_4	71	50	83	50	59	49	68	45
13.	Ctrl.	58	46	71	46	64	43	59	45

Table 2. Available potassium of soil at different stages of crop growth (kg/ha)

Treatment		20th day		40the day		60th day		At harvest	
		0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm	0-15 cm	15-30 cm
1. D_1	N_1	767	904	568	475	558	442	489	415
2.	N_2	692	904	568	483	539	449	489	415
3.	N_3	750	879	511	458	484	398	443	371
4.	N_4	654	820	530	492	521	468	458	415
5. D_2	N_1	850	692	551	423	522	383	475	357
6.	N_2	746	617	401	345	393	324	364	300
7.	N_3	692	558	494	360	466	345	429	321
8.	N_4	763	600	520	338	476	317	442	293
9. D_3	N_1	729	654	558	283	494	250	451	222
10.	N_2	729	650	487	309	442	277	407	249
11.	N_3	804	654	520	298	484	269	443	239
12.	N_4	804	688	556	317	476	288	394	247
13.	Ctrl.	317	260	277	243	247	201	213	166

trend was noticed irrespective of the levels of nitrogen applied. Thus it is seen that the leaching losses of nitrogen is reduced at higher compaction levels of 1.7 and 1.9 g/cc. Similar trend was noticed at all stages.

The movement of potassium (Table 2) also followed the same trend as that of nitrogen. Mobility was restricted at higher B.D. of 1.7 and 1.9 g/cc which was indicated by high amount of available K at 15-30 cm depth.

The grain yield of maize (Table 3) indicated significant difference between the treatments and nitrogen levels. The yield in soils of different bulk densities was in the order of 1.71.51.9. Among the four levels of NPK ratios tested 1:1:1 ratio recorded higher yield than others and the yield was in the decreasing order of 1:1:13:1:10:1:12:1:1. The straw yield of maize showed that the treatments of 1.5 and 1.7 g/cc B.D. were on par and superior to 1.9 B.D. There was no significant difference in yield of straw due to various levels of Nitrogen.

The uptake of nitrogen showed a significant difference between the bulk densities and nitrogen levels. The potassium uptake showed a significant difference between the various bulk density levels. T_2 was on par with T_1 and significantly superior to T_3.

Thus it was observed that higher levels of nitrogen application did not alleviate the adverse effect of high bulk densities and the grain yield and nutrient uptake was maximum at an optimum bulk density of 1.7 g/cc. Though leaching losses of nutrients were reduced by increasing bulk density to 1.9 g/cc, there was no appreciable increase in the uptake of nutrients and yield of maize grains.

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