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EFFECT OF SOIL MOISTURE STRESS ON INFLOW RATE OF N, P, K, Fe AND Mn AT VARIOUS GROWTH STAGES OF GROUNDNUT

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Water and nutrient absorption are independent processes in the root. The essentiality of available water, both in the plant and in the soil for growth and nutrient transport makes it intimately related with nutrients. Fluctuations in water availability in field conditions may range from field capacity (-J 1/3 bar) to extreme stress (-15 bar). Patel and Padalia (1980) studied the nutrient accumulation and nutrient use efficiency in groundnut at different soil water potentials. The present report gives information on inflow rates of N, P, K, Fe and Mn with special reference to water stress at various growth stages of groundnut.

The experiment was carried out in galvanised iron pots (30 cm diameter with 42.5 cm height) filled with 3.8 kg soil. The crop was fertilized per ha with 25 kg N and 50 kg P_2O_5. A part of nitrogen and full dose of phosphorus was applied as ammonium phosphate and the remaining dose of N was supplimented with urea. The treatments were imposed four days after germination (DAG) on four varieties of groundnut, viz; TG-17, J-11, OSN-2 and G-201. The treatments were M_1—moisture stress during vegetative growth period (4 to 20 DAG); M_2—moisture stress during flowering period (33 to 46 DAG); M_3 — moisture stress during pegging period (61 to 77 DAG); M_4 — moisture stress during pod development (78 to 87 DAG); and M_5 — water applied at field capacity (1/3 bar soil moisture potential). The soil moisture stress was adjusted by withholding the irrigation at various stages of growth. The magnitude of stress was — 14 bar soil water potential and was essentially uniform for all the treatments except the control (M_5). The soil water potential in bar was read out from the moisture retention characteristic curve of soil which was constructed by using pressure plate membrane apparatus. For calculation of root inflow rate of N, P, K, Fe and Mn, the roots were dug out gently from each pot at different growth periods. The total length of the roots was calculated assuming them as cylindrical form by the formula $L = V/\pi r^2$ where L, V, r represent length (cm), volume (cubic cm), radius (cm). Roots and shoots were ground together and N, P, K contents were determined by following the standard methods whereas Fe and Mn were determined by using Atomic Absorption Spectrophotometer (Model Techtron AA-120). Growth analysis equation (Brews-

Table 1. Effect of soil moisture regimes on inflow rate (mg cm^{-1} sec^{-1}) of N, P, K, Fe and Mn at different growth periods in groundnut varieties

Days after germination	N 1×10^{-8}			P 1×10^{-9}			K 1×10^{-8}			Fe 1×10^{-10}			Mn 1×10^{-10}		
	25 to 50	50 to 75	75 to 100	25 to 50	50 to 75	75 to 100	25 to 50	50 to 75	75 to 100	25 to 50	50 to 75	75 to 100	25 to 50	50 to 75	75 to 100
Soil moisture regime															
M_1	11.22	1.54	4.70	7.52	1.42	5.10	9.70	0.26	0.60	14.29	5.25	11.03	3.00	0.52	0.36
M_2	9.51	1.48	4.36	7.07	1.36	4.77	9.03	0.29	0.62	11.87	5.95	9.92	2.16	0.50	0.33
M_3	11.43	0.00	3.33	8.42	0.24	3.84	10.82	−1.10	0.65	16.38	2.32	7.54	3.50	−0.18	0.28
M_4	11.51	1.39	2.63	8.43	1.50	3.28	10.89	0.21	−0.09	16.59	6.54	5.30	3.53	0.53	−0.12
M_5	11.46	1.39	5.08	8.43	1.43	5.30	10.88	0.15	0.42	16.42	6.49	11.95	3.50	0.55	0.36
Variety															
TG−17	11.11	0.98	3.33	8.18	1.04	3.73	10.58	−0.30	0.37	15.39	5.14	7.69	3.33	0.32	0.20
J − 11	10.59	1.31	4.09	7.75	1.30	4.51	9.97	0.13	0.46	14.81	5.72	9.22	3.12	0.43	0.25
OSN−2	11.14	1.02	3.88	8.21	1.08	4.32	10.55	−0.16	0.42	15.43	5.31	8.94	3.32	0.34	0.22
G 201	10.39	1.33	4.14	7.64	1.34	4.55	9.80	0.16	0.45	14.75	5.83	9.34	3.08	0.43	0.25

ter and Tinker, 1972) was adopted to get mean inflows of nutrients in roots over the three growth periods viz; 25 to 30 days, 50 to 75 days and 75 to 100 days after germination :

$$\text{Inflow} = \frac{U_2 - U_1}{t_2 - t_1} \quad \frac{\ln \frac{L_2}{L_1}}{L_2 - L_1}$$

where U_1, U_2 are nutrient uptake and L_1, L_2 root length at times t_1 and t_2.

Inflow rates of N and K were highest folllowed by those of P, Fe and Mn (Table 1). In general, inflow rates of nutrients were fairly high for the varieties TG-17 and OSN-2 than for J-11 and G-201.

Inflow rates of N, P, K, Fe and Mn were spectacularly higher at the initial growth period. Later, these declined with the advancement in growth during 50 to 75 DAG and thereafter, again improved notably. It suggests that root system of groundnut tends to be efficient upto early flowering stage and again later at the pod development stage. The moisture stress during growth stage intervening the flowering and pod development in certain cases perhaps caused negative inflow rate values.

It was observed that maximum inflow rates of N, P, K, Fe and Mn were noted under M_5 (1/3 bar) treatment during various growth periods indicating better nutrient and water absorption efficiency of roots. The amount of water transpired is also related to uptake of N, P, K, Fe and Mn (Sahu *et al.*, 1973). Moisture stress when imposed during vegetative and flowering periods resulted in considerable decrease in inflow rates of all the nutrients under study, whereas moisture stress when imposed during pegging and pod development periods could produce no influence on the inflow rate values. The root inflow rates of N, P, K, Fe and Mn are, thus, shown to be adversely affected while groundnut crop endured soil moisture stress particularly during vegetative and flowering stages.

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