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Root Characteristic and Phosphorus Uptake of Cotton as Influenced By Different Levels of Phosphorus*

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The study on root characteristics of cotton as influenced by varieties and levels of P at three stages of crop growth showed that the rate of root growth was slow during first 60 days, but was rapid during 60 to 90 days. Root length, root density and fresh root weight were not affected by P level. Uptake of P in shoot and root increased up to 60 days but subsequently declined with advancing age. Cultivar CJ-73 was an efficient extractor of P compared to L-147. P uptake by shoot was affected. Uptake by root was not very much affected by P levels.

A knowledge of root development and the total volume of the soil occupied by the root system is important in order to evolve proper cultural practices, such as fertilizer placement, seeding depth and quantity of irrigation water to be applied in order to maximise production and nutrient use efficiency. Under dry farming conditions, spread, configuration and distribution of root help the plants to resist moisture stress. Welbank, (1974) reported that greater the root length most efficient was the use of available resources. However, hampered root growth limits uptake of both water and nutrients (Schuurman, 1965). Most of the Maharashtra soils being deficient in P, it was felt necessary to study the factors influencing the efficiency of P uptake by cotton, an important commercial crop of the region.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Farm, in *Kharif*, 1975. Two cotton cultivars, L-147 and CJ-73, were raised with three levels of P, 0, 25 and 50kg P_2O_5/ha, with a basal dressing of 25 kg N and 30 kg K_2O/ha. The experiment was laid out in simple randomized block design with three replications. The soil was clayey in texture with pH 8.3, organic carbon 0.7%, EC 0.31 mmhos/cm and CEC 48.7 me/100g.

For root study, the roots of randomly selected plants were sampled by opening the soil 15 cm away from the plant on 30, 60 and 90 days after sowing. Prior to sampling, the root zone was loosened by watering and the plants were

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separated from the roots. The roots were washed with a fine jet of water to remove the adhering soil particles. Water adhering to roots was removed with the help of a blotting paper. The fresh weight of roots was noted and the root length was measured using Newman's line intersect method (1966). Rooting density was determined as suggested by Taylor and Klepper (1973). The data were analysed statisticaly.

RESULTS AND DISCUSSION

Fresh root weight : The data presented in Table I revealed that the fresh root weight was increased as the plant advanced in age. Such increase in fresh root weight along with the plant age was observed by Mengel and Barber (1974). The increase in fresh root weight of L-147 during 30 to 60 days was about 2.5 g/plant and it was 9.0g/plant during 60 to 90 days period. In the case of CJ-73, it was about 2.0 and 10.0 g/plant during the period of 30 to 60 and 60 to 90 day periods respectively. The increase in fresh root weight was rapid during later stages of growth which corresponded with peak shoot growth period. The influence of P levels on fresh root weight was not significant.

TABLE I. Phosphorus uptake (kg/ha) by cotton plant tops

Treatments	Days after sowing		
	30	60	90
L-147	2.48	3.85	3.00
CJ-73	3.42	4.26	3.36
SE±	0.02	0.16	0.11
CD at 5%	0.06	N.S.	0.34
0	2.65	3.29	2.70
25	3.18	4.92	3.39
50	3.00	3.96	3.44
SE±	0.03	0.19	0.14
CD at 5%	0.08	0.58	0.42
Variety x P level			
SE±	0.04	0.27	0.20
CD at 5%	0.11	N.S.	N.S.
Mean	2.95	4.06	3.18

Root length : There was continuous root elongation till 90 days. Similar results were obtained by Mengal and Barber (1974). The rate of root growth was slow during 30 to 60 days but it increased during 60 to 90 days.

The difference in root length between varieties was significant only on 90th day. At this stage L-147 produced longer roots than CJ-73. At all the growth stages P did significantly influence the root length.

Root density : Variety L-147 produced greater rooting density than CJ-73. The rate of increase in rooting density in both the varieties was faster during 60 to 90 day period. Levels of P had no significant influence on root density.

Phosphorus Uptake by plant top: The scrutiny of the data on P uptake by plant (Kg/ha P) presented in table II, indicated significant variations in the varieties tested at 30 and 90 days and not at 60 days. The differences in P uptake may be due to the variation in dry matter production by these varieties. Cultivar L-147, being more susceptible

TABLE II. Phosphorus uptake (kg/ha) by cotton roots

Treatments	Days after sowing		
	30	60	90
L-147	0.17	0.16	0.11
CJ-73	0.13	0.18	0.15
SE±	0.005	0.007	0.005
CD at 5%	0.015	N.S.	0.015
0	0.15	0.15	0.11
25	0.16	0.18	0.14
50	0.15	0.18	0.13
SE±	0.006	0.009	0.006
CD at 5%	N.S.	0.026	N.S.
Variety x P level			
SE±	0.008	0.012	0.009
CD at 5%	0.026	0.026	0.026
Mean	0.15	0.17	0.13

to waterlogging than CJ-73, produced less dry matter. Maximum uptake of P was observed at 60 days in both the varieties. The differences in P uptake as influenced by different P levels were significant at all the stages of crop growth. Application of 25 and 50kg/ P_2O_5/ha enhanced P uptake over control. At 25kg P_2O_5/ha, there was increase in P uptake by 0.53, 1.63, and 0.69 kg/ha over control at 30, 60 and 90 days respectively, while at 50 kg P_2O_5/ha the increase in P uptake was 0.35, 0.67 and 0,74 kg/ha. Thus, the response to applied P in terms of P uptake was erratic.

Phosphorus uptake by plant roots : The data presented in table III indicated that P uptake increased up to 60 days and declined thereafter. Variety CJ-73 was significantly superior to L-147 at 90 days; while, the opposite was the case at 30 days. The difference in P uptake due to different levels of P were significiant only at 60 days. The P uptake was higher by 0.03 kg/ha than control at 60 days due to application of 25 kg P_2O_5/ha. But there was no increase in P uptake when the level of P was increased to 50kg/ha.

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