

Influence of Soil Moisture on Root distribution pattern of Sugarcane

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ABSTRACT

An experiment was conducted in the sandy loam soil of Brahmaputra river floodplain of Jamalpur district and Ganges river flood plain soils of Rajshahi district during 1990-91 cropping season to investigate the influence of soil moisture on sugarcane root distribution. The experiment was set up following randomized complete block design with four replications. Sugarcane variety L. Jaba-C, a known drought tolerant variety was used in both the locations as test crop. Root growth was affected due to application of surface irrigation during January to April. As the number of irrigation was increased, distribution of sugarcane roots were also increased in the upper (0-50 cm) layer of soil and decreased in the subsequent lower layers (below 50 cm depth). Root distribution in the upper layer (0-50 cm) was found to be proportionately increased with the increase in number of irrigation.

INTRODUCTION

Roots are the functional unit of plants used for uptake of water and nutrients from the soil as well as anchorage of plants to keep upright for facilitating photosynthesis in green leaves. Root growth is influenced by cultural practices, tillage, soil type, soil profile characteristics, soil moisture etc. Effective root depth of any crop is very important for water and nutrient uptake as well as effective anchorage of plants. Sugarcane, is a long duration field crop, requires adequate soil moisture during germination and early crop establishment phases. It is important to know the effective depth of roots as well as its volume and distribution pattern for irrigation purposes. Research reports have been published on sugarcane root growth, development, volume, distribution pattern etc. elsewhere (King *et al.* 1965; Humbert, 1968; Michael, 1978; Yang, 1979; Miah *et al.* 1983; Roghunath, 1987). But little work have been done on sugarcane root growth and development in Bangladesh especially on influence of irrigation on root distribution in different soil layers. Therefore, the present experiment was undertaken to investigate the influences of number of irrigation on distribution of roots in the different layers of soil.

MATERIALS AND METHODS

The experiment was carried out in the growers' fields in the district of Jamalpur and Rajshahi. The soil was sandy loam having almost similar physical condition in both the places. The treatments were as follows:

- T₀ : No irrigation (rainfed condition)
- T₁ : Two irrigations from February to March
- T₂ : Four irrigations from January to April

In each irrigation on an average 60 mm water was applied to sugarcane field.

The experiment was laid down following RCBD with 4 replications. The individual plot size was 8 x 12.5m². Three budded sugarcane setts were planted in the trenches following end to end method with row to row spacing of 90 cm. In both the years cane

was planted by the month of November and harvested by December (13 month crop). Recommended doses of manures and fertilizers were applied in the field. The sugarcane variety L. Jaba-C was used as test crop in both the locations.

RESULTS AND DISCUSSION

The results of the experiment have been shown in the Table 1. It is seen from the Table 1 that root growth, development and especially distribution of sugarcane were affected due to application of surface irrigation to sugarcane field during January to April. Root distribution was found to be increased in the upper layer (0-50 cm depth) as the number of irrigation was increased and it was proportionately decreased in the subsequent lower layers of soils. It is seen from the Table 1 that average 50, 30, 15 and 5 percent roots were recorded in the 0-50cm, 50-100cm, 100-150cm and over 150 cm deep soil layers respectively under rainfed condition (where no irrigation was applied). But horizontal distribution was found to be increased in the 0-50 cm soil layer due to application of irrigation, while gradually percentage of roots decreased in the subsequent layers such as 50-100cm, 100-150cm and over 150cm deep layers. It is seen that 20 percent increase in root distribution was recorded in the 0-50 cm upper/top layer, while 16.7, 26.7 and 20 percent decreases were recorded in the 50-100cm, 100-150cm and over 150cm deep soil layers respectively due to application of two irrigations during February to March.

Table 1. Root distribution patterns in different layers of soil at two irrigation levels.

Treatment	Layers of soil (depth in cm) and percent increase/decrease of root distribution							
	1st layer (0-50)	% increase over control	2nd layer (50-100)	% decrease over control	3rd layer (100-150)	% decrease over control	4th layer (Below 150)	% decrease over control
T ₀	50	-	30	-	15	-	5	-
T ₁	60	20	25	16.7	11	26.7	4	20
T ₂	65	30	22	26.7	10	33.3	3	40
Mean	58.3		25.7		12.00		4.00	

Root volume was found to be increased by 30 percent in the top layer (0-50cm) and decreased by 26.7, 33.3 and 40 percent in the 50-100cm, 100-150cm and over 150cm deep soil layers respectively over control due to application of four subsequent irrigations during January to April. The results conform the earlier reports published elsewhere that low soil moisture encourages roots to penetrate in deeper soil layer (vertical penetration) and adequate soil moisture encourages to develop shallow rooting (in horizontal distribution) in sugarcane (Israelson and Hansen, 1950; King *et al.* 1965; Yang, 1979; Humbert, 1968; Michael, 1978 and Reghunath, 1987). Israelsen and Hansen (1950) reported that rooting depth varies from 30 to 45 cm per month of active growth period of sugarcane. Effective rooting depth of sugarcane was found to be 180 cm for deep well drained homogeneous & soil (Michael, 1978; Roghunath, 1987). Humbert (1968) reported influence of cultural practices, soil type, soil profile characteristics, fertilization etc. on root distribution.

The results of the present investigation and data published elsewhere expresses that irrigation encourages shallow rooting and no irrigation forces roots to penetrate in

the deeper layers which help plants to protect from longer draught and lodging. It may be suggested that to encourage deeper and vertical penetration of roots, irrigation should not be applied very frequently in the sugarcane.

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