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Studies on Root Growth of Sorghum Under Different Mulching Systems

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A mulching experiment was carried out in the black soil area of the Tamil Nadu Agricultural University Farm, Coimbatore with Co 24 sorghum as test crop. The treatments consisted of the mulching materials cumbu straw (T_1), sugarcane trash (T_2), maize straw (T_3) and control (T_4). A Randomised Block design was adopted with five replications. The root growth measurements like root length, number of adventitous roots/plant, volume of roots and dry weight of roots were taken at flowering and at harvest stages. The results indicated that the above said root characters were found to be superior in the mulched plots compared to control at both the stages of crop growth. Among the different mulches tried the sugarcane trash applied plots recorded the highest dry weight of roots. A positive relationship between root weight and yield of sorghum was brought out.

An important step in the studies of soil physics is precisely to find out ways and means of conserving soil moisture which gets lost through evaporation. Any attempt in reducing the evaporational loss when water is a constraint will go a long way in maximising crop production. An effective soil and water management for minimising the evaporation loss is the use of mulches. The crop residues that become available in the crop sequence which have less utility otherwise itself are the easily available mulching materials.

Mulches were applied to crops from the dawn of agriculture, mainly with a view to conserve the soil and moisture and to arrest the weed growth. Scientific investigations on the use of mulches were directed mainly to the soil and water conservation aspects and for bringing a change in the physical environment besides increasing the organic carbon content of soil, microbial activities and availability of nutrients which in turn enhances the crop growth characteristics and yield. The present investigation was aimed at to find out the effect of different mulches on the root growth characters of sorghum crop on which depend the ultimate stand and yield of crop.

MATERIAL AND METHODS

A field experiment was conducted using different mulches viz., cumbu

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straw (T_1), sugarcane trash (T_2) maize straw (T_3) each applied at the rate of 10 tonnes/ha in the black soil area of the Tamil Nadu Agricultural University Farm, coimbatore. The soil was low in available nitrogen (188 kg/ha), medium in available phosphorus (15.68 kg/ha) and high in available potassium (686 kg/ha). Sorghum var. CO 24 was tried as the test crop. The exprement was laid out adopting Randomised Blocks design with five replications. The root growth measurement like root length, number of adventitious roots/plant, volume of roots and dry weight of roots were recorded at flowering and harvest stages of crop growth. At random four plant roots were dug out carefully from each plot for recording the above root characteristics and the average was worked out.

RESULTS AND DISCUSSION

The data on the root growth characters and the results of correlation studies made are presented in Table I and II respectively.

1. Number of adventitious plant roots : The mulch applied plots recorded significantly higher root number/plant when compared to control (Table I). This brought out the marked influence of root growth resulting out of considerable conservation of soil moisture under different mulching systems in contrast to the unmulched plots. The mulched plots were on par with each other at flowering stage of the crop growth, although sugarcane trash recorded numerically higher number of adventitious roots/plant than the rest. But at the harvest stage, the sugarcane trash applied plots registered its superiority by recording higher number of adventitious roots/plant than the other treatments (Table I). This might be due to the fact at the later stages of crop growth the sorghum produced more number of adventitious roots by utilising the moisture conserved by the mulches (Table III).

2. Volume of roots : The effects of mulching on the volume of roots followed the same trend as in the case of number of adventitious roots/plant both at flowering and harvest stages of crop growth (Table I).

3. Length of roots : The mulch applied plots being on par recorded longer roots than control both at flowering and harvest stages of crop growth (Table I). The conserved moisture due to mulching (Table III) and added nutrients had helped in increasing the vertical foraging capacity of sorghum roots.

4. Root weight : The mulched plots were superior to control both at flowering and harvest stages of crop growth. Among the mulches the sugarcane trash applied plots recorded the highest root weight followed by maize straw and cumbu straw which were on par (Table I). Because of the increased number of

adventitious roots/plant, volume of roots and length of roots in the mulched plots the dry weight of the roots in the mulched plots also increased. The increased root weight in the sugarcane trash applied plots could be due to the enhanced conservation of moisture (Table III) resulting out of better insulation effect and also due to a little increase in the available nutrient status of soil. The increased root weight by the application of different types of mulches was inferred by Chaudry and Prihar (1974), Ravindranath *et al.* (1974), Millard (1975) and Maehara (1978).

It was noteworthy that the beneficial effect of increased root weight in increasing the yield of sorghum was evident in the correlatien studies made. The root weight and dry matter yield at flowering stage and the root weight and dry matter yield and grain yield at harvest stage were positively related (Table II).

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TABLE I Root Growth Characteristics of Sorghum Under Different Mulches (Mean of five replications)

Treatments	Flowering stage				Harvest stage			
	Number of roots/ plant	Volume of root (m)	Length of root (cm)	Weight of root (gm)	Number of roots/ plant	Volume of root (ml)	Length of root (cm)	Weight of root (gm)
Cumbu straw	26	25.2	27.7	7.9	28	29.2	28.0	8.9
Sugarcane trash	30	27.7	31.3	12.5	35	33.1	33.7	13.3
Maize straw	26	20.0	28.0	8.2	29	29.3	28.9	9.5
Control	19	12.4	20.9	6.0	23	19.8	2 .6	6.6
S. E.	1.43	1.58	2.13	0.52	1.82	1.09	1.99	0.23
C. D. (P = 0.05)	4.40	4.87	6.56	1.59	5.61	3.88	6.12	0.72
	All are significant							

TABLE II Results of Statistical Analysis for Correlation (Number of pairs 20)

Relationship between X	Y	Correlation coefficient 'r'	Regression equation
Flowering stage			
Root weight	Drymatter yield	0.677**	Y = 21.66 + 0.68 X
Harvest stage			
Root weight	Drymatter yield	0.798**	Y = 22.34 + 2.31 X
Root weight	yield	0.769**	Y = 4.74 + 0.77 X

** Significant at 1 per cent level

TABLE III Soil Moisture Content Under Different Mulches (Mean of five replications)

Treatments	Soil moisture in per cent			
	Flowering stage		Harvest stage	
	0 - 20 cm	20 - 40 cm	0 - 20 cm	20 - 40 cm
Cumbu straw	18.7	20.6	18.1	20.1
Sugarcane trash	19.7	20.5	19.1	19.0
Maize straw	18.7	20.6	18.2	19.7
Control	14.5	20.6	13.9	19.5