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Influence of pearlmillet (*Pennisetum glaucum* (L.) R. Br.) Crop Geometry on Soil Moisture Budgeting under Dryland Conditions

Sangeeta[*], V. S. Surakod and M. B. Patil

Department of agronomy, College of Agriculture, Bijapur

University of Agricultural Sciences, Dharwad - 580 005, India

*Corresponding Author E-mail: npsangeeta4968@gmail.com

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ABSTRACT

The field experiment was conducted at College of agriculture, Bijapur, to know the effect of crop geometry on pearl millet under dryland conditions during Kharif 2013-2014. The experiment was laid out with eight treatments replicated three times in randomized block design. Wider row spacing 120 cm x 5.0 cm recorded significantly higher soil moisture content (cm) on volume basis at all the stages of crop growth when compared to recommended spacing 60 cm 10 cm. Soil moisture content at the time of sowing was 12.92 cm (left side of the row), 9.32 cm (middle of the row) and 15.94 cm (right side of the row), at 15 DAS, it was 5.96 cm (left side of the row), 5.74 cm (middle of the row) and 6.18 cm (right side of the row), at 30 DAS 14.33 cm (left side of the row), 7.12 cm (middle of the row) and 13.69 cm (right side of the row), at 45 DAS, it was 13.07 cm (left side of the row), 14.36 cm (middle of the row), 12.93 cm (right side of the row), at 60 DAS, it was 27.11 cm (left side of the row), 28.74 cm (middle of the row), 27.49 cm (right side of the row) and at harvest, it was 12.83 cm (left side of the row), 29.91 cm (middle of the row), 20.82 cm (right side of the row).

Key words: *Crop geometry, Dryland, Pearlmillet, Soil moisture*

INTRODUCTION

Pearl millet (*Pennisetum glaucum* (L.) R. Br.) belongs to family Poaceae (section Paniceae), is one of the most important among the millets or nutritious coarse grain cereals, the crop is grown as a nutrient rich food source for humans as well as a fodder crop for livestock and feed for poultry.

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Pearl millet is the most drought and heat tolerant among cereals or millets and it has the highest water use efficiency under drought stress, also this plant species has unique tolerance to high temperature and moisture stress even at flowering, seed setting and grain filling stages. Yield of a crop depends on the final plant density. The density depends on the germination percentage and the survival rate in the field. Establishment of required plant density is essential to get maximum yield. For example when a crop is raised on stored soil moisture under rain fed conditions, high density will deplete moisture before crop maturity. Whereas, low density will leave moisture unutilized. Hence, optimum density will lead to effective utilization of soil moisture, nutrients, sunlight etc. Northern Dry Zone (zone three) of Karnataka is a biggest zone having an area of 50.8 lakh.ha, out of this 35.5 lakh.ha is under cultivation. This area receives an annual rainfall of 594.3 mm in 30 rainy days. The rainfall is not sufficient for profitable crop production due to uneven distribution of rainfall. The problems such as erratic rainfall, undulating topography, poor adoption of soil and moisture conservation practices by the farmers, hence crop management practices play an important role in overcoming the drought situations. Keeping this in view a present investigation on influence of pearlmillet crop geometry on soil moisture budgeting under dryland conditions was conducted.

MATERIAL AND METHODS

The experiment was conducted at the farm of College of Agriculture, Bijapur in the Northern Dry Zone of Karnataka (Zone 3) and is situated at 16^0 49' North latitude, 75^0 43' and East longitude and at an altitude of 593.8 m above the mean sea level. The experiment consisted of eight treatments Viz., T_1: 60 cm x 10 cm, $T_{2:}$ 75 cm x 8 cm T_3: 90 cm x 7 cm, T4:90 cm x 10 cm, T_5: 120 cm x 5 cm, T_6:120 cm x 10 cm T_7:135 cm x 5 cm T_8:135 cm x 10 cm. The experiment was laid out in RBD with three replications. The soil of the experimental sight was medium deep black soils. The soil moisture content is determined by gravimetric method from 0-15, 15-30, 30-45 cm depth in each treatment at sowing and 15 days interval (soil moisture from row to mid of the row on either side) in experiment with the help of screw auger during 2013-14. The soil moisture content was determined gravimetrically after oven drying the samples at105^0C for 48 hrs and expressed on oven dry weight basis.

$$\text{Soil moisture (\%)} = \frac{\text{WW-DW}}{\text{DW}} \times 100$$

Where, WW= Wet weight of soil

DW= Dry weight of soil

$$\text{Soil moisture content on volume basis(cm)} = \frac{\text{\% Soil moisture x BD X D}}{100}$$

Where, BD= Bulk density of the soil

D= Depth of the soil

RESULTS AND DISCUSSION

The results revealed that, among all treatments wider row spacing 120 cm x 5.0 cm recorded significantly higher soil moisture content at the time of sowing 12.92 cm (left side of the row), 9.32 cm (middle of the row) and 15.94 cm (right side of the row), at 15 DAS 5.96 cm (left side of the row), 5.74 cm (middle of the row) and 6.18 cm (right side of the row), at 30 DAS 14.33 cm (left side of the row), 7.12 cm (middle of the row) and 13.69 cm (right side of the row), at 45 DAS 13.07 cm (left side of the row), 14.36 cm (middle of the row), 12.93 cm (right side of the row), at 60 DAS 27.11 cm (left side of the row), 28.74 cm (middle of the row), 27.49 cm (right side of the row), at harvest 12.83 cm (left side of the row), 29.91 cm (middle of the row), 20.82 cm (right side of the row). This is mainly due to the frequent deep inter cultivation in wider row spacing. Frequent deep intercultivation helps to create dust mulch on the soil surface. This dust mulch acts as a barrier for the capillary rise of water which results in higher evaporation losses. These results are in agreement with the scientists Willey *et al*. 1977 revealed that in a moisture deficit situation as in kharif 1976, wider rows recorded 93.2% higher yields in red soil and 15.8% in black soils. Blum, 1972 reported that altering the planting pattern to give earlier competition can improve water use efficiency of dryland crops grown on conserved soil moisture. The higher yields of sorghum at wider rows have resulted more plants within the row induced early competition and resulted in more efficient utilization of limited moisture[3]. When a crop is grown in a dry area without irrigation, the rate at which roots extract water from the soil can be manipulated by changing either the planting density[2] or the planting arrangement, or both. At least in principle, this type of manipulation may increase the economic yield of the crop per unit of available water.

Table 1: Soil moisture content (cm) on volume basis in the soil profile as influenced by pearlmillet crop geometry

Treatments	**Soil moisture content (cm)**																	
	Sowing			**15 DAS**			**30 DAS**			**45 DAS**			**60 DAS**			**Harvest**		
Spacing(cm)	L	M	R	L	M	R	L	M	R	L	M	R	L	M	R	L	M	R
T1-60 x 10	9.09	6.23	4.08	3.43	2.88	2.72	8.76	5.73	8.06	10.38	9.50	10.68	10.97	9.80	10.27	7.13	6.45	7.88
T2-75 x 8.0	9.52	5.67	6.58	3.80	3.72	2.07	8.30	5.79	9.87	10.47	9.86	8.59	9.03	8.19	9.60	8.46	7.16	8.46
T3-90 x 7	9.24	4.98	7.10	3.55	3.24	3.74	8.68	5.74	11.18	10.79	10.21	10.74	9.70	8.77	10.29	5.43	8.06	9.21
T4-90 x 10	9.66	6.71	10.03	4.47	3.29	3.49	9.32	4.64	11.41	11.24	10.43	10.41	10.89	13.79	11.13	6.44	11.46	5.57
T5-120 x 5.0	12.92	9.32	15.94	5.96	5.74	6.18	14.33	7.12	13.69	13.07	14.36	12.93	27.11	28.74	27.49	12.83	29.91	20.82
T6-120 x 10	12.62	7.89	15.87	5.52	3.86	4.43	12.39	6.16	12.22	12.15	13.11	11.38	26.58	22.93	27.29	9.15	25.90	18.49
T7-135 x 5.0	11.40	8.04	11.55	5.65	4.39	5.08	12.28	6.35	12.52	12.67	12.77	12.24	25.01	27.54	26.58	11.36	25.39	17.72
T8-135 x 10	12.89	7.97	14.58	5.90	4.13	6.05	12.69	6.95	12.59	12.22	13.28	12.79	26.88	28.56	27.07	8.86	25.48	19.46
SEm±	0.65	0.45	1.86	0.45	0.53	0.75	0.70	0.41	0.65	0.44	0.73	0.62	0.42	0.47	0.41	0.53	2.11	1.11
CD (0.05)	1.96	1.35	5.65	2.12	1.62	2.26	2.13	1.24	1.96	1.35	2.21	1.89	1.27	1.42	1.25	1.59	6.43	3.38

L-Left side of the row M-Middle of the row R- Right side of the row

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