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Effect of crop geometry and nitrogen levels on growth parameters and yield attributes of Pearl millet

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ABSTRACT

A field experiment was conducted during the kharif season of 2007 at Agronomy Research Farm, Chaudhary Charan Singh Haryana Agricultural University, Hisar to study the effect of crop geometry and nitrogen levels on growth and yield of newly develop pearl millet hybrid HHB197. Four spacing patterns viz., 45 x 12, 45 x 16, 60 x 12 and 60 x 16 cm and five nitrogen levels viz., control, 40, 80, 120 and 160 kg N ha-1 tested in factorial randomized block design (FRBD) with three replications. Plant growth in terms of height, dry matter accumulation plant^{-1}, leaf area plant^{-1} increased significantly with increase in spacing at most of the stages of observations. Similarly, yield attributing characters like effective tillers plant^{-1}, 1000 grain weight, length of earhead and girth of earhead increased significantly with increase in spacing.

Key words: Crop geometry, hybrids, fertility levels, nitrogen levels and yield attributes.

Pearl millet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz] is sixth most important cereal of the world and stands fourth in order of importance as food grain crop in India. It is a staple food grain crop in the arid and semiarid region of India and Africa and new grain crop in USA. Besides being a potent source of food for human beings, it is enormously used for feeding the cattle and poultry birds. Pearl millet is quick growing, drought tolerant and dual purpose crop i.e. high yielding and nutritious crop, used by amassed and excellent succulent fodder when harvested before the formation of grains. Efficient fertilizer management plays important role in increasing the crop yield through efficient utilization of limited moisture /water supply. The soils of these areas are deficient in various nutrient elements in general and nitrogen in particular. It is, therefore, imperative to have better understanding of growth, yield and quality of this crop in relation to nitrogen for promoting its adoption by farmers of these regions. Though nitrogen management of pearl millet cultivars has been studied by various researchers (Kumar *et al*,2003; Sewhag *et al,* 2003; Parihar *et al*,2005; Singh *et al,* 2006;).

The most important factor affecting the pearl millet yield is plant density. Higher number of plants per unit area increases the competition between the plants for resources (Moisture, light, nutrients, etc.), whereas, under low plant population / plant density these resources are not fully utilized. Keeping the above points in view, 1the present study entitled "Effect of crop geometry and nitrogen levels on growth and yield of newly develop pearl millet hybrid HHB 197" was planned.

MATERIALS AND METHODS

The field experiment entitled "Effect of crop geometry and Nitrogen levels on growth and yield of newly develop pearl millet hybrid HHB197" was conducted at the Crop Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar during kharif season 2007. The experiment was laid out in factorial randomized block design (FRBD). Each of 20 treatment combination plant spacing-4 x nitrogen levels-5 was randomly allotted to individual plot in block of equal size. The following treatments were replicated thrice (A) Crop Geometry (4) 45x12cm (185185 plant ha^{-1},S1), 45x16cm (138888 plant ha^{-1},S2), 60x12cm (138888 plant ha^{-1} S3), 60x16 cm (104166 plant ha^{-1}).(B) Nitrogen levels (5) No nitrogen (control,No) ,40 kg ha^{-1} (N1), 80 kg ha^{-1} (N2), 120 kg ha^{-1}(N3), 160 kg ha^{-1} (N4). The soil of the track is derived from Indo-Gangetic alluvium and is sandy loam in texture. All P (60 kg P_2O_5 ha^{-1}) and half N as per treatments were drilled at the time of sowing and rest of the N was top dressed after thinning and gap filling. Zinc sulphate @ 25kg ha^{-1} was applied in the field before last harrowing. Urea (46% N), single super phosphate (16% P_2O_5) and zinc sulphate (21%) were used as source of N, P, and Zn respectively.

RESULTS AND DISCUSSION

At 20, 40, 60 DAS and at harvest, the plant height increased significantly with each successive increase in nitrogen level upto 160 kg N ha^{-1}. The shortest plants were recorded with control treatment and tallest plants were recorded at 160 kg ha^{-1} at all the crop growth stages. More plant height under wider spacing might be attributed to proper utilization of natural resources i.e. moisture and nutrients which might have underutilized due to mutual plant competition develop by more plant in closer spacing. Overall improvement in the growth of individual pearl millet plant due to wider spacing have also been reported by Yadav and Jangir (1997) and Kumar et al. (2004). In general, leaf area plant^{-1} increased upto 40 DAS and after that there was declining trend upto harvest. Spacing of 60 x 16 cm was significantly superior to 45x12 cm and 45x16 cm. At 40, 60 DAS and at harvest leaf area plant-1 was lowest at 45x12 cm spacing and with increasing in spacing significant higher leaf area plant-1 was observed, however, 60x16 cm and 45x16 cm spacing treatment being at par at 40 DAS. At 60 DAS leaf area plant^{-1} was at par under 45x16 cm and 60x12 cm spacing. The lowest leaf area plant-1 was recorded under control treatment and each successive increase in nitrogen dose brought about significant increase in leaf area plant^{-1} upto to the highest, dose i.e. 160 kg N ha^{-1} at all the stages of observations. The highest dry weight plant-1 was observed under 60x16 cm which was significantly higher than rest of spacing treatment. The lowest dry weight plant^{-1} was recorded under control treatment and it went on increasing with the increase in nitrogen dose at all the crop growth stages. The plant cells produced under adequate supply of nitrogen tend to be large in size with thin walls (Black, 1967) and result in increase in plant height, photosynthetic area (leaf size) and dry matter accumulation. An overall improvement in the growth of pearlmillet due to application of nitrogen has also been documented by Parihar et al. (1997), Bhagchand and Gautam (2000).

Significantly lower number of effective earhead plant^{-1}, length of earhead, girth of ear head and 1000 grain weight were recorded under closer spacing i.e. 45x12cm and with increase in inter as well as intra row spacing there was significantly increase in yield attributing characters. Highest values were recorded under 60x16cm. This might be due to the fact that optimum spacing on plant population might be attributed to minimum intraspecies competition in crop plants and proper utilization of natural resources i.e. space, light, moisture and nutrients which might have remained under utilized due to mutual plant competition developed by more plants in closer spacing. i.e. 45x12cm. Similar findings have been reported by Kaushik and Gautam 1991 and Yadav and Jangir (1997).

Table 1. Effect of crop geometry and nitrogen levels on growth parameters and yield attributes of Pearl millet

Treatment	Plant height (cm)	Leaf Area plant^{-1}				Dry matter accumulation (g plant^{-1})				Yield attributes			
		20 DAS	40 DAS	60 DAS	At harvest	20 DAS	40 DAS	60 DAS	At harvest	Effective earhead plant^{-1}	Length of earhead (cm)	Girth of earhead (cm)	1000 grain weight (g)
Spacing (cm)													
45x12	190.4	593.12	1429.30	1006.30	686.72	2.87	27.92	60.16	67.29	2.15	23.57	8.57	9.49
45x16	195.9	589.74	1506.10	1170.60	743.30	2.95	30.62	76.85	85.34	2.91	24.33	8.71	9.71
60x12	200.3	606.12	1476.26	1145.10	712.42	3.03	29.38	69.27	75.48	2.48	23.95	8.65	9.60
60x16	204.6	613.06	1522.42	1210.30	774.52	3.08	32.67	87.23	93.60	3.07	24.63	8.74	9.78
SEm ±	0.6	6.25	7.65	9.61	7.06	0.05	0.58	1.05	0.77	0.04	0.19	0.04	0.04
CD at 5%	1.7	17.90	21.90	27.53	20.22	0.14	1.65	3.02	2.20	0.12	0.54	0.11	0.11
Nitrogen levels (Kg ha^{-1})													
0	173.9	421.12	1080.5	778.52	454.77	2.30	22.74	64.66	69.40	1.82	22.63	8.25	8.96
40	188.0	529.42	1416.75	959.37	650.07	2.54	27.63	69.26	75.17	2.42	23.56	8.43	9.19
80	197.9	636.75	1575.80	1107.00	796.67	2.96	31.54	74.02	80.69	2.67	24.18	8.56	9.66
120	210.0	692.80	1619.85	1159.27	845.82	3.22	33.64	78.56	87.11	3.05	24.82	8.79	9.80
160	219.2	722.45	1724.70	1234.40	898.85	3.90	35.17	80.97	89.77	3.30	25.41	9.29	10.21
SEm ±	0.7	6.99	8.55	10.75	7.89	0.06	0.65	1.18	0.86	0.05	0.21	0.04	0.04
CD at 5%	2.0	20.02	24.50	30.78	22.06	0.16	1.85	3.37	2.46	0.14	0.60	0.12	0.13

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