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GROWTH INDICES AND STOVER YIELD OF PEARL MILLET AS INFLUENCED BY HYBRIDS AND FERTILITY LEVELS UNDER TREATED SEWAGE WATER APPLICATION

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SUMMARY

A field experiment was conducted at Vegetable Research Farm, Chaudhary Charan Singh Haryana Agricultural University; Hisar to study the effect of hybrids and fertility levels on growth, growth indices and stover yield of pearl-millet under treated sewage water application. The experiment was laid out in factorial RBD with three replications. The treatment comprised of hybrids *viz*. HHB 67(Improved) and HHB299 and fertility levels viz. control, 75% RDN + FYM @ 5 t/ha, 75% RDN + Vermicompost @ 2.5 t/ha, 75% RDN + Vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha and 100% RDN (156.25 kg N/ha). Higher value of growth and growth indices were observed with hybrid HHB 299 over HHB67(Improved). Significantly higher stover yield was recorded with the application of 75 percent recommended N + vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha over control and 100 per cent recommended N. However, it remained at par with all other fertility levels.

Key words: FYM, pearlmillet, stover yield, treated sewage water and vermicompost

Pearl millet is considered as important nutri-cereal and has received considerable attention as an alternative source for food, fodder, and energy production in the arid and semi-arid tropical regions of world including India. Due to its tolerance to drought, low soil fertility and high temperature, it can be grown in areas where other cereals crop like maize or wheat could not survive. Being exhaustive crop, it requires large amount of nutrients for production especially nitrogen. This requirement is fulfilled by applying inorganic fertilizers to the soil but due to continuous use of inorganic fertilizers to fulfil the nutritional demand of crop, the ill-effects of these high analysis fertilizers have been reported on the soil productivity and sustainability. Although, organics are eco-friendly and sustain productivity but their limited availability is the major constraint in agriculture production systems. Due to immediate response farmers prefer inorganic sources over organic sources. But judicious use of organic and inorganic sources in an integrated way for maintaining the soil fertility and productivity can be helpful on long term basis. Secondly, availability of good quality irrigation water is declining day by day especially under semi-arid region. Under these conditions, the water constraint may be bestowed with irrigating the crop with poor quality water like treated sewage water (Kumar and Kumar, 2022). In developing countries like India, the safe disposal of the waste material is among the most critical environmental and health issues (Romanos *et al.*, 2019). Now days only a part of it is used in agriculture (Mtshali *et al*., 2014). The value of wastewater for crop production has been widely recognized in India and other water-scarce regions.

MATERIALS AND METHODS

A field experiment was carried out at Vegetable Research Farm, Chaudhary Charan Singh Haryana Agricultural University; Hisar located in Indo-Gangetic Plains of North-West India with latitude of $29^0$10' North and longitude of $75^0$46' East at 215.2 meters above mean sea level during *kharif* 2021 and 2022. The soil of the experimental site was sandy loam in texture, slightly alkaline in reaction, low in organic carbon (0.43%), available nitrogen (135 kg/ha), medium in available phosphorus (16.6 kg/ha) and high in available potassium (315 kg/ha). The climate is semiarid and subtropical, hot and dry summer with mean rainfall of 400 mm. Rainfall being monsoonal in nature, 70-80% is received during the months of July, August and September, which coincides with the active growing season of pearl millet. The maximum temperature varied between 31.8 to 41.4°C with an

average of 36.6°C in the *Kharif* season of 2021 and 30.3 to 36.7°C in the *Kharif* season of 2022 with average of 33.5°C. The experiment was laid out in factorial RBD with three replications. The treatment comprised of hybrids viz. HHB 67(Improved) and HHB 299 and fertility levels viz. control, 75 % RDN + FYM @ 5 t/ha, 75 % RDN + Vermicompost @ 2.5 t/ha, 75 % RDN + Vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ ha and 100 % RDN. The pre-sowing irrigation was applied through treated sewage water, and the seed bed was prepared at field capacity. Pearl millet hybrid 'HHB 67(Improved)' and HHB 299 were sown by drilling in rows using 5 kg seed /ha. The farm yard manure and vermicompost were applied five days before sowing as per treatment. Full dose of phosphorus and half dose of nitrogen were applied as per the treatments at the time of sowing and rest of the nitrogen was top dressed in two equal splits one after thinning and gap filling and another at ear head formation. Urea (46% N) and single super phosphate (16% P_2O_5) were used as the sources of nitrogen and phosphorus, respectively. During the growing season, two irrigations with treated sewage water each of 5 cm were applied through border strip flood irrigation method. The growth indices and stover yield were calculated by using standard procedure/formula. The recorded data on growth, growth indices and stover yield of pearl millet collected during study years were analysed statistically for factorial RBD design and presented at 5% significant level. The data were subjected to analysis of variance using online statistical analysis package of OPSTAT (Sheoran *et al*., 1998).

RESULTS AND DISCUSSION

Effect of hybrids

Plant height was significantly influenced by both hybrids and fertility levels at 20, 40, 60 DAS and at maturity. Between hybrids, during both years, significantly taller plants were recorded under HHB 299 over HHB 67 (Improved) at different days after sowing. The minimum increase in plant height was from 60 DAS to maturity while maximum increase was recorded between 20 to 40 DAS. This might be due to fast growth character, genetically tall growing and more vertical growth of HHB 299 due to longer crop duration than HHB 67 (Improved). Difference in plant height among pearl millet hybrids and varieties have also been reported by Chaudhari *et al.* (2018). Both hybrids and fertility levels had significant influence on dry matter accumulation per plant at 40, 60 DAS and maturity, however, hybrids did not bring any significant variation in dry matter accumulation at 20 DAS. HHB 299 produced significantly higher dry matter per plant than HHB 67 (Improved) at different days after sowing during both the years of study. The CGR in HHB 299 was higher over HHB 67 (Improved) at different days after sowing during both years. In general crop growth rate decreased with the advancement of crop age. Relative growth rate (RGR) differs significantly among pearlmillet hybrids during 20-40 DAS and 40-60 DAS while a non-significant effect was observed at 60 DAS-maturity. RGR was observed higher in hybrid HHB 299 over HHB 67 (Improved) at different growth intervals during both years. Hybrid HHB 299 produced more stover yield than HHB 67 (Improved) during 2021 and 2022, respectively. The effect of different fertility levels on pearl millet was also found significant. The stover yield recorded significantly lower in control than rest of fertility levels (Table 2). Higher stover yield of hybrid HHB 299 might be attributed to its highest ear head girth and also due to its longer duration to reach maturity duration which might have helped to produce more photosynthates and enough time to translocate them to developing grains. These findings are supported by Hassan *et al*., (2019).

Effect of fertility levels

Among fertility levels, 75 per cent RDN + vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha produced significantly taller plants and higher dry matter accumulation over control and 100% RDN, however it did not differ significantly from the treatment 75 per cent RDN + vermicompost @ 2.5t/ha and 75 per cent RDN + FYM @ 5 t/ha (Table1). Similarly, application of 75 percent recommended N + vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha recorded higher CGR over control, however, it did not differ significantly from the treatment 75 per cent RDN + vermicompost @ 2.5 t/ha, 75 per cent RDN + FYM @ 5 t/ha and 100 per cent RDN at 20-40 DAS and 40-60 DAS in both years. During both years of study, effect of fertility levels on CGR of pearl millet between 60 DAS – at maturity was found non-significant. Significantly higher RGR was recorded with the application of 75 percent recommended N + vermicompost @2.5 t/ha + FYM @2.5 t/ha over control and it was statistically at par with 75 per cent RDN + vermicompost@2.5t/ha, 75 per cent RDN +

TABLE 1
Plant height and dry matter accumulation in pearl millet as influenced by hybrids and fertility levels under treated sewage water application

Treatment	Plant height (cm)								Dry matter accumulation per plant (g)							
	Kharif 2021				*Kharif* 2022				*Kharif* 2021				*Kharif* 2022			
	20 DAS	40 DAS	60 DAS	At maturity	20 DAS	40 DAS	60 DAS	At maturity	20 DAS	40 DAS	60 DAS	At maturity	20 DAS	40 DAS	60 DAS	At maturity
Hybrids																
HHB 67 (Improved)	22.7	109.0	161.6	168.7	24.3	113.5	166.1	173.1	2.1	33.9	59.9	61.1	2.2	34.4	60.8	62.1
HHB 299	37.8	144.0	195.9	202.9	37.9	147.9	198.6	205.1	2.2	38.7	73.2	76.3	2.2	40.6	75.1	77.3
CD at 5%	0.6	3.9	5.6	6.4	0.5	3.0	4.3	4.7	NS	1.0	1.6	1.6	NS	1.2	2.4	1.9
Fertility levels																
Control	26.5	114.3	168.5	175.6	28.4	116.7	171.4	178.5	2.0	31.6	60.9	61.6	2.1	33.1	62.9	63.6
75% RDN + FYM @ 5 t/ha	31.8	131.3	180.0	187.0	33.8	133.4	184.2	191.2	2.1	38.9	67.5	69.2	2.2	40.8	69.5	70.2
75% RDN + Vermicompost @ 2.5 t/ha	32.5	132.5	183.3	190.3	34.2	135.6	188.0	195.0	2.2	39.6	68.9	70.6	2.3	41.0	70.6	71.7
75% RDN + Vermicompost @ 2.5 t/ha + FYM @2.5t/ha	34.4	136.8	187.8	194.9	36.4	139.1	190.8	197.8	2.3	41.0	70.8	72.5	2.3	43.0	72.1	73.5
100% RDN	29.3	126.6	174.3	181.3	31.2	127.8	177.4	183.1	2.2	36.8	64.5	66.7	2.2	38.8	66.7	67.7
CD at 5%	2.6	5.7	7.8	7.9	2.6	5.8	6.8	7.2	NS	2.1	3.3	3.4	NS	2.2	3.8	3.3

TABLE 2
Growth indices and stover yield of pearl millet as influenced by hybrids and fertility levels under treated sewage water application

Treatment	CGR ($g/m^2/day$)						RGR (mg/g/day)						Stover yield (kg/ha)	
	Kharif 2021			*Kharif* 2022			*Kharif* 2021			*Kharif* 2022			*Kharif* 2021	*Kharif* 2022
	20-40	40-60	60-maturity	20-40	40-60	60-maturity	20-40	40-60	60-maturity	20-40	40-60	60-maturity		
Hybrids														
HHB 67 (Improved)	1.58	1.30	0.06	1.61	1.32	0.06	0.059	0.012	0.001	0.060	0.012	0.001	1926	2635
HHB 299	1.82	1.73	0.16	1.92	1.73	0.18	0.063	0.016	0.002	0.064	0.016	0.002	3703	4674
CD at 5%	0.20	0.35	0.07	0.21	0.37	0.09	0.003	0.003	NS	0.003	0.003	NS	114	135
Fertility levels														
Control	1.47	1.47	0.03	1.55	1.49	0.03	0.058	0.014	0.001	0.059	0.014	0.001	1790	2002
75% RDN+FYM @ 5 t/ha	1.83	1.43	0.07	1.93	1.43	0.04	0.061	0.012	0.002	0.063	0.012	0.002	3160	3987
75% RDN+Vermicompost @ 2.5 t/ha	1.86	1.47	0.08	1.94	1.45	0.05	0.062	0.012	0.002	0.063	0.012	0.002	3250	4209
75% RDN+Vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha	1.93	1.49	0.09	2.04	1.48	0.07	0.063	0.012	0.003	0.064	0.011	0.003	3261	4227
100% RDN	1.72	1.39	0.06	1.83	1.39	0.05	0.061	0.012	0.002	0.062	0.012	0.002	3014	3846
CD at 5%	0.13	0.13	NS	0.24	0.11	NS	0.003	NS	NS	0.003	NS	NS	180	214

FYM @ 5 t/ha and 100 per cent RDN during 20-40 DAS. Non-significant effect was observed among fertility levels at 40-60 DAS and 60 DAS-maturity in both years. Maximum stover yield of pearlmillet was recorded with the application of 75 percent RDN + vermicompost @ 2.5 t/ha + FYM @2.5 t/ha (3261, 4227 kg/ha), which was significantly superior to control and 100% RDN, however, it was statistically at par with 75 per cent RDN + vermicompost @ 2.5 t/ha and 75 per cent RDN + FYM @ 5 t/ha during both years. A critical observation of the data revealed the fact that integrated application of both organic and inorganic sources of nutrients were better as compared to sole application of inorganic sources and control. This might be attributed to better nutrition to crops due to mineralization of FYM and solubilisation of nutrients from the native sources during the process of decomposition (Kumar and Kumar, 2017). Vermicompost had been reported to contain large number of nitrogen fixing microorganisms, phosphate solubilizing bacteria and other beneficial microbes, antibiotics, vitamins, hormones, enzymes etc. that had favorable effect on growth and yield of pearl millet. These results have also been documented by Satyajeet *et al*., (2018).

CONCLUSION

Based on two years results, it may be concluded that among hybrids, significantly highest straw yield was recorded in HHB 299. Among fertility levels, significantly higher stover yield was recorded with the application of 75 percent RDN + vermicompost @ 2.5 t/ha + FYM @ 2.5 t/ha being on at par with 75 percent RDN + FYM @2.5 t/ha and 75 percent RDN + FYM @ 5t/ha.

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