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CONTRIBUTION OF PRODUCTION FACTORS TO THE YIELD AND ECONOMICS OF PEARL MILLET [*PENNISETUM GLAUCUM* (L.) R. BR.]

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The present experiment was conducted at Research Farm of the Department of Agronomy, CCS Haryana Agricultural University, Hisar during **kharif** season of 2011 with the objective to quantify the contribution of different production factors on the grain productivity of pearl millet. T_1 : FPP [RDF (125 kg N+62.5 kg P/ha) + $ZnSO_4$ @ 25 kg /ha+ biofertilizer biomix (*Azospirillum* +PSB)+thinning and gap filling + weeding and hoeing (20 and 35 DAS) + irrigation] , T_2 : T_1 – RDF (N and P), T_3 : T_1 – $ZnSO_4$ @ 25 kg /ha, T_4 : T_1–Biomix, T_5 : T_1 – Thinning and gap filling (19 DAS), T_6 : T_1 – Weeding and hoeing (20 and 35 DAS), T_7 : T_1 – Irrigation and T_8 : Control in randomized block design with three replications. Non-adoption of individual factors RDF (T_2), $ZnSO_4$ (T_3), biomix (T_4), thinning and gap filling (T_5), weeding and hoeing (T_6) and irrigation (T_7) caused a decrease in grain yield by 32.8, 12.2, 7.7, 16.7, 30.1, 20.2, 48.0 (control) per cent and stover yield by 22.7, 7.9, 4.0, 10.0, 18.9, 16.0 and 32.2 per cent (control) than T_1 (FPP), respectively. Maximum gross returns (Rs. 48727/ha), net returns (Rs. 16926/ha) and B : C ratio (1.53) were found in treatment T_1 followed by T_4.

Key words : Production factors, yield, economics, pearl millet

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a dual purpose crop with food, feed and fodder value. Its grain is staple food of people living in arid regions of India and also has a high feed value for livestock, poultry and fish. It also provides high quality green forage in seasons of fodder scarcity. In India, area under grain pearl millet is about 7.95 million hectares with production of 8.80 million tonnes. The national average productivity of this crop is 1106 kg/ha (Anonymous, 2012-13). In Haryana, the area under this crop is 4.38 lakh hectares with production and productivity of 8.98 lakh tonnes and 2050 kg/ha, respectively (Anonymous, 2012-13). The research efforts have been made to enhance its productivity through high yielding hybrids/varieties and refinement in production and protection technologies. Due to the development of high yielding hybrids and populations, the productivity has increased from 932 kg/ha (2006-10) to 1106 kg/ha registering an increase of 18.7 per cent improvement, thereby resulting in 3.8 per cent improvement in its grain production from 8.48 to 8.80 million tonnes (Yadav *et al.,* 2012). The average yield of pearl millet in the country as well as in the state is quite low as compared to its potential yield because it is grown in the marginal areas with poor management practices. So, there is considerable scope for increasing the productivity of pearl millet by adopting better agronomic practices in the high yielding hybrids/varieties.

Productivity of any crop depends on many management factors : fertilizer, thinning, gap filling, weeding, hoeing and irrigation management and every factor has its towards productivity. Non-adoption of improved package of practices recommended for specific zone by the farmers is one of the major causes of low yield of pearl millet crop. Therefore, it is necessary to find out the contribution of individual or combinations of full package of practices to the yield of pearl millet. But very less information is available regarding role of individual factor towards the productivity of pearl millet. Keeping the above points in view, the present study was conducted.

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The experiment was conducted at Research Farm of the Department of Agronomy, CCS Haryana Agricultural University, Hisar during **kharif** season of 2011. Eight different treatments were taken for the experimental study : T_1 : FPP [RDF (125 kg N+62.5 kg P/ha)+$ZnSO_4$ @ 25 kg/ha+biofertilizer biomix (*Azospirillum*+PSB)+thinning and gap filling+weeding and hoeing (20 and 35 DAS)+irrigation] , T_2: T_1 – RDF (N and P), T_3 : T_1 – $ZnSO_4$ @ 25 kg /ha, T_4: T_1 – Biomix, T_5 : T_1–Thinning and gap filling (19 DAS), T_6 : T_1 – Weeding and hoeing (20 and 35 DAS), T_7 : T_1– Irrigation, T_8 : Control [No application of RDN & P, $ZnSO_4$, biomix, thinning and gap filling, weeding and hoeing and irrigation application] were tested in randomized block design with three replications. The soil of the experimental site was sandy loam in texture with alkaline pH (8.5), medium in organic carbon (0.42%), medium in P (16 kg/ha) and high in potash (320 kg/ha). The pearl millet hybrid HHB 197 was planted on July 20, 2011 at 45 cm row spacing and plant to plant spacing was maintained at 10-15 cm with net plot size of 3.6 x 3.0 m^2. The total rainfall received during the crop growth period was 247.5 mm. One irrigation was applied on 6 August 2011 among all the treatments except in T_7. Five randomly selected plants from each plot were taken for recording growth and yield parameters.

Grain and Stover Yield

Pearl millet grain yield was maximum under the full package of practice (T_1) with a grain yield of 3444 kg/ha (Table 1) and it was statistically at par with T_4 (3178 kg/ha). The T_1 treatment was significantly superior in terms of grain yield/ha compared to rest of the treatments as it had received full package and practices. The grain yield in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 treatments was higher by 92.4, 29.2, 68.9, 77.5, 60.3, 34.4 and 53.3 per cent, respectively, than control (T_8). The grain yield in T_2, T_3, T_4, T_5, T_6, T_7 and T_8 treatments decreased by 32.8, 12.2, 7.7, 16.7, 30.1, 20.2 and 48.0 per cent, respectively, compared to T_1. It means that contribution of recommended dose of N and P in pearl millet productivity was 32.8 per cent, 12.2 per cent by $ZnSO_4$, 7.7 per cent by biomix, 16.7 per cent by thinning and gap filling, 30.1 per cent by weed control and 20.2 per cent by one irrigation. This increase in grain yield may be due to the application of balanced fertilizer, adequate water supply, seed treatment with biofertilizer and weed control thereby resulting in better root growth and development, more nutrient uptake and higher dry matter accumulation/plant and its subsequent translocation to the developing panicles/earhead. Similar results were also reported by Singh *et al*. (2006), Rajput (2006), Rani (2007) and Neelam (2009). In terms of stover yield, the T_1 treatment produced significantly more in stover yield /ha compared to rest of the treatments. The stover yield in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 treatments was higher by 47.4, 14.0, 35.7, 41.5, 32.7, 19.5 and 23.8 per cent, respectively, over control. The stover yield of T_2, T_3, T_4, T_5, T_6, T_7 and T_8 treatments was lower by 22.7, 7.9, 4.0, 10.0, 18.9, 16.0 and 32.2 per cent, respectively, over T_1. This increase in the stover yield of pearl millet may be attributed to the increase in plant height, leaf area and dry matter production. The biological yield also

TABLE 1
Effect of different treatments on grain and stover yields, harvest index and grain : chaff ratio of pearl millet

Treatment	Grain yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Grain : chaff
T_1 : Full package of practice	3444	10697	14142	24.35	2.43
T_2 : T_1–Recommended dose of fertilizer	2315	8271	10586	21.88	2.36
T_3 : T_1–$ZnSO_4$ @ 25 kg/ha	3025	9846	12870	23.49	2.39
T_4 : T_1–Biomix	3178	10265	13444	23.62	2.42
T_5 : T_1–Thinning and gap filling	2870	9629	12499	23.00	2.38
T_6 : T_1–Weeding and hoeing	2407	8673	11080	21.65	2.35
T_7 : T_1–Irrigation	2747	8981	11728	23.41	2.37
T_8 : Control	1790	7253	9043	19.79	2.18
S. Em±	106	215	238	0.84	0.15
C. D. (P=0.05)	326	657	730	2.57	NS

NS–Not Significant.

followed the trend of grain and stover yield.

The harvest index (HI) was highest in T_1 which was significantly higher over T_6 and T_8 but statistically at par with T_2, T_3, T_4, T_5 and T_7 treatments. The range of HI was between 19.79 to 24.35 per cent among different treatments. Different treatments did not significantly influence grain : chaff ratio in pearl millet hybrid HHB 197.

Economics

The data pertaining to economics of various treatments are presented in Table 2. Maximum values of gross returns, net returns and benefit : cost ratio were found in T_1 (Rs. 48727/ha, Rs. 16926/ha and 1.53) treatment followed by T_4 treatment. Net returns varied from Rs. 6277 (T_8) to Rs. 16926/ha (T_1) among different treatments, whereas the benefit : cost ratio ranged from 1.18 (T_2) to 1.53 (T_1). Gross and net returns in T_1 were Rs. 21003 and 10649/ha higher than the control (Rs. 27696 and 6277/ha), respectively.

The highest values of gross returns, net returns and benefit: cost ratio might be ascribed to the higher grain and stover yield recorded in T_1. Corroborative findings were also reported by Rathore (2006) and Sonawane *et al.* (2007).

TABLE 2
Economics of grain pearl millet as affected by different treatments

Treatment	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B : C ratio
T_1 : Full package of practices	48727	31801	16926	1.53
T_2 : T_1–RDF	34256	29055	5201	1.18
T_3 : T_1–$ZnSO_4$ @ 25 kg/ha	43418	31155	12263	1.39
T_4 : T_1–Biomix	45515	31760	13755	1.43
T_5 : T_1–Thinning and gap filling	41606	29662	11944	1.40
T_6 : T_1–Weeding and hoeing	35729	27523	8206	1.30
T_7 : T_1–Irrigation	39484	31270	8214	1.26
T_8 : Control	27696	21419	6277	1.29

CONCLUSION

The present study clearly indicated that non-adoption of individual factors i. e. recommended dose of N & P and weeding and hoeing caused a maximum decrease in grain yield by 32.8 and 30.1 per cent and stover yield by 22.7 and 18.9 per cent, respectively. Maximum gross returns (Rs. 48727/ha), net returns (Rs. 16926/ha) and B : C ratio (1.53) were found in full package of practices treatment.

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