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INTEGRATED NUTRIENT MANAGEMENT IMPACT ON THE PERFORMANCE OF HYBRID AND COMPOSITE CULTIVARS OF PEARL MILLET (*PENNISETUM GLAUCUM*)

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SUMMARY

The potential performance of Hybrid Pusa 605 and Composite Pusa 443 cultivars of Pearl millet with respect to Integrated Nutrient Management practices in the semi-arid Western Indo-Gangetic plains region of Agra was evaluated in this paper. *Azospirillium* + PSB + FYM treatment showed significant increase in vegetative growth in terms of plant height, number of leaves per plant, tiller thickness and also panicles per plant, panicle thickness in both hybrid and composite cultivars of Pearl millet is observed when compared to the control. However, the hybrids exhibited more grain yield (1.47 t/ha) in comparision to composite cultivar (1.30 t/ha). The composite cultivar on the other hand, improved green fodder yield (76.5 t/ha) over hybrid cultivar (62.36 t/ha).

Key words : Management practices, *Azospirillium*, PSB, FYM, grain yield and pearl millet

Higher level of heat tolerance and efficient utilization of soil moisture by Pearl millet (*Pennisetum glaucum* (L.) R. Br. Emend stuntz) is mainly responsible for its choice as dual-purpose crop (fodder as well as grain crop) in marginal dry land areas. Nag *et al.* (2005) reported the beneficial role of integrated nutrient management practices in maintaining soil health and also enhancing crop productivity. The potential performance of Hybrid Pusa 605 and Composite Pusa 443 cultivars of Pearl millet with respect to integrated nutrient management practices in the semi-arid Western Indo-Gangetic plains region of Agra was evaluated in this paper. Similar evaluation for arid regions was attempted earlier by Yadav *et al.* (2012).

MATERIALS AND METHODS

Two cultivars of Pearl millet i.e., Hybrid Pusa 605 and Composite Pusa 443 were grown in the experimental plots of Dayalbagh Educational Institute in July 2011 and 2012 using Randomized Block design with three treatments and each treatment replicated three times. The treatments included: T_1-Control, T_2-Azospirillium+Phosphate solubilizing bacteria (APSB), T_3-Azospirillium+Phosphate solubilizing bacteria + Farm Yard Manure (APSBFYM). Their application rate was FYM @ 5 tonnes / ha and biofertilizers (seed treatment). A starter dose of chemical fertilizers was also applied @ 60-30-30 NPK kg ha^{-1}. Each plot contained total 6 rows which included 3 rows each of hybrid cultivar Pusa 605 and composite cultivar Pusa 443. Distance of 45cm between the rows and 15cm within the rows was also maintained. These cultivars were later evaluated and compared to see the effect of applied treatments on vegetative and reproductive traits (fodder and grain yield included) and the results were analyzed statistically. (Gomez & Gomez, 1984).

RESULTS AND DISCUSSION

The soil of the experimental field was clay loam in texture, low in organic carbon (0.4%), potassium (115.86 kg/ha) and medium in phosphorus (40kg/ha) and nitrogen (362.8 kg/ha) with pH 7.9.

A. Growth Traits and Fodder Yield

Application of farm yard manure in combination with biofertilizers (T_3) was found to be significantly superior in recording higher growth parameters like plant height of 150.3cm in Hybrid cultivars and 175.2cm in Composite cultivars which are the average values of

TABLE 1
Effect of Different Treatments on Vegetative Performance of Hybrid Pearl millet Cultivar Pusa 605 at Agra (Western UP)

S. No.	Treatments	Plant height (cm)			No. of leaves/plant			Internodal length (cm)			Tiller thickness (cm)			Green fodder yield (t/ha)		
		2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
1.	Control	120.0	125.2	122.6	35.1	34.1	34.1	14.5	15.4	14.9	3.65	3.90	3.77	52.4	55.6	54.0
2.	Azospirillium+PSB	121.7	139.1	130.4	41.3	42.0	41.6	14.2	16.9	15.5	3.88	4.46	4.17	61.0	63.8	62.4
3.	Azospirillium+PSB+FYM	149.2	151.5	150.3	45.1	45.9	45.5	15.6	19.2	17.4	4.16	4.60	4.38	62.4	79.0	70.7
	C.D (5%)	15.52	NS	-	5.51	6.5	-	NS	2.7	-	0.22	0.38	-	NS	NS	-

TABLE 2
Effect of Different Treatments on Vegetative Performance of Composite Pearl millet Cultivar Pusa 443 at Agra (Western UP)

S. No.	Treatments	Plant height (cm)			No. of leaves/plant			Internodal length (cm)			Tiller thickness (cm)			Green fodder yield (t/ha)		
		2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
1.	Control	134.0	138.1	136.0	61.0	62.1	61.5	13.86	14.4	14.1	4.20	4.53	4.36	61.6	73.1	67.3
2.	Azospirillium+PSB	164.0	170.4	167.2	62.1	70.9	70.7	14.01	15.5	14.7	4.56	5.13	4.84	66.8	83.3	75.0
3.	Azospirillium+PSB+FYM	170.2	180.3	175.2	61.5	78.0	77.9	14.71	16.4	15.5	4.83	5.50	5.16	79.9	94.5	87.2
	C.D (5%)	21.6	29.5	-	7.76	7.73	-	NS	1.28	-	NS	NS	-	NS	NS	-

TABLE 3
Effect of Different Treatments on Reproductive Performance of Hybrid Pearl millet Cultivar Pusa 605 at Agra (Western UP)

S. No.	Treatments	Panicles/plant			Panicle length (cm)			Panicle thickness (cm)			Grain yield (t/ha)		
		2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
1.	Control	2.4	2.2	2.30	24.4	23.2	23.8	7.2	7.8	7.5	1.31	1.23	1.27
2.	Azospirillium+PSB	2.9	3.0	2.95	28.1	24.2	26.1	7.4	8.2	7.8	1.59	1.46	1.52
3.	Azospirillium+PSB+FYM	3.3	3.4	3.35	27.0	26.6	26.8	8.1	8.6	8.3	1.69	1.52	1.61
	C.D (5%)	NS	0.79	-	NS	NS	-	NS	0.49	-	1.97	1.60	-

TABLE 4
Effect of Different Treatments on Reproductive Performance of Composite Pearl millet Cultivar Pusa 443 at Agra (Western UP)

S. No.	Treatments	Panicles/plant			Panicle length (cm)			Panicle thickness (cm)			Grain yield (t/ha)		
		2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled
1.	Control	1.53	1.73	1.63	28.5	27.3	27.9	6.96	7.13	7.04	1.11	1.13	1.12
2.	Azospirillium+PSB	2.26	2.36	2.31	29.6	29.1	29.3	6.68	7.66	7.17	1.26	1.31	1.28
3.	Azospirillium+PSB+FYM	3.53	3.20	3.36	31.8	30.8	31.3	7.83	7.86	7.84	1.45	1.53	1.49
	C.D (5%)	NS	NS	-	NS	NS	-	NS	0.38	-	NS	NS	-

two years, higher number of leaves/plant (45.5 leaves in hybrid & 77.9 leaves in composite), higher tiller thickness of 4.38cm in hybrids and 5.16cm in composites (increase is non-significant in composites). Moreover, the above treatment registered higher inter-nodal length in both the cultivars but the increase is non-significant in 2011. The control presented lowest values for all the above growth traits. (Table 1 and 2). Similar findings of improved soil health by the integrated use of organic manures, bio-fertilizers thus resulting in higher plant growth were recorded by Jyothish *et al.* (2011) in hybrid Napier grass.

The two year field trials showed that APSBFYM practice was superior in recording higher fodder yield of 70.7 t/ha in hybrids and 87.2 t/ha in composites when compared to the control (54.0 t/ha in hybrids and 67.3 t/ha in composites) (Table 1 and 2). Moreover, the study also showed that composites recorded higher green fodder yield with 18.4% increase over hybrids. (Table 5 and 6). Probably increase in plant height, tiller thickness and late flowering of composite variety may be responsible for higher fodder yield (Khairwal *et al*, 1999, Sukanya *et al*, 2004).

B. Reproductive Traits and Grain Yield

Similarly, the APSBFYM treatment also enhanced the values of reproductive traits and grain yield. Which mainly include, panicle number/plant (3.35 panicles in hybrids & 3.36 in composites), panicle length, panicle thickness (8.3 cm in hybrids and 7.8 cm in composites). The lowest values for the above attributes were recorded in the control. Moreover, thousand seed weight was higher in hybrids (9.51g) when compared to composites (9.34g).

APSBFYM practice recorded maximum grain yield in both the cultivars. The treatment effect was significant in hybrids but not in composites. The highest grain yield recorded was 1.61 t/ha in hybrids & 1.49 t/ha in composites in comparison to control (1.27 t/ha in hybrids and 1.12 t/ha in composites). (Table 3 and 4). Thus, on an average, hybrids recorded more grain yield with 11.5 per cent increase over composites and this may be attributed to superiority of hybrids for early flowering, higher panicles/plant, panicle thickness and thousand seed weight over composites. (Table 5 and 6).

CONCLUSION

The assessment of the performance of Hybrid Pusa 605 and Composite Pusa 443 cultivars of Bajra under semi-arid western Indo-Gangetic Plains of Agra conditions clearly indicated that the hybrids exhibited more grain yield with 11.5 % increase over Composites and on other hand, Composites exhibited more fodder yield with 18.5 % increase over Hybrids. Moreover, in

TABLE 5
Overall Performance of Hybrid Pusa 605 Cultivar of Pearl millet

S. No.	Character	2011				2012			
		Mean ± S.E	CV%	Maximum	Minimum	Mean ± S.E	CV%	Maximum	Minimum
1.	Plant height (cm)	130.32±6.0	13.82	157.4	103.8	138.31±7.0	15.19	185.5	119.7
2.	No. of leaves	40.54±2.29	16.94	54.3	32.2	40.7±2.3	17.19	54.5	32.4
3.	Inter-nodal length (cm)	14.84±0.35	7.14	17.3	13.8	17.2±0.62	10.81	20.2	14.0
4.	Tiller thickness (cm)	3.9±0.09	6.92	4.51	3.58	4.32±0.12	8.56	4.8	3.8
5.	Panicles/plant	2.88±0.18	19.44	3.4	2.0	2.91±0.20	20.61	4.0	2.0
6.	Panicle length (cm)	26.54±0.90	10.21	30.3	22.0	24.57±0.66	8.14	28.0	21.5
7.	Panicle thickness (cm)	7.61±0.18	7.22	8.50	6.83	8.20±0.13	5.00	8.7	7.4
8.	Green Fodder yield (t/ha)	58.62±3.65	18.71	75.6	45.5	66.2±5.26	23.85	82.7	40.8
9.	Grain yield (t/ha)	1.536±0.069	13.47	1.79	1.16	1.406±0.056	12.14	1.62	1.11

TABLE 6
Overall Performance of Composite Pusa 443 Cultivar of Pearl millet

S. No.	Character	2011				2012			
		Mean ± S.E	CV%	Maximum	Minimum	Mean ± S.E	CV%	Maximum	Minimum
1.	Plant height (cm)	156.16±6.59	12.61	180.3	115.1	162.94±7.28	13.99	197.0	135.3
2.	No. of leaves	69.87±2.87	12.34	86.3	58.2	70.4±2.83	12.08	86.5	58.5
3.	Inter-nodal length (cm)	14.19±0.19	4.08	15.5	13.3	15.44±0.32	6.28	17.0	14.0
4.	Tiller thickness (cm)	4.53±0.16	11.03	5.33	3.65	5.05±0.17	10.29	5.8	4.2
5.	Panicles/plant	2.44±0.38	19.26	4.6	1.0	2.43±0.15	18.51	3.6	1.6
6.	Panicle length (cm)	29.98±1.23	12.34	36.6	24.6	29.1±0.75	7.80	33.2	24.5
7.	Panicle thickness (cm)	7.16±0.21	9.07	8.03	6.16	7.62±0.19	7.61	8.6	6.6
8.	Green Fodder yield (t/ha)	69.47±3.34	14.45	89.5	58.4	83.68±4.83	17.33	108.2	65.0
9.	Grain yield (t/ha)	1.277±0.058	13.74	1.47	1.01	1.328±0.076	17.42	1.59	0.91

the above study, both the culitvars of Pearl millet responded well to APSBFYM treatment by recording higher values for both growth and reproductive traits. As the farmers in this region are facing a huge deficit in the demand and supply of green fodder, it is recommended that he may opt for Composite cultivars under Integrated Nutrient Management regime.

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