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PERFORMANCE OF SINGLE CUT FORAGE SORGHUM GENOTYPES TO DIFFERENT FERTILITY LEVELS

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SUMMARY

The present study was undertaken to find out the performance of different single cut forage sorghum genotypes under different fertility levels. The field experiment was conducted at Forage Section Research Farm, CCS Haryana Agricultural University, Hisar (Haryana), India during **kharif** season, 2015. Genotypes SPH 1752, CSH 13 and HJ 541 were sown at 50, 75, 100 and 125 per cent of RDF, where RDF was 80 kg N, 40 kg P_2O_5 and 40 kg K_2O /ha . Significantly highest green fodder yield was recorded in HJ 541 (493.8 q/ha) and dry matter in SPH 1752 (115.2 q/ha) as compared to CSH 13 genotype. The maximum net returns (26262.4) and B : C ratio (1.74) were observed in genotype HJ 541. On comparison with different fertility levels, highest green fodder (516.37 q/ha) and dry matter (125.08 q/ha) were recorded under 125 per cent RDF. The maximum net returns (Rs. 28095.9 q/ha) and B : C ratio (1.78) were observed with the application of 100 per cent RDF followed by 125 and 75 per cent RDF. Conclusively, the genotypes, HJ 541 and SPH 1752 performed better and the application of RDF was the most suitable and economical fertilization practice.

Key words : Dry matter, green fodder yield, recommended dose of fertilizer (RDF), sorghum

Sorghum [*Sorghum bicolor* (L.) Moench] belonging to family Poaceae, is an important **kharif** season crop which is widely grown to meet the green as well as dry fodder requirement of the livestock. It is a fast growing, adaptive to different environmental condition and palatable nutritious fodder to the animals. India faces a net deficit of 61.1 per cent green fodder, 21.9 per cent dry crop residues and 64 per cent feeds (Sunil Kumar *et al*., 2012). Adequate fertilization and suitable genotypes are among the major factors limiting forage sorghum production in our country. Identification of good quality sorghum genotypes and development of location-specific production technology offer an excellent opportunity to provide fodder for better nutrition to bovine population (Pushpendra and Sumeriya 2012). It is well established fact that nitrogen, phosphorus and potassium play very important role in growth and development of crop plants. Hence, the present study was undertaken to find out the suitable single cut forage sorghum genotypes under different fertility levels.

MATERIALS AND METHODS

The field experiment was conducted during rainy (**kharif**) season at Forage Section Research Farm, CCS Haryana Agricultural University, Hisar, (Haryana), India (29°10' N of 75°46' E, at an average elevation of 215.2 m above mean sea level). The site has semi-arid and sub-tropical climate with hot dry summer and severe cold winter. Average annual rainfall is about 450 mm, 75 per cent of which is received in three months, from July to September during south-west monsoon. The crop received 230.7 mm rainfall for the genotypes SPH 1752 and HJ 541 but 210.9 mm for the CSH 13 during the crop period from date of sowing to harvesting at 50 per cent flowering. Fig. 1 represents the weekly weather parameters i. e. temperature °C (a), relative humidity (%) (b), bright sunshine (h) (c) and rainfall (mm) (d) during the study. The soil of the experimental field was sandy loam in texture, slightly alkaline in reaction (pH 7.2),

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low in available nitrogen (187.4 kg/ha), medium in available phosphorus (13.5 kg/ha) and potassium (148.0 kg/ha) with moderate water holding capacity. The experiment consisted of 12 treatment combinations comprising three single-cut forage sorghum genotypes (SPH 1752 CSH 13 and HJ 541) and four fertility levels viz. 50, 75, 100 (80 kg N+40 kg P_2O_5+40 kg K_2O /ha) and 125 per cent of recommended dose of fertilizer (RDF). These treatments were tested in factorial randomized block design with three replications. As per treatment, full dose of phosphorus, potassium and half of the nitrogen were applied at the time of sowing and rest half of the nitrogen was applied 30 days after sowing. Diammonium phosphate (DAP), muriate of potash (MOP) and urea fertilizers were used as a source of P_2O_5, K_2O and N nutrients, respectively. The genotypes were sown manually on 1st July 2015 in opened furrows at 25 cm apart using seed rate of 40 kg/ha. All the other standard agronomic practices for the cultivation of forage sorghum were followed uniformly in all the treatments. Five plants per plot were randomly selected and leaf length and leaf breadth of fourth leaf from the base of the plant were measured. All the genotypes were harvested at the time of 50 per cent flowering. The harvested green fodder from each plot was weighed *in situ* in kg/plot and then converted into q/ha. A random sample of 500 g was taken from each plot at the time of green fodder harvest, chopped well and put into paper bag. These bags were aerated by making small holes all over. The samples were first sun-dried for 15 days and then transferred in an electric hot air oven for drying at a temperature of 60±5°C till constant weight was achieved. On the basis of these samples, the green fodder yield was converted into dry matter yield (q/ha). Economics was worked out on the basis of prevailing market prices of inputs and outputs in the local market. Data were analyzed by using OPSTAT software available on CCS Haryana Agricultural University website (Sheoran *et al*., 1998). The results are presented at 5 per cent level of significance (P=0.05) for making comparison between treatments.

RESULTS AND DISCUSSION

Fertility levels

The number of tillers per square metre (Fig. 2a) was not affected significantly with the application of different fertility levels at harvest. The highest plant height (Fig. 2b) was recorded with the application of 125 per cent RDF (261.59 cm) which was on a par with the application of 100 per cent RDF (258.15 cm) but significantly superior over rest of the treatments. Data presented in Table 1 reveal that highest number of leaves per plant (13.11), leaf length per plant (80.41 cm) and leaf breadth per plant (8.67 cm) were recorded with 125

TABLE 1
Effect of fertility levels and sorghum genotypes on leaf characters and days to 50 per cent flowering, per day productivity of green fodder & dry matter

Treatment	No. of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)	Days to 50% flowering	Per day productivity (q/ha)	
					Green fodder	Dry matter
A. Fertility levels						
50% RDF	10.52	71.63	7.53	92.67	4.22	0.91
75% RDF	11.70	75.67	7.91	93.11	4.87	1.12
100% RDF	12.59	78.85	8.38	94.89	5.40	1.29
125% RDF	13.11	80.41	8.67	96.11	5.37	1.30
S. Em±	0.33	1.22	0.10	0.73	-	-
C. D. (P=0.05)	0.99	3.61	0.30	2.17	-	-
B. Genotypes						
SPH 1752	14.47	79.78	8.69	105.17	4.66	1.10
CSH 13	9.97	79.56	8.10	79.83	5.23	1.22
HJ 541	11.50	70.58	7.58	96.83	5.10	1.17
S. Em±	0.29	1.06	0.09	0.64	-	-
C. D. (P=0.05)	0.85	3.13	0.26	1.88	-	-
A x B						
S. Em±	0.58	2.12	0.18	1.27	-	-
C. D. (P=0.05)	NS	NS	NS	NS	-	-

100% RDF (80 : 40 : 40 kg N : P_2O_5 : K_2O/ha). NS–Not Significant.

TABLE 2
Economics of sorghum genotypes at different fertility levels during **kharif** 2015

Treatment	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B : C ratio
A. Fertility levels				
50% RDF	34024.1	48356.5	14332.4	1.42
75% RDF	34981.8	56666.7	21684.9	1.62
100% RDF	35922.6	64018.5	28095.9	1.78
125% RDF	36897.0	64546.3	27649.3	1.75
B. Genotypes				
SPH 1752	35456.4	61302.1	25845.7	1.72
CSH 13	35456.4	52170.1	16713.8	1.47
HJ 541	35456.4	61718.8	26262.4	1.74

100% RDF (80 : 40 : 40 kg N : P_2O_5 : K_2O/ha) , B:C-Benefit : Cost ratio.

per cent RDF which were on a par with 100 per cent RDF but significantly superior over rest of the fertility levels. The duration of 50 per cent flowering (96.11 days) was highest with the application of 125 per cent RDF which was on a par with the application of 100 per cent RDF (94.89 days) but significantly superior over rest of the treatments. The highest green fodder yield (516.4 q/ha) (Fig. 2c) and dry matter yield (125.1 q/ha) (Fig. 2d) were recorded with the application of 125 per cent RDF which were on a par with the application of 100 per cent RDF (512.2 q/ha GFY and 122.2 q/ha DMY) but significantly superior over rest of the treatments. The GFY at 125 per cent was 13.90 and 33.48 per cent and DMY was 20.17 and 49.31 per cent higher over 75 and 50 per cent of RDF, respectively. Data presented in Table 1 reveal that maximum per day productivity of green fodder was observed with the application of 100 per cent RDF (5.40 q/ha) followed by 125 per cent RDF (5.37 q/ha). The maximum per day productivity of dry matter was observed with the application of 125 per cent RDF (1.30 q/ha) followed by 100 per cent RDF (1.29 q/ha). Preponderant effects of nitrogen were seen on the growth and productivity of the genotypes which were mainly due to the improvement in nutritional environment of the plants. This was very well evinced from estimates of nutrient status of plants, which showed that nitrogen application not only increased its concentration but also had synergistic effect on other indispensable nutrients. Thus, this assumption was due to its greater availability in soil environment, better extraction by roots and translocation within plant system. The higher plant height and dry matter accumulation per plant occurred due to the improvement in synthesis of amino acids, proteins, growth promoting substances, which finally led to

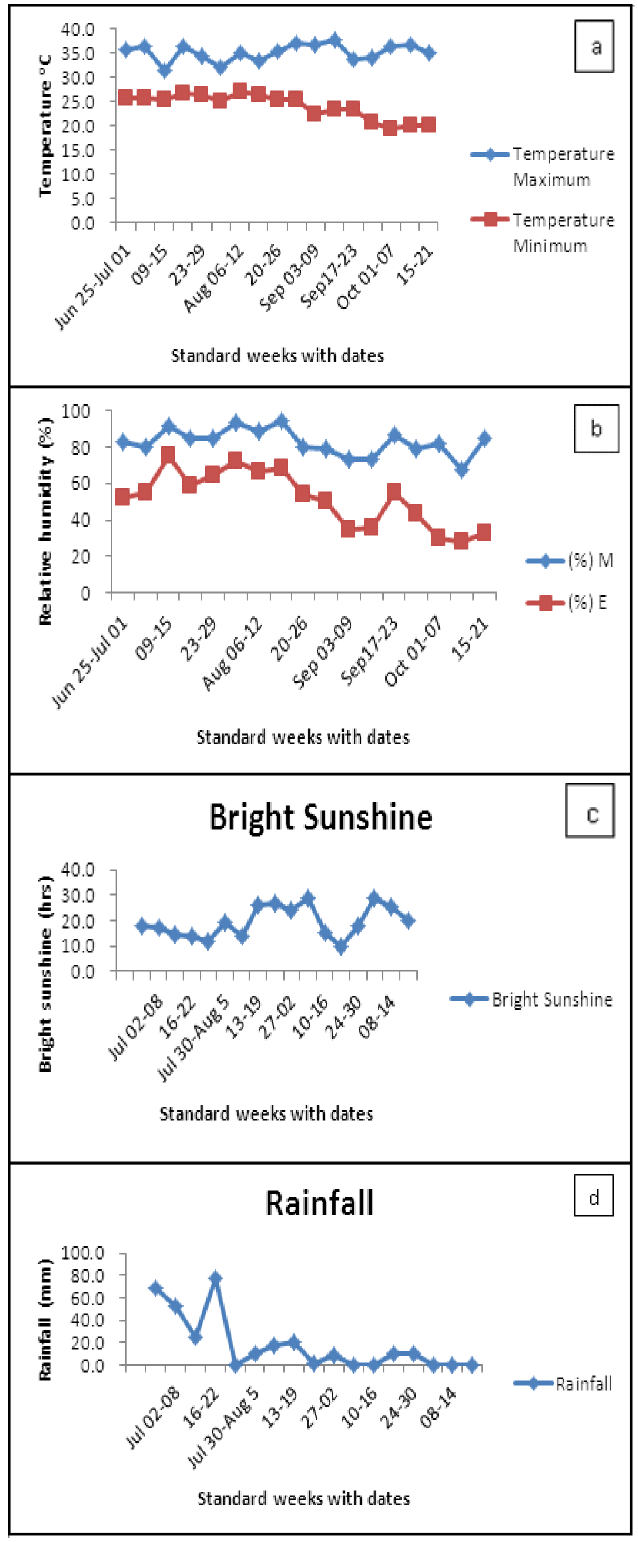

Fig. 1. Weekly weather parameters viz. temperature °C (a), relative humidity (%) (b), bright sunshine (h) (c) and rainfall (mm) (d) during study in **kharif** 2015.

increment in meristematic activity and cell enlargement (Singh *et al.*, 2015). The abundant supply of nitrogen may also have increased protoplasmic constituents that accelerated the process of cell division and elongation, which resulted in luxuriant vegetative growth in terms of plant height, biomass and dry matter. Besides, phosphorus is involved in energy transfer, may have significant increase in the tiller number especially at early crop growth stage thereby resulting in higher tonnage. These results corroborate the findings of Bali *et al.* (2003). The similar increase in green fodder and dry matter yield was also reported by Satpal *et al.* (2015).

Genotypes

The number of tillers per square metre (Fig. 3a) was not affected significantly at harvest in all the genotypes. The highest plant height (Fig. 3b) was noticed in SPH 1752 (282.64 cm) and lowest in CSH 13 (208.17) sorghum genotypes. Data presented in Table 1 reveal that highest number of leaves per plant (14.47) and leaf breadth (8.69 cm) were significantly superior over rest of the genotypes. The maximum leaf length per plant (79.78 cm) was recorded in SPH 1752 which was on a par with CSH 13 but significantly superior over HJ 541. Days to 50 per cent flowering (105.17) were recorded with SPH 1752 and which were significantly superior over rest of the genotypes. The variation in plant height of the genotypes might be related to the inherent difference and their high vigour. The differential behaviour of these genotypes could also be explained solely by variation in their genetic constituent (Meena *et al.*, 2012). The highest green fodder yield (Fig. 3c) was recorded in HJ 541 (493.4 q/ha) which was on a par with SPH 1752 (490.4 q/ha) but significantly superior over CSH 13. The green fodder yield of HJ 541 was 18.30 per cent higher over CSH 13. The highest dry matter yield (Fig. 3d) was recorded with SPH 1752 which was on a par with HJ 541 but significantly superior over CSH 13. The dry matter yield of SPH 1752 and HJ 541 was 18.18 and 16.71 per cent higher over CSH 13, respectively. The lowest green fodder yield (417.4 q/ha) and dry matter yield (97.5 q/ha) were recorded in the

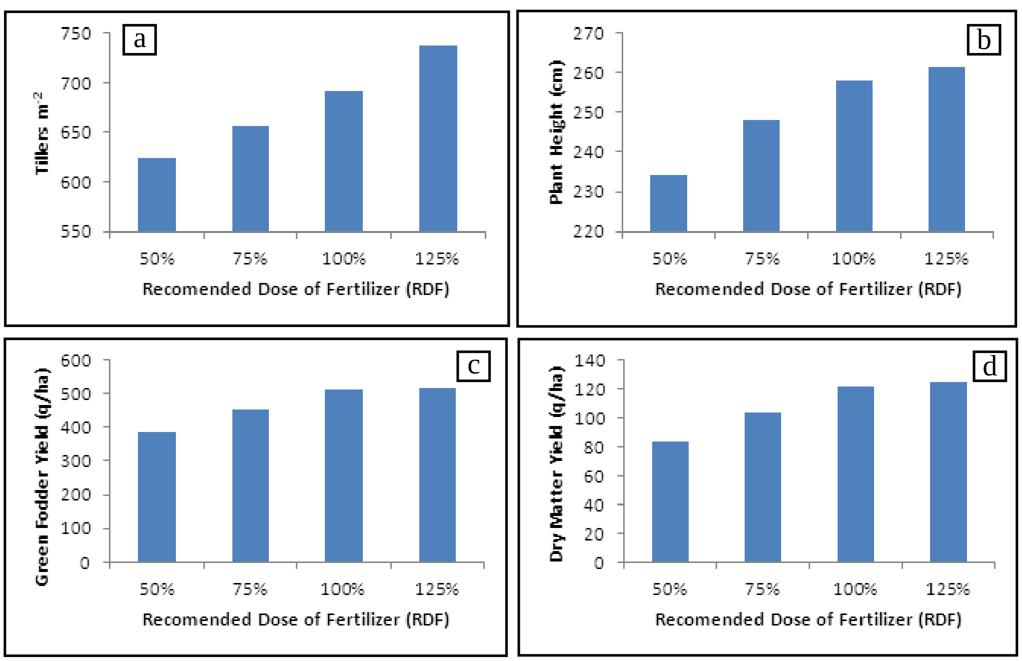

Fig. 2. Effect of fertility levels on (a) number of tillers/m^2, (b) plant height (cm), (c) green fodder yield (q/ha) and (d) dry matter yield (q/ha) of single cut forage sorghum.

genotype CSH 13. Our results are also in concomitant with the observations of Hanuman *et al*, 2008. Data presented in Table 1 reveal that maximum per day productivity of green fodder was observed in genotype CSH 13 (5.23 q/ha) followed by HJ 541 (5.10 q/ha) and SPH 1752 (4.66 q/ha). Similar trend was observed in per day productivity of dry matter among the genotypes. The per day productivity of dry matter in CSH 13 was 4.27 and 10.90 per cent higher over HJ 541 and SPH 1752, respectively.

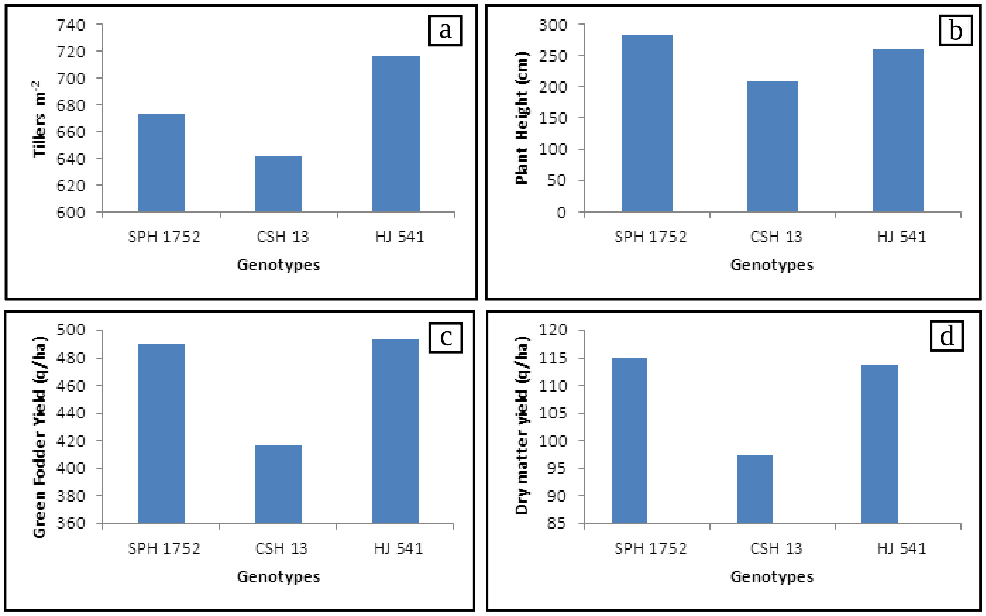

Fig. 3. Effect of genotypes on (a) number of tillers/m^2, (b) plant height (cm), (c) green fodder yield (q/ha) and (d) dry matter yield (q/ha) of single cut forage sorghum.

Economics

The economic analysis (Table 2) indicated that among genotypes, highest gross returns (Rs. 61718.8/ha), net returns (Rs. 26262.4/ha) and B : C ratio (1.74) were recorded in HJ 541 followed by SPH 1742 and CSH 13. Among fertility levels, maximum net returns (Rs. 28095.9/ha) and B : C ratio (1.78) were recorded with the application of 100 per cent RDF (80 kg N+40 kg P_2O_5+40 kg K_2O/ha) followed by the application of 125 and 75 per cent RDF.

CONCLUSION

Based on the results, it can be concluded that among genotypes, HJ 541 recorded highest green fodder yield (493.8 q/ha), which was on a par with SPH 1752. Among fertility levels, the maximum green fodder yield (516.4 q/ha) and dry matter yield (125.1 q/ha) were recorded with the application of 125 per cent RDF (100 kg N+50 kg P_2O_5+50 kg K_2O /ha) which were on a par with the application of 100 per cent RDF (80 kg N+40 kg P_2O_5+40 kg K_2O /ha). But there was 2.71 per cent increase in cost of cultivation with application of 125 per cent RDF over 100 per cent RDF. The maximum B : C ratio was recorded with the application of 100 per cent RDF (1.78) followed by 125 per cent RDF (1.75) and 75 per cent RDF (1.62). In crux, the genotypes HJ 541 and SPH 1752 performed better and application of 100 per cent RDF was the most suitable fertilization practice to achieve the maximum yield of green fodder and dry matter.

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