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Effect of fertility levels and hybrids on growth parameters and yield of multi cut forage sorghum

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Abstract
An experiment was conducted at RCA, Udaipur, Rajasthan during Kharif season of 2022 on multi cut forage sorghum hybrid under different fertility levels. The experiment consisted four main plots of fertility levels (control, 50% RDF, 100% RDF, 150% RDF) and four subplots of hybrids (SPH 1966, SPH 1967, SPH 1970, CSH 24MF) in split plot design and replicated thrice. Results revealed that maximum growth and yield of forage sorghum was recorded by the application of 150% RDF at each cut. Among hybrids, SPH 1966 recorded significantly higher plant height, number of tillers hill^{-1}, number of leaves and green and dry fodder at each cut.

Keywords: Forage sorghum, hybrid, number of tillers

Introduction
Sorghum (*Sorghum bicolor* L. Moench) belongs to and ropogoneae tribe of family Poaceae and sub-family Panicoideae. It was traditionally grown for grain, but also used as fodder for animals, biofuel and alcohol beverages production. At present, it is an important source of fodder mainly in Kharif season. Leafiness, high palatability, quick and copious tillers, high dry matter content, hardiness and suitability for silage making make it a perfect fodder crop. Out of total demand of fodder in kharif season, around 60-70% is met from sorghum. It is highly palatable for livestock in comparison to other fodder, so it is more preferred by farmers. It provides hay and silage along with green fodder. Multi-cut fodder sorghum is mainly grown under irrigation and single cut is grown mainly as rain fed crop in kharif season. It is preferring to grow in tropical, warmer and semi-arid regions of the world, due to its high drought adaptation capability. On the dry matter basis forage sorghum contains 9 to 10% crude protein, 37 to 42% acid detergent fibre, 60 to 65% neutral detergent fibre, 21 to 23% hemicellulose and 32% cellulose at 50% flowering stages (Kumar *et al*., 2012) [1]. Globally, Sorghum production was 58.54 million metric tons in 2022. India ranks sixth and contributes 8 percent to the total sorghum production globally *i.e.*, 4.40 million metric tonnes (USDA, 2022) [7]. For proper growth and development of sorghum crop, adequate and balanced nutrition is an important factor. Proper nutrient management has played vital role in achieving self-sufficiency in sorghum forage production, but extensive application of the fertilizers without proper recommendation to increase the productivity and profitability have brought the higher consumption of the nutrients ultimately leading to higher cost of cultivation, lower nutrient use efficiencies and increased environmental problems. In fodder crops for more yield production, nitrogen is one of the key nutrients. Sorghum being a non-leguminous crop is highly responsive to nitrogenous fertilizer. Different varieties respond to different doses of fertilizer application, so to obtain required yield and quality determine the fertilizer requirement of varieties. The aim of this study investigates performance of multi cut forage sorghum hybrid under different fertility levels on growth parameters and yield.

Materials and Methods
An experiment was carried out during Kharif 2022 at RCA, MPUAT, Udaipur, India. The soil of the field was clay-loam, organic carbon was high (0.77%), slightly alkaline in nature (pH 7.8), available nitrogen was low (282.76 kg ha^{-1}), available phosphorus was medium (22.40 kg ha^{-1}) and available potassium was high (318.45 kg ha^{-1}). In split plot design, main plots contain four fertility levels (Control, 50% RDF, 100% RDF, 150% RDF) and four hybrids (SPH 1966, SPH 1967, SPH 1970, CSH 24MF) in sub plots and replicated thrice.

Plot size was 4.50 m × 5.10 m. N was supplied through DAP and urea, P through DAP and K through K_2O. Only 1/3 dose of N was supplied as basal dose at the time of sowing and remaining was top dressed in two equal splits after first and second cut of crop. Full dose of P and K was supplied according to the treatment at the time of sowing as basal dose. For evaluation of the experiment, five plant samples were taken from each plot.

Result

Plant height: Maximum height of the crop was obtained with the application of 150% RDF over 50% RDF, 100% RDF and control and among the hybrids, SPH 1966 showed significantly highest plant height superior over all the hybrids, at each cut.

Tillers hill^{-1}: The application of 150% RDF produced maximum number of tillers hill^{-1} at all three cuts which was statistically at par with 100% RDF and among the hybrids, SPH 1966 showed significantly maximum number of tillers hill^{-1} at each cut.

Leaf number plant^{-1}: In different fertility levels with the application of 150% RDF there was maximum leaf number plant^{-1} at each cut. However, it was statistically at par with 50 and 100% RDF at first and third cut and significantly superior over rest of the fertility levels. Among the hybrids, SPH 1966 produces significantly maximum leaf number plant^{-1} at second cut over hybrids SPH 1967 and CSH 24 MF and it was statistically at par with SPH 1970. There was no significant variation in leaf number plant^{-1} at first and second cut.

Overall development in sorghum crop may be due to increased rate of fertilizer, responsible for modifying the soil and plant environment which make it conducive for development of both morphological and biochemical components. Development in these components might be responsible for higher root growth and its proliferation which helps in better uptake of nutrients from the soil. Similar findings were found with Tandon and Narayan, 1990 [6]. And the different behavior of these hybrids in respect to growth parameters could be explained entirely by the variations in their genetic heritance. (Shivadhar *et al.*, 2005) [5].

Fodder yield: Maximum green and dry fodder yield was obtained at first, second and third cut by the application of 150% RDF and it was superior over rest of the fertility levels. Right from sowing of crop, availability of the nutrients and metabolites caused vigorous growth and development in reproductive structure, which leads to higher productivity of each plant. The results of the present investigation are in close agreement with the findings of Kumar and Chaplot (2015) [2], Satpal *et al.* (2016) [3]. Among hybrids, maximum green fodder yield was recorded by SPH 1966 at each cut. At first and second cut, it was statistically at par with SPH 1970 and with CSH 24 MF at second cut. At third cut, it was significantly higher over rest of the hybrids. Maximum dry fodder yield was also recorded by SPH 1966 and it was statistically at par with SPH 1970 at first cut and SPH 1970 & CSH 24 MF at second cut. Difference in green and dry fodder yield of the sorghum hybrids might be due to high vigour and genetic differences in growth characters. Similar research results were also done by Satpal *et al*. (2018) [4] and Yadav *et al*. (2019) [8].

Table 1: Effect of fertility levels and hybrids on growth parameters of multi cut sorghum

Treatments	Plant height (cm)			Tiller number hill^{-1}			Leaf number plant^{-1}		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
Fertility levels									
Control	190.27	178.53	144.07	2.63	2.11	1.68	8.22	6.80	4.80
50% RDF	242.77	221.18	187.63	2.96	2.13	1.78	9.29	8.13	5.75
100% RDF	258.93	250.75	220.21	3.60	2.37	2.12	9.43	8.69	5.74
150% RDF	264.57	273.50	233.98	3.80	2.39	2.17	9.49	9.19	6.17
S.Em±	6.79	4.24	4.77	0.14	0.06	0.04	0.22	0.10	0.15
CD (P= 0.05)	23.51	14.68	16.50	0.47	0.19	0.15	0.77	0.36	0.53
Hybrids									
SPH 1966	258.66	253.86	215.05	3.43	2.39	2.10	9.39	8.38	5.66
SPH 1967	230.97	218.05	185.95	3.30	2.17	1.76	8.66	7.96	5.58
SPH 1970	217.28	231.20	197.98	2.93	2.25	2.07	9.15	8.35	5.60
CSH 24 MF	249.63	220.86	186.91	3.33	2.19	1.83	9.22	8.13	5.62
S.Em±	3.00	2.87	2.98	0.11	0.05	0.04	0.22	0.07	0.11
CD (P=0.05)	8.761	8.39	8.70	0.32	0.15	0.12	NS	0.21	NS

Table 2 Effect of fertility levels and multi cut sorghum hybrids on green and dry fodder yield (kg ha^{-1})

Treatments	Green fodder (kg ha^{-1})			Dry fodder (kg ha^{-1})		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
Control	41882	15700	14962	10986	4247	3663
50% RDF	55123	20339	18238	14292	5364	4474
100% RDF	59728	24407	20228	15667	6529	4957
150% RDF	69535	26837	22348	18239	7155	5459
S.Em±	1256	598	398	323	141	94
CD (P= 0.05)	4348	2070	1376	1118	489	325
SPH 1966	60923	22890	20191	15813	6048	4925
SPH 1967	53231	20590	17956	13963	5523	4408
SPH 1970	57443	22312	19036	15067	5976	4667
CSH 24 MF	54671	21490	18593	14340	5747	4553
S.Em±	1226	516	349	321	134	87
CD (P=0.05)	3578	1506	1018	936	391	254

Conclusion

This study concluded that higher application of nutrient *viz.*, 150% RDF gave maximum growth and yield at each cut and among hybrids SPH 1966 gave best results on growth parameters and yield.

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