

Optimization of production potential of single cut forage sorghum under resources constraints

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ABSTRACT

A field experiment was carried out during Kharif season of 2016 at Sorghum research station, S.D. Agricultural University, Deesa (24.5° N, 72° E and 134 M above mean sea level) under rainfed condition to evaluate the effect of resource constraints on productivity of single cut forage sorghum. Eight treatments combinations of resource constraints viz; (1) control (only improved hybrid without any input) (2) full package of practices (FPP i.e. RDF 80 : 40 : 0 NPK kg/ha + Weed control (herbicide and weeding) + Plant protection (application of insecticide and fungicides including seed treatment with fungicides) + Seed treatment with PSB and Azospirillum + Thinning + Improved hybrid) (3) FPP without fertilizer (4) FPP without weed control (5) FPP without plant protection (6) FPP without seed treatment with PSB and Azospirillum (7) FPP without thinning and (8) FPP without improved hybrids (Local Varieties) were evaluated in randomized block design with three replications. Growing of improved hybrids or local variety with full package of practices recorded maximum fodder yield and net realizations. Fertilizer, seed treatment with PSB and azospirillum, and plant protection were identified as most important input resources for the production of single cut forage sorghum crop

Key words: Forage sorghum, fertilizer, seed treatment, plant protection

Sorghum (*Sorghum bicolor* L. (Moench)) is one of the most important grain and forage crops. It is an unique forage crop after Lucerne in the arid and semi arid tropics. It can be extensively grown during kharif and summer season mostly due to its high yielding, good palatability, better nutritive value and quick re growth after first cut particularly in multi cut sorghum variety. The production of rainy season sorghum crop is declining every year due to imbalance application of fertilizers including micronutrients, non adoption of weed management and plant protection practices, seed treatment with bio fertilizers and use of local varieties/hybrids under assured rainfall areas. Since the possibilities of horizontal expansion or putting more area under cultivation of forage sorghum is difficult, so future augmentation in yield should have to be harnessed vertically through increase

in production by judicious management of input resources. Moreover, under dry land area, where shortage of input resources is a common problem, economically weak farmers forced to exclude/omit the some of the important input resources in crop for proper forage sorghum production. Therefore the present experiment was conducted to find out the resources constraints on production of single cut forage sorghum under arid and semi arid condition of north Gujarat.

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MATERIALS AND METHODS

A field experiment was carried out during kharif season of 2016 at Sorghum research station, S.D. Agricultural University, DEESA (24.5° N, 72° E and 134 M above mean sea level) under rainfed condition

to evaluate the effect of resource constraints on productivity of single cut forage sorghum. The experiment site has loamy sand soil with pH (7.85), organic carbon (0.26 %), available nitrogen (145.2

OPTIMIZATION OF PRODUCTION POTENTIAL

kg/ha), medium in available phosphorus (29.2 kg/ha) and available potassium (288 % kg/ha). Eight treatments combination of resource constraints viz; (1) control (only improved hybrid without any input) (2) full package of practices (FPP i.e. RDF 80 : 40 : 0 NPK kg/ha + Weed control (herbicide and weeding) + Plant protection (application of insecticide and fungicides including seed treatment with fungicides) + Seed treatment with PSB and Azospirillum + Thinning + Improved hybrid) (3) FPP without fertilizer (4) FPP without weed control (5) FPP without plant protection (6) FPP without seed treatment with PSB and Azospirillum (7) FPP without thinning and (8) FPP without improved hybrids (Local Varieties) were evaluated in randomized block design with three replications. The recommended dose of fertilizer for sorghum was 80:40:00 N, P₂O₅ and K₂O. Half dose of nitrogen and full dose of phosphorus and potassium was applied as basal and remaining half

dose of nitrogen was applied 30 days after sowing. Hybrid forage sorghum CSH 13 and local variety GFS 5 was sown at a distance of 30 cm on 22, July, 2016 with a 20 kg per hectare seed rate by drilling methods. There was no much variation in weather like relative humidity, maximum and minimum temperature during the crop growth period. During the period of study, the relative humidity varied from 31.71 to 90.00 % and minimum temperature 14.74 to 28.53 c° and maximum temperature from 29.30 to 37.20 c°. The total rainfall 449 mm was received during the cropping period having 208 mm in the month of July and 183 mm in the month of August. The forage sorghum crop was harvested at 50 % flowering stage (i.e. 71 DAS). The growth, yield and yield attributes parameters of forage sorghum were recorded from the net plot and yield was converted in to hectare basis. The green and dry fodder productivity was calculated by following formula.

$$\text{Green/Dry fodder productivity (kg/ha/day)} = \frac{\text{Green/Dry fodder yield (kg/ha)}}{\text{Total crop duration (Days)}}$$

The economics were calculated based on the prevailing market prices of inputs and outputs. The data of the experiment was statistically analyzed by using OPSTAT software design by HAU, Hisar.

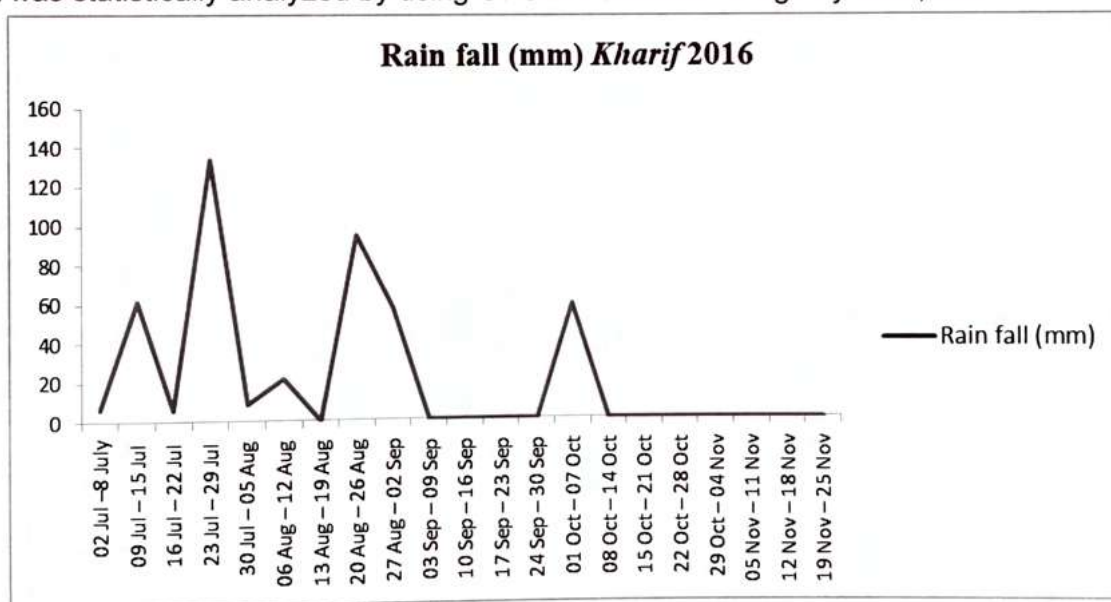


Fig.1. Weekly rainfall distribution during kharif season 2016.

RESULTS AND DISCUSSION

Significant effect of different treatments of resources constraints were observed on plant height, stem diameters, green and dry fodder yield and their productivity per days. (Table: 1) The growth parameters viz; plant height and stem diameter were found significantly taller / higher with the adoption of full package of practices

(FPP) under improved varieties as compared to control treatments. The growth of improved forage sorghum crop with full package of practices i.e. without any resources constraints recorded taller/ higher plant and it was closely followed by growing of local variety without any resource constraints by recording 103.75 and 97.34 % taller plant than

control treatments, respectively. The response of omitting the plant protection, seed treatments with PSB and azospirillum, weed management and thinning was recorded more or less equal plant height. The omission of fertilizer to single cut forage sorghum crop drastically reduced the plant height. This might be due to the better growing conditions to fully exploit the gentle potentiality of the improved variety of the sorghum crop.

The stem diameter was markedly influenced by different resources constraint treatments. Significantly the highest stem diameter was recorded by the application of full package of practices to the improved hybrid and it was found equally effective to the local cultivars of the forage sorghum crop. The omission of the resources constrains like weed control, plant protection and thinning were found equally effective for stem diameter growth. Thus difference in growth of forage sorghum might be attributed to their genetically constitution.

The productivity of forage sorghum per day was markedly influenced by different treatment of resource constraints. The green and dry fodder productivity per day of forage sorghum was significantly highest when improved sorghum hybrid was grown without any resources constraints and it was closely followed by local variety without any resources constraints. The response of omission of weed control, plant protection, seed treatments and thinning did not reduced the productivity of the forage sorghum crop but the omission of fertilizers resources drastically reduced the productivity of the forage sorghum crop. The growing of improved hybrids of forage sorghum without any resource constraints recorded significantly highest green and dry fodder yield and which was to the tune of 196.6 and 337.4 per cent higher than control treatments

but it was at par with the FPP without thinning treatment. Moreover sowing of improved hybrid with seed treatment of PSB + azospirillum, without omission of plant protection and weed control expressed more or less equal green and dry fodder yield. The higher green and dry fodder yield might be due to higher plant height and stem diameter under this treatments. Abdullani *et al.* (2016) also found more or less similar results. The maximum reduction in green and dry fodder yield were observed under control treatment and it was followed by omission of fertilizers.

Economics

The economic parameters of the fodder sorghum was calculated on the basis of prevailing market prices of inputs and outputs (Table : 2). The maximum gross return, net return and benefit cost ratio was obtained when the improved hybrids of the sorghum crop was grown without omission of the resource constraints. Consequently the owing of improved hybrid with full package of practices recorded higher percentage increase in green and dry fodder yield over control followed by FPP without thinning and FPP without weed control. This was because of higher production potential of forage sorghum crop under favourable resource constraints. Lowest net realization and benefit cost ratio was recorded under FPP without seed treatment with PSB and azospirillum and FPP without fertilizers.

Based on the present results, it can be concluded that growing of improved hybrids or local variety with full package of practices recorded maximum fodder yield and net realizations. Fertilizer, seed treatment with PSB and azospirillum, and plant protection were identified as most important input resources for the production of single cut forage sorghum crop

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Table 1 Yield and yield attributes of single cut forage sorghum as influenced by different resource constraints

Tr. No.	Treatments	Plant height (cm)	Stem diameter (cm)	Fodder Yield (t/ha)		Productivity (kg/ha/day)		Per cent yield increase over control	
				Green	Dry	Green	Dry	Green	Dry
1	Control (only improved hybrid without any input)	97.80	3.14	16.93	7.91	238.45	70.34	-	-
2	full package of practices (FPP)	199.27	4.24	50.21	34.60	707.19	307.63	196.6	337.4
3	FPP without fertilizer	99.73	3.90	35.05	18.32	493.64	162.90	107.0	131.6
4	FPP without weed control	182.73	4.17	41.40	27.54	583.06	244.89	144.5	248.2
5	FPP without plant	188.07	4.14	36.30	23.57	511.27	209.62	114.4	198.0
6	FPP without seed treatment with PSB and Azosporillium	186.60	3.77	32.81	22.24	462.07	197.77	93.8	181.2
7	FPP without thinning	177.60	4.09	46.72	31.30	657.99	278.33	176.0	295.7
8	FPP without improved hybrids (i.e. Local Varieties)	193.00	4.20	40.97	27.97	577.07	248.72	142.0	253.6
	SEm±	7.05	0.11	2.12	0.93	29.80	11.64		
	CD (5%)	15.26	0.23	4.58	2.83	64.53	25.20		

Table 2 Economics of single cut forage sorghum as influenced by different resource constraints

Tr. No.	Treatments	Green fodder yield (t/ha)	Dry Fodder Yield (t/ha)	Gross return (10 ³ Rs/ha)	Net return (10 ³ Rs/ha)	BCR
1	Control (only improved hybrid without any input)	16.93	7.91	42.32	27.52	1.86
2	Full package of practices (FPP)	50.21	34.60	125.53	100.27	3.97
3	FPP without fertilizer	35.05	18.32	87.62	65.40	2.94
4	FPP without weed control	41.40	27.54	103.49	81.36	3.68
5	FPP without plant	36.30	23.57	90.75	68.38	3.06
6	FPP without seed treatment with PSB and Azosporillium	32.81	22.24	82.02	56.96	2.27
7	FPP without thinning	46.72	31.30	116.79	92.73	3.85
8	FPP without improved hybrids (i.e. Local Varieties)	40.97	27.97	102.43	78.67	3.31
	SEm±	2.12	0.93	5.29	5.29	0.27
	CD (5%)	4.58	2.83	11.45	11.45	0.58