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EFFECT OF DIFFERENT FERTILITY LEVELS AND GENOTYPES ON YIELD AND ECONOMICS OF SINGLE CUT FORAGE SORGHUM UNDER RAINFED ENVIRONMENT OF THE NORTH GUJARAT

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SUMMARY

A field experiment was conducted at Centre for Millets Research, SDAU, Deesa during *kharif*-2018 with four single cut forage sorghum genotypes (CSV 21F, CSV 30F, SPV 2445 and SPV 2316) grown at three fertility levels {75% recommended dose of fertilizer (RDF), 100% RDF (80 kg N + 40 kg P_2O_5 ha-1) and 125% RDF}. Results showed that application of 75% RDF markedly increased growth parameter plant height while 100 % RDF markedly increased yield attributes like stem diameter, green and dry fodder yields, fodder productivity and profit in single cut forage sorghum. Genotype SPV 2316 was promising as single cut forage sorghum under rain-fed environment of Northern Gujarat as it performed well in terms of growth, yields and productivity with higher remuneration than other genotypes.

Key words : Fertility levels, single-cut, forage sorghum, sorghum genotypes, green fodder yield, economics

Sorghum [*Sorghum bicolor* (L.) Moench] is widely grown to meet requirement of fodder, feed, food and fuel. It is highly adaptive to wide edapho climatic conditions and provides palatable nutritious fodder for huge livestock population of India *i.e.* 536.76 million (Anonymous, 2020). In India, the area under sorghum is approximately 7.38 million hectares with an annual production of 8.71 million tonnes. (Anonymous, 2022). At present, in India 8.6 million hectare of the cultivated area with productivity of green fodder was 50 t/ha and dry fodder of 10-15 t/ha. Demand of green and dry fodder yields were 851.3 and 530.5 million tones, respectively and supply of green and dry fodder yield 590.4 and 467.6 million tonnes respectively (Anonymous, 2020). To satisfy the demand of the current level of livestock and its annual growth in population, the deficit has to be met from either increasing productivity or increasing land area under fodder cultivation or through import.

Sorghum [*Sorghum bicolor* (L.) Moench] is known as the king of forage millets crops. Sorghum fodder contains more than 50 per cent digestible nutrients which consist of 8-10 per cent protein, 2.5 per cent fat, 45 per cent nitrogen free extract (NFE), 70 per cent carbohydrates and minerals. Dairy farming is a back bone of the farmers and economy in North Gujarat area owing to poor land holding and uncertain climatic conditions. In spite of large livestock population of the state, the production of milk continues to be exceedingly low. Inadequate and poor quality feed and fodder supplied to the milch animals is the main cause of low milk production. There is an urgent need to boost the production of good quality fodder for improving the health of the vast livestock population of the state (Anonymous, 2021). Identification of location specific genotypes with good fodder quality, higher fodder yields and early stage of harvesting (days to 50 % flowering) are essential to achieve sustainable productivity of livestock. Nutrient management is the practice of using nutrients for optimum economic benefit, with minimizing impact on the environment. Plant nutrients, which come primarily from chemical fertilizers which when applied in proper quantities and at appropriate times, nutrients (especially nitrogen, phosphorus and potassium) help to achieve optimum crop yields. Thus, location specific genotypes and recommended nutrients application are very important to realize potential fodder yield with better quantity of fodder produced. It is essential to determine the fertilizer requirements of single-cut sorghum as new emerge every year. Hence, the present study was undertaken to assess the impact of different fertilizer levels on production, productivity and quality of promising single-cut forage sorghum genotypes.

MATERIALS AND METHODS

A field experiment was conducted at Centre for Millets Research, SDAU, Deesa during *kharif* 2018 with four single cut forage sorghum genotypes (CSV 21F, CSV 30F, SPV 2445 and SPV 2316) grown at three

fertility levels [75% recommended dose of fertilizer (RDF), 100% RDF (80 kg N + 40 kg P_2O_5/ha) and 125% RDF]. The 100 % P_2O_5 and 50 % N in respective treatments were applied as a basal while remaining 50 % N was applied at 35 DAS. The site of experiment is situated in the North Gujarat Agro-climatic Zone IV (AES-I) of Gujarat. The climate of this region is semi-arid and sub-tropical with fairly dry and hot summer. The experimental soil was loamy sand in texture and slightly alkaline in reaction with pH 7.81 and EC 0.18 dS/m. It was moderately fertile being low in organic carbon (0.28 %) and low in available nitrogen (167.5 kg/ha), medium in available phosphorus (28.18 kg/ha) and high in available potassium (273.30 kg/ha). The twelve treatment combinations consisted of three levels of fertilizers and in main plots and 4 Genotypes as sub-plots treatments were evaluated using split-plot design with 3 replications. The seeds were sown keeping 30 cm row spacing using 20 kg seeds/ha and the crop was irrigated immediately after sowing. The required cultural practices were followed as per recommended package. The sun dried bundles were weighed and data on green and dry fodder yields were recorded. Gross returns were calculated based on dry fodder yield of the crop and their prevailing market prices at the time of harvesting.

RESULTS AND DISCUSSION

Fertility levels

Growth characters such as plant height increased significantly with decreasing fertility level up to 75% RDF (248.08 cm) (Table 1), while stem diameter increased significantly with increase fertility level up to 125 % RDF (3.95 cm) (Chongtham *et al.,* 2018 and Meena *et al.,* 2017). Green fodder yield value was noted significantly the highest under 100% RDF (505.55 q/ha) (Chongtham *et al.,* 2018). Sufficient supply of nitrogen might have enhanced synthesis of amino acids, proteins and growth promoting substances, which led to accelerated cell division and elongation and ultimately resulted in luxuriant vegetative growth in terms of stem diameter and dry matter (Singh *et al*., 2015). In addition, phosphorus being responsible for energy transfer, could have significantly increased plant growth especially at early crop growth stage which was ultimately reflected in higher green fodder and dry matter yield. Similar findings were also reported by Satpal *et al.* (2015 and 2016).

Application of 100% RDF also registered the highest value of net return (‘ 60425/ha) and BCR (2.39) (Table 2). While combined effect of level fertility and variety, highest net return was recorded in F_2 (100 % RDF and V_3 (SPV 2445) *i.e.* F_2V_3 (Table 3). This could be attributed to better growth and yield under high fertility level.

Genotypes

Among all genotypes, CSV 30F registered significantly the highest plant height (262.80 cm) and in case of stem diameter maximum value (4.08 cm) was registered by SPV 2445.

Variation in genetic constitution of different genotypes could be the reason for their differential behaviors. Earlier findings of Rana *et al*. (2013) corroborated with this results. The highest green fodder yield (487.03 q/ha) was recorded under SPV 2316 could mainly be attributed to comparatively higher

TABLE 1
Growth and yield of various genotypes of sorghum as influenced by different fertility levels

Treatment	Plant height at harvest (cm)	Stem diameter (cm)	Days to 50% flowering	Plant population/ meter row length	Green fodder yield (q/ha)	Dry fodder yield (q/ha)
Fertility levels (F)						
F1 : 75% RDF	248.08	3.74	73.83	19.25	450.00	176.39
F2 :100% RDF	244.90	3.94	76.25	19.75	505.55	207.87
F3 : 125% RDF	242.92	3.95	75.42	21.33	430.09	165.79
S. Em±	3.81	0.06	0.30	0.78	4.43	2.31
CD (p=0.05)	NS	NS	1.19	NS	17.87	9.32
Genotypes (V)						
V1 :CSV 21 F	257.47	3.67	65.67	19.11	486.42	187.04
V2 :CSV 30 F	262.80	4.07	79.78	19.33	412.34	165.43
V3 :SPV 2445	253.20	4.08	74.56	20.67	461.73	201.85
V4 :SPV 2316	257.82	3.68	80.67	21.33	487.03	179.01
S. Em±	2.95	0.12	1.03	0.50	7.27	5.12
CD (p=0.05)	8.82	0.36	3.08	NS	21.78	15.33
CV %	5.64	12.31	5.31	10.84	6.37	11.04
F × V	NS	NS	NS	NS	NS	NS

TABLE 2
Economics of different treatments

Treatment	Cost of cultivation (Rs./ha)	Dry fodder yield (q/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
(A) Fertility levels (F)					
F_1 : 75 % RDF	42767	176.39	88193	45426	2.06
F_2 :100 % RDF	43510	207.87	103935	60425	2.39
F_3 :125 % RDF	44280	165.79	82870	38590	1.87
(B) Genotypes (V)					
V_1 : CSV 21 F	43519	187.04	93518	49999	2.15
V_2 : CSV 30 F	43519	165.43	82715	39196	1.90
V_3 : SPV 2445	43519	201.85	100926	57407	2.32
V_4 : SPV 2316	43519	179.01	89505	45986	2.06

Selling price of dry fodder-5 Rs./kg.

TABLE 3
Economics of different treatment combinations

Treatment	Cost of cultivation (Rs./ha)	Dry fodder yield (q/ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
F_1V_1	42767	175.93	87963	45196	2.06
F_1V_2	42767	153.70	76850	34083	1.80
F_1V_3	42767	192.59	96295	53528	2.25
F_1V_4	42767	183.33	91665	48898	2.14
F_2V_1	43510	209.26	104628	61118	2.40
F_2V_2	43510	187.04	93518	50008	2.15
F_2V_3	43510	233.33	116667	73157	2.68
F_2V_4	43510	201.85	100925	57415	2.32
F_3V_1	44280	175.93	87963	43683	1.99
F_3V_2	44280	155.55	77777	33497	1.76
F_3V_3	44280	179.63	89815	45535	2.03
F_3V_4	44280	151.85	75925	31645	1.71

Selling price of dry fodder-5 Rs./kg.

plant height, leaf stem ratio, number of leaves per plant and stem girth of genotypes (Gurjar *et al.,* 2019) while dry fodder yield (201.85 q/ha) were recorded by SPV 2445 this both were statistically at par with SPV 21F (Oberol *et al.,* 2020) and significantly better than rest of the genotypes. Several workers have also recorded the variation among the genotypes of sorghum for forage yield and growth characteristics (Hanuman *et al*., 2008; and Satpal *et al*., 2016).

Similarly, the genotype SPV 2445 had maximum gross return (Rs. 100926), net return (Rs. 57407) and BCR (2.32). The economic benefits accrued could be attributed to better growth and yield of these genotypes under high fertility level.

CONCLUSION

Based on above findings, it can be inferred that application of 100% RDF to genotypes SPV 2445 should be advocated for high yield (233.33 q/ha), net return (Rs. 73157/ha) and BCR (2.68) for single cut forage sorghum production under rainfed environment of the Northern Gujarat.

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