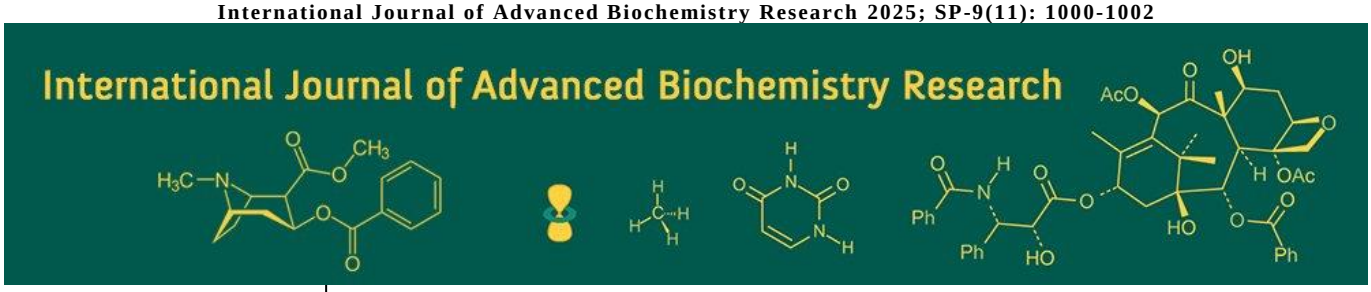

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(11): 1000-1002
www.biochemjournal.com
Received: 23-08-2025
Accepted: 26-09-2025

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Effect of nitrogen scheduling and cultivars on *kharif* grain sorghum (*Sorghum bicolor* L.)

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i11Sm.6370

Abstract
A field study was done during the *kharif* season from 2022-23 to 2024-25 at the Main Sorghum Research Station in Surat, NAU, Surat to check how effect of nitrogen scheduling and cultivars on *kharif* grain sorghum (*Sorghum Bicolor* L.). Results showed that significantly highest grain and stover yields of sorghum were achieved with N3: 25% as basal +50% at 30 DAS + 25% at boot leaf stage, which was at par with N2 (50% N as basal + 25% N at 30 DAS + 25% N at boot leaf stage).

Keywords: Sorghum, grain sorghum, millet, nitrogen, fertilizer, fertilization, scheduling, cultivars, GNJ-1, GJ-44, Boot leaf stage, grain, Stover, Gujarat

Introduction
Sorghum (*Sorghum bicolor* L.) is the most important type of millets and rank as the fourth major cereal crop after maize, wheat and rice. It is used food, feed and fodder crop. In India, the area under Sorghum is approximately 5127 lakh ha with an each year, production of about 4370 lakh tonnes and an average productivity of 952 kg/ha. In Gujarat, it is cultivated over an area of 84.88 lakh ha with a production and productivity of 115.33 lakh tonnes and 1359 kg/ha, respectively.

Among essential plant nutrients, nitrogen plays the significant role in augmenting agricultural productions and its deficiency limits crop production (Aulakh and Malhi, 2005) [3]. The use and demand of nitrogen is going up every day. Because nitrogen moves easily through soil and plants, it is often lost in different ways (Abd EI-Lattief, 2011) [1]. Even when farmers use the best ways to manage nitrogen, 30 to 50% of applied nitrogen lost through different mechanism and hence, the farmer have to apply more nitrogen than actual need of the crop to compensate the loss. Using a planned approach for applying nitrogen is low cost effective way to reduce nutrient losses, so that nutrient supply is synchronized with plant demand and increases NUE (Gehl *et al.*, 2005) [4]. During the last few years, many high yielding cultivars of grain sorghum have been evolved. Cultivars of a crop plays an important role in increasing crop production but information on the response of newly evolved cultivars to split application of nitrogen is meagre. Considering these facts an experiment was conducted for evaluation of nitrogen scheduling and cultivars on *kharif* grain sorghum.

Materials and Methods
A field experiment was carried out at Main Sorghum Research Station, Navsari Agricultural University, Surat (Gujarat) during 2022-23 to 2024-25 to find out the effect of nitrogen scheduling and cultivars on *kharif* grain sorghum. The experiment was set up in RBD design with factorial concept which replicated thrice with two factors of cultivars and four factors of Nitrogen scheduling *i.e.*; Factor-A:-Cultivars: V_1: GNJ-1 and V_2: GJ-44, and Factor-B: Application of Nitrogen Scheduling: N_1: 50% N as basal + 50% N at 30 DAS, N_2: 50% N as basal + 25% N at 30 DAS + 25% N at boot leaf stage, N_3: 25% N as basal + 50% N at 30 DAS + 25% N at boot leaf stage, N_4: 25% N as basal + 50% N at 30 DAS + 15% N at boot leaf stage + 10% N at grain filling stage. The gross plot size of each experimental unit was 4.5 m x 5.1 m and net plot size was 3.6 m x 4.5 m. The crop was sown with spacing of 45 cm x 15 cm, FYM 5 t/ha and 80-40-00 kg N-P_2O_5-K_2O/ha fertilization with seed treatment of

Azospirillum + PSB @ 10 ml/kg seed. The basal fertilization was supplied through DAP and urea, while top dressing through urea.

Plant was counted and recorded from net plot for plant population. Flowering days for 50% plants and days to physiological maturity were recorded. Plant height was recorded from five randomly selected plants from the net plot area and marked with tags. The heights of each tagged plants was measured from ground level to the top of the plant when they were harvest. The average height was then calculated and expressed in cm. Earhead length and 100 seed weight was recorded from tagged plants. The green fodder was harvested by hand with the help of a sickle, after sun drying stover tied together. The earhead was harvested, dried and threshed manually. Grain yield and stover yield was weighed in kg for each net plot and then converted into kilogram per hectare.

Results and Discussion

Growth attributing characters

Growth attributing characters of sorghum *viz*., initial and final plant population, days to 50% flowering and days to physiological maturity were not influenced significantly due to various cultivars as well as nitrogen scheduling. Plant height was found significantly higher with GNJ-1 cultivar of sorghum while, plant height remained unaffected by nitrogen scheduling (Table-1). Higher plant height with GNJ-1 cultivar was found due to physiological characteristics of the cultivars.

Yield and yield attributes

The yield attributing characters of sorghum *viz*., 100 seed weight was not significantly influenced due to various cultivars as well as nitrogen scheduling. Earhead length was significantly higher with GJ-44 cultivar of sorghum and nitrogen scheduling in three splits; N_3: 25% as basal + 50% at 30 DAS + 25% at boot leaf stage While, N_2: 50% as basal + 25% at 30 DAS + 25% at boot leaf stage and N_4: 25% as basal + 50% at 30 DAS + 15% at boot leaf stage + 10% at grain filling stage remained at par. Both the cultivars have no any significant effect on grain yield but N_3: 25% as basal + 50% at 30 DAS + 25% at boot leaf stage has recorded highest grain yield (2807 kg/ha) and N_2 and N_3 remained at par. Highest stover yield (10883 kg/ha) was found with GNJ-1 cultivar of sorghum and nitrogen scheduling of N_3 and remained at par with N_2 and N_4 (Table-2).

An increase in earhead length could be because of the positive effect of RDF which provided the right amoun nutrients at the right time during the crop's growth. Nitrogen is associated with protoplasm synthesis and growth. These results agree with the studies by Kalibhavi *et al.* (2001) [5], Miko and Manga (2008) [7], Afzal *et al.* (2012) [2], Singh and Sumeriya (2012) [9] and Singh *et al.* (2013) [10].

The rise in grain and stover yield could be because increase in translocation of assimilates from source to sink. This might happen because the plant had the right amount of of NPK, which helped in increased rate of photosynthesis and also active absorption of various nutrients and translocation of photosynthates to the site of storage part of plant (sink). The present findings are collaborative with Kubsad (2018) [6], Munagilwar *et al.* (2020) [8], Soleymani *et al.* (2011) [12] and Singh *et al.* (2012) [11].

Table 1: Growth attributing characters influenced by different cultivars and nitrogen scheduling in sorghum

Treatments	Plant Population		Days to 50% flowering	Days to physiological maturity	Plant Height (cm) at harvest
	Initial	Final			
Cultivars (V)					
V_1: GNJ-1	228	215	70	110	230
V_2: GJ-44	229	219	71	109	173
S.Em. ±	4.55	3.83	1.20	1.82	3.17
C.D. at 5%	NS	NS	NS	NS	9.04
Nitrogen Scheduling (N)					
N_1: 50% as basal + 50% at 30 DAS	227	215	69	108	198
N_2: 50% as basal + 25% at 30 DAS + 25% at boot leaf stage	229	217	70	108	202
N_3: 25% as basal + 50% at 30 DAS + 25% at boot leaf stage	232	220	72	110	203
N_4: 25% as basal + 50% at 30 DAS + 15% at boot leaf stage + 10% at grain filling stage	225	215	73	112	203
S.Em. ±	6.43	5.42	1.70	2.58	4.48
C.D. at 5%	NS	NS	NS	NS	NS
Interaction					
S.Em. ±	9.09	7.67	2.40	3.65	6.34
C.D. at 5%	NS	NS	NS	NS	NS
C.V. %	11.96	10.60	10.17	9.99	9.43
Source	YxVxN	YxVxN	YxVxN	YxVxN	YxVxN
S.Em. ±	15.75	13.28	4.16	6.32	10.98
C.D. at 5%	NS	NS	NS	NS	NS

Table 2: Yield attributing characters influenced by different cultivars and nitrogen scheduling in sorghum

Treatments	Ear Head Length (cm)	100 seed weight (g)	Grain Yield (kg/ha)	Stover Yield (kg/ha)
Cultivars (V)				
V_1: GNJ-1	26.27	2.35	2532	10883
V_2: GJ-44	28.11	2.34	2644	9023
S.Em. ±	0.33	0.04	39.22	125.83
C.D. at 5%	0.95	NS	NS	359.11
Nitrogen Scheduling (N)				
N_1: 50% as basal + 50% at 30 DAS	25.74	2.28	2281	9049
N_2: 50% as basal + 25% at 30 DAS + 25% at boot leaf stage	27.35	2.37	2686	10103
N_3: 25% as basal + 50% at 30 DAS + 25% at boot leaf stage	28.35	2.38	2807	10583
N_4: 25% as basal + 50% at 30 DAS + 15% at boot leaf stage + 10% at grain filling stage	27.32	2.34	2577	10076
S.Em. ±	0.47	0.06	55.47	177.95
C.D. at 5%	1.35	NS	158.32	507.86
Interaction				
S.Em. ±	0.67	0.09	78.45	251.66
C.D. at 5%	NS	NS	NS	NS
C.V. %	7.37	11.26	9.09	7.59
Source	YxVxN	YxVxN	YxVxN	YxVxN
S.Em. ±	1.16	0.15	135.88	435.88
C.D. at 5%	NS	NS	NS	NS

Conclusion

Highest grain and stover yield can be obtained in sorghum by applying three splits *i.e.;* 25% N as basal + 50% N at 30 DAS + 25% N at boot leaf stage of nitrogen fertilization under south Gujarat condition.

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