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Response of sorghum hybrids on growth parameters and economics of sorghum

A Niveditha, S Bharathi, M Sree Rekha and T V Sridhar
Department of Agronomy, Acharya N G Ranga Agricultural University,
Agricultural College, Bapatla - 522101, Andhra Pradesh, India

ABSTRACT

An experiment entitled, Response of sorghum hybrids with nitrogen in Rice fallows was conducted during rabi 2023-2024 at Agricultural College Farm, Bapatla. The experiment was laid out in split plot design and replicated thrice. The treatments consisted of fifteen combinations with three sorghum hybrids CSH 30 (M_1), CSH41(M_2), MLSH 296 (M_3) assigned to main plots and five nitrogen levels (N_1: control, N_2- 120 kg N ha^{-1}, N_3 - 160 kg N ha^{-1}, N_4 - 200 kg N ha^{-1} N_5 - 240 kg N ha^{1}) which were allocated to sub plots.

Key words:Nitrogen levels, Sorghum hybrids and Performance of hybrids

India is the largest producer of different kinds of millets, which are often referred as coarse cereals. Millets that are widely grown in India are sorghum, pearl millet, finger millet and other small millets. Grain sorghum is also called "milo" and is a major feed grain for cattle. It is popularly known in India as "jowar". It is emerging as a potential alternative food, feed, fodder and bio energy crop. It is regarded as king of millets and fourth important crop in the country after rice, wheat and maize. Sorghum is a climate ready crop due to its resilience to high temperatures and moisture stress conditions. Its drought adaptation capability made sorghum as a preferred crop in tropical, warmer and semi-arid regions of the world which experience high temperature and water stress conditions. In the current scenario sorghum is a strong competitor with the cash crops due to its huge diversity in bio-physical and socio-economic environment. Moreover, its ability to survive in water scarce conditions provides an alternative for marginal farmers after the harvest of rice.

MATERIAL AND METHODS

A field experiment was conducted during *rabi* 2023-2024 at Agricultural College Farm, Bapatla on sandy clay loam soils with pH 7.2, Low in organic carbon, low in nitrogen, medium in available phosphorus, medium in available potassium. The experiment laid out in split plot design as 15 treatments with three hybrids as main plots and different nitrogen levels as sub plots and replicated thrice. CSH 30, CSH 41, MLSH 296 are the three sorghum hybrids assigned to main plots and 0 kg N ha^{-1}, 120 kg N ha^{-1}, 160 kg N ha^{-1}, 200 kg N ha^{-1}, 240 kg N ha^{-1} are allocated to sub plots. Immediately after harvesting of the rice, the area was divided into required number of plots as per the layout plan. No tillage operations were conducted after harvesting of the rice crop as the experiment has to be carried out under zero-till conditions. Sowing was done on 28th December, 2023 by adopting a seed rate as per the recommendation. Bold and healthy seeds (>85 % germination) were hand dibbled into the soil @ 2 hill^{-1} at a depth of 2-3 cm and the spacing adopted was 45 cm x 15 cm in order to maintain optimum planting density. Immediately after sowing, paraquat @ 2.5 ml L^{-1} and pre-emergence herbicide i.e., Atrazine @ 1.0 kg *a.i.* ha^{-1} were sprayed to prevent ratooning from harvested rice stubbles and to control pre-emergence weeds respectively. Nitrogen (120, 160, 200, 240 kg ha^{-1}) was applied in the form of urea (46% N) at varied doses in 3 equal splits *i.e.,* 1/3 each as basal dose, 30 DAS and the remaining at 60 DAS as per the treatments.Entire recommended dose of phosphorus 60 kg P_2O_5 ha^{-1} and 40 kg K_2O ha^{-1} were applied as basal in the form of single super

Treatments	Plant height (cm)			
	30 DAS	60 DAS	90 DAS	At harvest
Sorghum hybrids				
M1 - CSH 30	62.7	174.3	204.9	210.2
M2 – CSH 41	58.6	167.4	193.8	202.5
M_3- MLSH 296	49.7	152.4	181.7	184.9
SEm (±)	1.62	3.41	3.6	4.49
CD (p=0.05)	6.37	13.4	14.1	17.2
CV (%)	11	8	7.2	8.5
Nitrogen levels (kg ha^{-1})				
N1 - 0	32.7	123.3	154.3	159.2
N2- 120	54.9	165.1	191.6	195.2
N3 – 160	62.6	174.6	202.2	207.8
N4 - 200	65.6	178.2	207.4	214.1
N_5 - 240	69.3	182.3	211.7	218.8
SEm (±)	2.32	5.03	7.55	7.04
CD (p=0.05)	6.76	14.7	21.9	20.54
CV (%)	12.2	9.2	11.7	10.6
Interaction				
SEm (±)	3.96	8.51	12.21	11.75
CD (p=0.05)	NS	NS	NS	NS

phosphate and muriate of potash, respectively at the time of sowing. Data on plant height was recorded and analysed.

RESULTS AND DISCUSSION

The results on growth parameters like plant height was at 30DAS, 60 DAS, 90 DAS and harvest. Results of the plant height of sorghum with respect to the three sorghum hybrids tested (Table 4.1 and Fig. 4.1) showed that, the plant height increased with increase in the crop age. At 30 DAS, 60 DAS, 90 DAS and at harvest the maximum plant height (62.7 cm, 174.3 cm, 206.9 cm and 212.7 cm) was observed in sorghum hybrid CSH 30 (M_1) and was on a par with the sorghum hybrid CSH 41. The lowest plant height (49.7 cm, 150.4cm, 174.4 cm and 178.3 cm) was recorded with the hybrid MLSH 296 (M_3) at all the growth stages. This might be due to the genetical attributes of the hybrids as CSH 30(M_1) is tall hybrid and MLSH 296(M_3) is short hybrid and similar findings were reported by Nayak (2022).

The elevation in plant height was observed with increase in nitrogen levels due to the role of nitrogen in the cell division, cell elongation and protein synthesis. An improvement in the plant height with increasing in nitrogen levels has also been confirmed with the research findings of Hussaini *et al.* (2021), Kugbe *et al.* (2019), Aruna kumari (2018), Naik *et al.* (2018), Gebrelibanos and Assefa (2015), Mishra *et al.* (2013).

The response of the plant height varied significantly with graded nitrogen levels from 0 to 240 kg N ha^{-1}. The plant height increased with increment in nitrogen levels tested. At 30 DAS the maximum plant height (69.3 cm) recorded at 240 kg N ha^{-1}(N_5) and was on a par with 200 kg N ha^{-1}(N_4) and 160 kg N ha^{-1} (N_3) and significantly superior over other nitrogen levels tested. The lowest plant height recorded with no application of nitrogen.

At 60 DAS, 90 DAS and at harvest the tallest plants (185.9 cm, 214.5 cm, 219.6 cm) were recorded with the application of 240 kg N ha^{-1} and was on a par with application of 200 kg N ha^{-1} and 160 kg N ha^{-1} and the plant height recorded at 120 kg N ha^{-1} was on a par with the application of 160 kg N ha^{-1}. The lowest plant height (32.7 cm, 121.3 cm, 152.7 cm and 157.8 cm) was recorded with 0 kg N ha^{-1} when compared to other Nitrogen levels studied.

Economics

Data on economics states that significantly highest gross return ([1] 185494) and net returns ([1]

Economics of Rice fallow sorghum

Treatments	Gross returns (Rs. ha-1)	Net returns (Rs. ha^{-1})	B:C ratio
Sorghum Hybids			
M1 – CSH 30	142282	89611	1.69
M2 – CSH 41	156124	103453	1.95
M$_3$ – MLSH 296	185494	132653	2.5
SEm (±)	3588	3588	0.07
CD (p=0.05)	14089	14089	0.27
CV (%)	8.62	12.8	12.86
Nitrogen levels (kg ha^{-1})			
S1 - 0	83241	32370	0.64
S2 - 120	161386	108958	2.08
S3 - 160	183387	130355	2.46
S4 - 120	187810	134363	2.51
S$_5$ - 240	190676	136715	2.53
SEm (±)	4614	4614	0.09
CD (p=0.05)	13468	13468	0.26
CV (%)	8.58	12.7	12.88
Interaction			
SEm (±)	7998	7998	0.14
CD (P=0.05)	NS	NS	NS

132653) was observed in the sorghum hybrid MLSH 296 (M$_3$) and in different nitrogen levels highest gross returns(^{1} 190676) was observed at the nitrogen application rate of 240 kg N ha^{-1} and it was on par with the nitrogen levels of 160 kg N ha^{-1} and 200 kg N ha^{-1} and highest net returns (^{1} 136715) is recorded at 240 kg N ha^{-1} and it was on par with the nitrogen levels 160 kg N ha^{-1} and 200 kg N ha^{-1}

Lowest gross returns (^{1} 89611) recorded in CSH 30 (M$_1$) and with respect to different nitrogen levels lower gross returns (^{1} 83241) and net returns (^{1} 32370) are recorded at control 0 kg N ha^{-1} (N-$_1$) Significantly higher B:C (2.50) ratio was observed in the hybrid MLSH 296 (M$_{3-}$) and lowest B:C ratio (1.95) was observed in CSH 30 (M$_1$) and in different nitrogen levels highest B:C ratio was recorded at the nitrogen application rate of 240 kg N ha^{-1}(N$_5$) and it was on par with the nitrogen levels 160 kg N ha^{-1} and 200 kg N ha^{-1} lowest B:C ratio (0.64) is recorded at control 0 kg N ha^{-1} (N-$_1$)

Significantly higher B:C (2.50) ratio was observed in the hybrid MLSH 296 (M$_{3-}$) and lowest B:C ratio (1.95) was observed in CSH 30 (M$_1$) and in different nitrogen levels highest B:C ratio was recorded at the nitrogen application rate of 240 kg N ha^{-1}(N$_5$) and it was on par with the nitrogen levels 160 kg N ha^{-1} and 200 kg N ha^{-1} lowest B:C ratio (0.64) is recorded at control 0 kg N ha^{-1} (N-$_1$).

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