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Onfarm testing of Sorghum variety NTJ-5 in semi-arid regions of Andhra Pradesh

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Abstract

Onfarm testings were conducted to study the performance of sorghum variety NTJ-5 (Nandyal Tella Jonna) in *Rabi* season from 2019 and 2020 in Kurnool district of Andhra Pradesh. Ten demonstrations were conducted each year with three sorghum varieties NTJ-5 (TO₁), NTJ-4 (TO₂) and local Raichur variety (TO₃). During three years of assessment, the pooled results revealed that the highest panicle length was observed in NTJ-5 variety (26.0 cm) followed by NTJ-4 (23.7cm) and local variety (21.8cm) varieties. Highest average test weight (3.6 gm) and seed yield (4425 kg/ha) also recorded in NTJ-5 variety when compared with NTJ-4 and local varieties. The percent increase in yield was 31.2% and 37.2% higher in NTJ-5 variety when compared with NTJ-4 and local varieties respectively. The average highest net income (Rs. 30508 /ha) and benefit cost ratio (2.78) was realized in NTJ-5. The lowest net income (Rs. 16840/ha) and benefit cost ratio (2.20) was recorded in local variety. Hence NTJ-5 (Nandyal Tella Jonna) variety is the high yielding improved variety when compared with other existing varieties.

Keywords: Onfarm Testings, Sorghum, Nandyal Tella Jonna, net returns, benefit cost ration

Introduction

Millet plays a vital role in ensuring nutritional security, as they are packed with protein, fiber, iron, minerals, B-complex vitamins, and calcium. Their consumption has been linked to a range of health benefits, including reduced risk of heart disease, diabetes protection, improved digestive health, lower cancer risk, detoxification, enhanced immunity, increased energy levels, and improvements in muscular and neural systems. Studies such as those by Manach *et al.* (2005) [7], Scalbert *et al.* (2005) [10], and Chandrasekara and Shahidi (2012) [3] have highlighted these advantages.

Finger millet, proso millet, and sorghum are the most widely grown millets, particularly in regions with annual rainfall below 350 mm. However, there has been a concerning decline in the cultivation of small millets over the years. In Kurnool district of Andhra Pradesh, which is prone to drought and has experienced reduced rainfall, millets have become an important alternative for the farming community. While the area under millet cultivation decreased due to lifestyle changes, rice distribution schemes, and the availability of canal water, recent shifts in climate patterns and increased health awareness have led to a renewed interest in millets.

During the 1970s, Kurnool district was a traditional millet-growing area, but changes in agricultural practices reduced millet cultivation. In Kurnool the area under sorghum is 50,000 ha with 3480 Mt of production in 2023 and productivity of 3164 kg/ha (Anon., 2022) [2]. Despite facing challenges such as monsoon failure and drought, there has

been a recent resurgence in millet cultivation in the district. Sorghum, in particular, is the major millet grown in Kurnool district, with local varieties being low-yielding and less tolerant to drought.

To address these challenges, on-farm testings have been conducted by Krishi Vigyan Kendra Banavsi to introduce improved high-yielding varieties of sorghum this initiative aims to overcome the limitations of traditional varieties and enhance the resilience of millet cultivation in the district.

The overall promotion of millets in areas like Kurnool, coupled with efforts to introduce improved varieties, is crucial for the well-being of both farmers and consumers. Creating awareness, providing training, and offering support in terms of resources can further encourage the sustainable cultivation of millets in drought-prone regions.

Materials and Methods

Onfarm testings were conducted at four blocks (Pattikonda, Kodumuru, Adoni and Yemmiganur) in the western part of Kurnool district, Andhra Pradesh to disseminate the high yielding sorghum varieties. These testings were conducted at ten locations during *Rabi* (Maghi) season of two consecutive years (2019 and 2020). The size of each OFT plot was 0.2 ha. Scientific interventions like improved varieties, seed treatment, integrated nutrient management, integrated pest management and integrated disease management practices were practiced in the demonstrated fields. The improved sorghum NTJ-5 (Nandyal Tella Jonna) was selected for these Onfarm testings and distributed as critical input to the beneficiary farmers. The salient features

of sorghum varieties were given in the Table.1

The Onfarm testing was conducted to study the performance of improved varieties under recommended management practices in terms of its yield and cost economics. The improved NTJ-5 (Nandyal Tella Jonna) variety was compared with popular variety NTJ-4 and locally available Raichur Jonna (check) variety. Apart from demonstrations, training programmes were also conducted to the farmers on integrated crop management practices. During two years of assessment the observations such as panicle length (cm), test weight (g), yield (kg ha⁻¹), net returns and benefit cost ratio were recorded.

The results obtained during two years were analyzed using appropriate statistical tools viz., mean, standard deviation,

and the results were concluded at the respective levels of significances between means ($p < 0.05$). The mean values of panicle length, test weight and yield were calculated in 2019, 2020 and pooled data of three years. The technology gap, extension gap and technology index were calculated for NTJ-5 variety compared to locally grown variety as per Samui *et al.*, 2000 [9]

Technology gap = Potential yield – demonstration yield
 Extension gap = Demonstration yield - farmers practice yield

$$\text{Technology index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \times 100$$

Table 1: Salient features of sorghum varieties

S. No	Variety	Duration (Days)	Year of notification	Potential Yield kg ha ⁻¹	Specific features
1.	NTJ-5	105	2018	4500-6000	Non lodging type, medium bold grain with moderately tolerant to shoofly and stem borer and blights. It produces good quality straw with good palatability
2.	NTJ-4	100	2016	3250-3750	Tolerant to major pest and disease like shoot fly and charcoal rot
3	Local Raichur variety	110	2002	3200-3800	Locally adopted high yielding, variety

Result and Discussions

Yield attributes: During 2019 the average highest panicle length (24.5 cm) and test weight (3.6 gm) was recorded in NTJ-5 followed by NTJ-4 (23.1 cm and 2.7 gm). The average lowest panicle length (21.5 cm) and test weight (2.1 gm) recorded in local variety. Similar trend was followed in the year 2020 in case of panicle length and test weight. During 2019, an average yield of 4250 Kg ha⁻¹ was recorded with NTJ-5 and it was 16.4%, 41.3% higher than NTJ-4 (3500 kg ha⁻¹) and Raichur Jonna variety (3300 kg ha⁻¹) respectively. During 2020, an average yield of 4600 kg ha⁻¹ was recorded with NTJ-5 and it was 14.5%, 43.6% higher than NTJ-4 (3375 kg ha⁻¹) and Raichur Jonna variety (3225 kg ha⁻¹) respectively. (Table.2)

The pooled results of two consecutive years (2019 and 2020) revealed that significantly highest panicle length (26.0 cm) test weight (3.6 gm) and high seed yield (4425 kg ha⁻¹) was recorded in NTJ-5 followed by NTJ-4 and Raichur variety, since the p-value was less than 0.05 in both the years as well as in pooled analysis (Table 2). Higher yield under NTJ-5 was due to higher panicle weight and test weight and difference in yield (Grain and Stover) levels among the sorghum varieties might be attributed to their genetic potentiality to utilize and translocate photosynthates from source to sink. These results are supported with the findings of Ramyasri *et al.*, (2018) [8]. Hence it was concluded that there is significant difference among the sorghum varieties with regard to yield in which improved varieties significantly produced more yield than that of farmers' practice.

The improved varieties had shown their superior performance over locally grown variety under demonstrations conducted at farmer's field. Among the three improved varieties of sorghum, the NTJ-5 was proven its superiority in terms of yield over other varieties. These results are in accordance with Deva, *et al.*, 2019 [4] in foxtail

millet.

Cost economics

The highest net returns and benefit cost ratio was realized significantly highest in NTJ-5 followed by NTJ-4 and Raichur variety in both the years 2019 and 2020. The average higher net income (30508 Rs ha⁻¹) and benefit cost ratio (2.78) was realized in new improved NTJ-5 variety. The average lower net income (16841 Rs ha⁻¹) and benefit cost ratio (2.2) was recorded in farmers' variety (Table 3 & Fig 1.). The highest net returns and benefit cost ratio in NTJ-5 variety is due to lowest incidence of pest and diseases resistant drought and highest yields. Similar findings were reported by Deva, *et al.*, 2019 [4] with foxtail millet crop.

Gap analysis: In addition to cost economics, other parameters like technology gap, extension gap and technology index were calculated for the demonstration with NTJ-5 variety alone as it shown significant advantage over other varieties (Table: 4). The technology gap of demonstrated field (NTJ-5) was 835 kg ha⁻¹ and 832 kg ha⁻¹ during 2019 and 2020 respectively. This technology gap may be due to different management practices followed and different level of soil fertility present in the demonstrated fields. The Extension gap of 692 kg ha⁻¹ and 721 kg ha⁻¹ was recorded during 2019 and 2020 respectively, this extension gap describes the need of create awareness among the farming community by implementing various extension programmes. An average technology index of 25.5% was observed with NTJ-5 demonstration fields during two consecutive years. Lower the technology index value indicates the feasibility of improved technology. The similar results were reported by Jayalakshmi *et al.*, 2022 [6], Singh *et al.*, 2020 [11] and Jadhav *et al.*, 2022 [5] in chickpea crop at different states of India.

Table 2: Performance of sorghum varieties in 2019, 2020 and pooled.

Particulars	Panicle length (cm)			Test weight (gm)			Seed Yield kg ha ⁻¹		
	2019	2020	pooled	2019	2020	pooled	2019	2020	pooled
NTJ-5 (TO ₁)	24.5	27.2	26.0	3.6	3.5	3.60	4250	4600	4425
NTJ-4 (TO ₂)	23.1	24.4	23.75	2.7	2.5	2.65	3500	3250	3375
Raichur Jonna (TO ₃)	21.3	21.8	21.55	2.2	2.1	2.15	3150	3300	3225
SD for varieties									
NTJ-5	0.34	1.53	0.92	0.52	0.43	0.475	190.44	194.38	192.41
NTJ-4	0.32	2.83	1.56	0.14	0.24	0.19	50.26	71.25	62.755
Raichur Jonna	1.12	1.62	1.35	0.37	0.35	0.36	82.57	84.93	82.20
t-Value	3.31	3.30	3.35	3.32	3.34	3.32	3.32	3.35	3.36
p-value	0.004*	0.001*	0.002*	0.004*	0.000*	0.001*	0.002*	0.002*	0.003*

*Significantly difference at 0.05% probability

Table 3: Economics of sorghum varieties in 2019, 2020 and pooled

Years	2020			2021			pooled		
	Gross Returns Rs ha ⁻¹	Net Returns Rs ha ⁻¹	BC Ratio	Gross Returns Rs ha ⁻¹	Net Returns Rs ha ⁻¹	BC Ratio	Gross Returns Rs ha ⁻¹	Net Returns Rs ha ⁻¹	BC Ratio
NTJ-5 (TO ₁)	44967	28467	2.73	45049	32549	2.83	45008	30508	2.78
NTJ-4 (TO ₂)	38616	22116	2.34	39334	26834	2.50	38975	24475	2.42
Raichur Jonna (TO ₃)	31341	14841	1.90	31341	18841	2.51	31341	16841	2.20

Table 4: Gap analysis of NTJ-5 variety in 2019, 2020 and pooled

Gap analysis	Technology gap kg ha ⁻¹	Extension gap kg ha ⁻¹	Extension index
Years			
2019	835	692	25.5
2020	832	721	23.8
Pooled	834	739	22.8

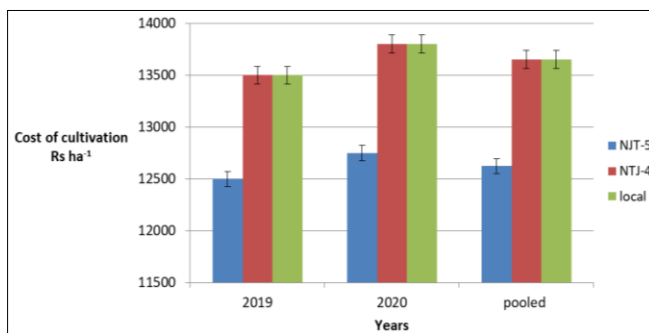


Fig 1: Cost of cultivation in demonstration (Rs ha⁻¹) and farmers practice fields



Fig 2: Onfarm testing of Improved and Check varieties of Sorghum

Conclusion

The improved sorghum variety NTJ-5 released from RARS, Nandyal have shown better performance than locally grown variety. Among the three cultivars, NTJ-5 variety is a high yielding variety which has tolerance to disease and gained attention of many farmers. It can be recommended as the best alternative to local varieties. The beneficiary farmers are playing a major role in transfer of technology to the neighbouring farmers. The OFTs has shown greater impact on the adoption of high yielding improved varieties and adjoining farmers are adopting new varieties as well as other technology interventions.

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