

RESEARCH ARTICLE

Growth and yield of proso millet varieties as influenced by different dates of sowing

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ABSTRACT

An experiment was conducted on “Evaluation of proso millet varieties with respect to dates of sowing” during Rabi season 2019-20 & 2020-21 at Agricultural Research Station, Jangamaheswarapuram, Guntur District, Andhra Pradesh, India with an aim to find out the suitable variety & optimum time of sowing in Palnadu region of Andhra Pradesh. Among the four different varieties, TNPM-230 recorded higher yields when compared to TNAU-202, TNAU-151 & Co-5. The crop sown during 1st fortnight of October performed better than 2nd fortnight of October & 1st fortnight of November With respect to dates of sowing. There is no interaction effect between varieties and different dates of sowing on yield and yield attributing characters in Proso millet.

Keywords: Nagarjuna sagar right canal area, TNPM-230, TNAU-202, TNAU-151, Co-5, Palanadu region, Test weight, Plant height

INTRODUCTION

Proso millet is the sixth world’s most important cereal, sustaining food security in arid regions and marginal lands (Francesca Ventura *et al.*, 2022). Proso millet is rich in protein, minerals, vitamins and micronutrients such as Iron, Zinc, Copper and Manganese and its nutritive parameters are comparable or better than common cereals (Kalinova and Moudry, 2006). The major source of irrigation in palnadu region of Guntur district is mainly through Nagarjuna Sagar Project Right Canal and to some extent depends on bore wells. The cropping pattern is Rice - Rice, Cotton-Fallow, Chilli-Fallow and Redgram – Fallow *etc.*. After Bifurcation of Andhra Pradesh in to two states (Andhra Pradesh & Telangana) this area faced the crisis for irrigation water due to irregular and

untimely release of water from Nagarjuna Sagar Project for cultivation. In this context, there is an urgent need to change the cropping pattern from Rice based cropping systems to rainfed crops with short duration varieties which requires less water demand during Rabi season. Under such situations, Proso millet is a promising alternative short duration crop because of its unique characteristics like heat and drought tolerance (Francesca Ventura *et al.*, 2022). Under drought and poor soil conditions, Proso millet gives a yield which surpasses the yield of all other crops and has the potential to produce food where other grain crops would fail (Brien Henry *et al.*, 2008 and Rahman Jubaidur *et al.*, 2020). Millet crops are grown on marginal lands and under low-input agricultural conditions in which major cereal crops often produce low yields (Amadou *et al.*, 2013).

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Proso millet is highly adapted to dryland cropping systems with high water use efficiency and short growing seasons. They can grow in marginal lands and can give a significant amount of yield compared to major cereal crops (Saurav das *et al.*, 2019). Keeping these points in view, the present experiment was under taken to find out the suitable varieties with respect to sowing windows during *Rabi* season.

Materials and Methods

This experiment entitled “Growth and yield of Proso millet varieties as influenced by different dates of sowing” was conducted at Agricultural Research Station, Jangamaheswarapuram, Acharya N.G Ranga Agricultural University, Andhra Pradesh during *Rabi* season in 2019-20 & 2020-21. The experiment was laid out as split plot design with three replications, in sub plots four varieties was taken namely TNPM-230, TNAU-202, TNAU-151 & Co-5 and in main plots, three dates of sowing was taken namely 1st fortnight of October, 2nd fortnight of October & 1st fortnight of November. The sowing windows were restricted upto 1st fortnight of November only due to low temperatures that may affect the germination of seed in winter. Proso millet is a warm season crop which requires minimum 30°C for germination and establishment (Baltensperger *et al.*, 1995; Amadou *et al.*, 2013 and Alessandro Calamai *et al.*, 2020). The crop was sown with a common spacing of 30X10 cm. The soil of the experimental field is deep black with soil P^H 7.98, EC 1.58 dsm⁻¹ & organic carbon content 0.63%. The soil is said to be medium in available Nitrogen (377 N kg ha⁻¹), Available phosphorus (18 P₂O₅ kg ha⁻¹) and high in Available potassium content (817 K₂O kg ha⁻¹). The fertilizer dose applied is 40-30-20 N, P₂O₅, K₂O kg ha⁻¹, respectively. Weeding operation was done by hand weeding at 20 DAS and 30 DAS. Need based light shallow irrigation was given during sowing & at Panicle Initiation stage with the help of sprinklers. Harvesting was done when the top panicle attains physiological maturity irrespective of side tiller panicles to avoid shattering. The grain was separated from stalk after drying. The yield and yield attributing characters like plant height, No. of panicles, No. of grains panicle⁻¹, Dry matter plant⁻¹, Test weight (1000 seed weight) and Seed yield were recorded at the time of harvest.

Varietal Description

TNPM-230: Semi compact panicle. The grains are bold and golden yellow in colour (Nirmala kumari,

A *et al.*, 2011)

TNAU-202: The panicle is loose and branched with more number of grains. The grains are medium bold in size. (Nirmala kumari, A *et al.*, 2011)

TNAU-151: The panicle is large and branched. The grains are bold and golden yellow in colour. (Nirmala kumari, A *et al.*, 2021)

Co-5: check variety. The panicle is compact and dense. The grains are bold with golden yellow colour. (Nirmala kumari, A *et al.*, 2021)

RESULTS & DISCUSSION

Plant height (cm):

Significantly higher plant height was recorded with TNPM-230 variety, which is at par with check variety *i.e* Co-5 (Table 2). The maximum plant height was recorded with the crop sown during 1st fortnight of October when compared to 2nd fortnight of October and 1st fortnight of November. The early sown crop (1st fortnight of October) having the chance of enjoying favourable environment leads to more accumulation of photosynthates in leaves when compared to late sown crop which resulted in attaining maximum plant height.

No. of panicles plant⁻¹

No significant difference was observed in No. of panicles plant⁻¹ with respect to varieties and with different dates of sowing and also no interaction was observed between different varieties and different dates of sowing. The crop was sown during 1st fortnight of October recorded highest No. of panicles plant⁻¹ during *Rabi*, 2019-20 and there was no significant difference with respect to dates of sowing on No. of panicles plant⁻¹ during *Rabi*, 2020-21.

No. of grains panicle⁻¹

The highest number of grains panicle⁻¹ was recorded with TNPM-230 variety *i.e* 2389 & 1762 during *Rabi*, 2019-20 & 2020-21 respectively when compared to other varieties. However the number of grains panicle⁻¹ of TNPM-230 variety is on par with Co-5 variety (2233 & 1977 during *Rabi*, 2019-20 & 2020-21 respectively). The crop sown during 1st fortnight of October has recorded more No. of grains panicle⁻¹ when compared to sowing in 2nd fortnight of October & 1st fortnight of November.

Table 1. Meteorological data for the experimental site during crop growing seasons during 2019-20 & 2020-21

Month	Mean T max. temperature (°C)		Mean T min. temperature (°C)		Total Rainfall (mm)		Mean Relative Humidity –I (%)		Mean Relative Humidity –II (%)	
	1 st season (2019-20)	2 nd season (2020-21)	1 st season (2019-20)	2 nd season (2020-21)	1 st season (2019-20)	2 nd season (2020-21)	1 st season (2019-20)	2 nd season (2020-21)	1 st season (2019-20)	2 nd season (2020-21)
October	32.78	32.37	23.67	23.92	160.0	38.8	85.77	85.93	77.35	76.67
November	32.44	32.29	22.59	21.92	0.0	0.0	85.56	83.16	72.46	77.53
December	31.03	32.10	19.43	19.88	0.8	0.0	86.12	85.90	74.93	81.35
January	32.25	31.59	20.77	20.10	19.2	0.0	81.67	83.22	71.87	78.29
February	33.52	33.72	22.20	20.08	23.2	0.0	90.17	80.28	76.82	66.60

Table 2.1: Plant height (cm), No. of panicles plant⁻¹ & No. of grains panicle⁻¹ of proso millet at harvest as influenced by dates of sowing and varieties during Rabi, 2019-20 & 2020-21

Dates of Sowing/ Varieties	2019-20					2020-21				
	Plant height (cm)									
	TNPM-230	TNAU-202	TNAU-151	Co-5	Mean	TNPM-230	TNAU-202	TNAU-151	Co-5	Mean
M ₁ : I FN of October	125.7	110.7	115.0	122.7	118.5	121.3	118.7	100.5	122.0	115.6
M ₂ : II FN of October	100.3	93.0	95.3	98.7	96.8	107.8	99.5	84.4	112.4	101.0
M ₃ : I FN of November	91.3	85.0	86.0	91.0	88.3	114.8	112.5	94.0	126.0	111.8
Mean	105.8	96.2	98.8	104.11		114.6	110.2	92.9	120.1	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		3.35	10.12			3.2	8.8			
S		14.85	NS			14.3	13.2			
M X S		25.72	NS			24.8	NS			
No. of panicles plant⁻¹										
M ₁ : I FN of October	24.0	24.0	24.0	24.0	24.0	20.4	17.6	16.9	23.3	19.6
M ₂ : II FN of October	20.00	19.3	19.8	22.0	20.2	16.8	14.5	12.7	19.8	15.9
M ₃ : I FN of November	20.0	18.9	17.7	19.3	18.9	18.1	16.2	15.2	22.0	17.9
Mean	21.3	20.0	19.8	21.3		18.4	16.1	14.9	21.7	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		0.79	11.77			1.9	NS			
S		2.07	NS			4.7	16.7			
M X S		3.44	NS			8.2	NS			
No. of grains panicle⁻¹										
M ₁ : I FN of October	2716	2487	2401	2514	2529	2075	1847	1667	2319	1977
M ₂ : II FN of October	2356	2151	2191	2244	2236	1417	1310	1327	1585	1410
M ₃ : I FN of November	2094	1780	1820	1940	1909	1793	1516	1336	2026	1668
Mean	2389	2139	2137	2233		1762	1558	1443	1977	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		102.81	14.14			84.8	15.4			
S		193.84	8.80			255.6	15.3			
M X S		335.73	NS			442.8	NS			

Dry matter plant⁻¹ (g)

Highest Dry matter plant⁻¹ was recorded with TNPM-

230 variety (39.76 g & 32.3 g. during *Rabi*, 2019-20 & 2020-21 respectively) when compared to other varieties. However the Dry matter plant⁻¹ of TNPM-230 variety is on par with Co-5 variety. Among

Table 2.2: Dry Matter Production Plant-1 (G.), Test Weight (G.) & Seed Yield (Kg Ha-1) Of Proso Millet At Harvest As Influenced By Dates Of Sowing And Varieties During Rabi, 2019-20& 2020-21

Dates of Sowing/ Varieties	2019-20					2020-21				
	Dry matter production plant ¹ (g)									
	TNPM-230	TNAU-202	TNAU-151	Co-5	Mean	TNPM-230	TNAU-202	TNAU-151	Co-5	Mean
M ₁ : I FN of October	44.93	37.33	37.33	39.67	39.82	36.1	31.7	30.3	38.6	34.2
M ₂ : II FN of October	38.00	36.00	35.07	37.00	36.52	33.6	28.5	25.4	35.1	30.7
M ₃ : I FN of November	36.33	28.33	21.67	34.00	30.08	27.2	24.4	23.1	29.7	26.1
Mean	39.76	33.89	31.36	36.89		32.3	28.2	26.3	34.5	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		0.89	7.63			1.08	10.86			
S		4.15	11.81			5.61	18.7			
M X S		7.18	NS			9.72	NS			
Test weight (g.)										
M ₁ : I FN of October	6.11	5.99	5.50	5.83	5.86	6.3	5.7	5.3	7.5	6.2
M ₂ : II FN of October	6.13	5.81	5.29	5.88	5.78	6.0	5.6	5.5	6.5	5.9
M ₃ : I FN of November	5.99	5.99	5.47	5.83	5.82	6.1	5.9	5.3	6.7	6.0
Mean	6.08	5.93	5.42	5.85		6.2	5.7	5.4	6.9	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		0.09	NS			0.5	NS			
S		0.02	7.81			0.7	12.9			
M X S		0.50	NS			2.3	NS			
Seed yield (kg ha ⁻¹)										
M ₁ : I FN of October	2416	2055	2100	2279	2213	2325	2178	1917	2541	2240
M ₂ : II FN of October	1990	1800	1749	1850	1847	1667	1573	1500	1835	1644
M ₃ : I FN of November	1646	1433	1542	1602	1556	2010	1799	1586	2276	1918
Mean	2017	1763	1797	1910		2001	1850	1668	2217	
		C.D@5%	C.V (%)			C.D@5%	C.V (%)			
M		26.08	7.41			67.7	10.7			
S		188.07	10.15			245.6	12.83			
M X S		325.91	NS			425.5	NS			

different dates of sowing tested, the higher dry matter plant⁻¹ was recorded in 1st fortnight of October when compared to rest of sowing dates

Test weight (1000 seed weight) (g)

No significant difference was observed with respect to different dates of sowing on test weight. Among the varieties tested TNPM-230 has recorded 6.08 g & 6.2 g 1000 seed weight during *Rabi*, 2019-20 & 2020-21, respectively. The results of TNPM-230 variety are on par with Co-5 variety (5.85 g & 6.9 g during *Rabi*, 2019-20& 2020-21 respectively).

Seed yield (kg ha⁻¹)

The higher seed yields were recorded with TNPM-230 (2017 kg ha⁻¹ & 2001 kg ha⁻¹ during *Rabi*, 2019-20& 2020-21 respectively) & Co-5 (1910 kg ha⁻¹ & 2217 kg ha⁻¹ during *Rabi*, 2019-20& 2020-21 respectively). The seed yields of TNPM-230 & Co-5 varieties were higher because of the compact nature of panicle which resulted in more no. of grains panicle⁻¹ when compared to TNAU-202 & TNAU-151 which are having loose sparsely arranged panicle (Nirmala kumari, A et al., 2011).

Among different dates of sowing tested, the sowing done during 1st fortnight of October has recorded mean yield of 2213 kg ha⁻¹ & 2240 kg ha⁻¹ during *Rabi*, 2019-20 & 2020-21, respectively. The mean yields recorded during both the seasons are much higher than world average yield of 890 kg ha⁻¹ (Alessandro Calamai *et al.*, 2020 & Jubaidur Rahman *et al.*, 2020). Sowing in 1st fortnight of November resulted in lowest mean seed yield of 1556 kg ha⁻¹ & 1918 kg ha⁻¹ during *Rabi*, 2019-20 & 2020-21, respectively due to lower temperatures during crop growth stages which resulted in more no. of chaffy grains than sound grains.

SUMMARY AND CONCLUSIONS

During the investigation, it was found that, the average mean yield, yield attributing characters like plant height, No. of panicle plant⁻¹, No. of grains panicle⁻¹ and dry weight plant⁻¹ was recorded with TNPM-230 variety when the crop was sown during 1st fortnight of October. The average mean yield of TNPM-230 variety is on par with check variety Co-5 variety. If Sowing was delayed beyond November there may be problem of maintenance of plant population due to poor germination. With respect to test weight there was no significant difference among the sowing dates. The TNPM-230 variety performed similar values of test weight with Co-5 variety when compared to TNAU-202 & TNAU-151. There was no interaction effect between dates of sowing & varieties for yield & yield attributing characters.

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