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Assessing the Influence of Sowing Windows on Growth and Yield of Small Millets

M. Jyostna Kiranmai*, S. Saralamma and C. V. Chandra Mohan Reddy

Regional Agricultural Research Station, Nandyal, Kurnool Dist. (A.P), Andhra Pradesh, India

**Corresponding author*

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A B S T R A C T

Small millets are important crops cultivated in input farming systems by resource poor farmers. Nutri cereals (Small millet crops) are neglected crops. As, sowing time has a major role in determining the yield of crops the present experiment was taken up to assess the impact of sowing windows on growth and yield of small millets. The site of experimentation was Regional Agricultural Research, station, Nandyal during *kharif*, 2019. The design used for experimentation is split-plot. The treatments consisted of 3 small millet crops littlemillet, foxtailmillet and proso millet with 6 sowings windows July 1st FN, July 2nd FN, August 1st FN, August 2nd FN, September 1st FN and September 2nd FN. Crop sown during July 2nd FN had the maximum, plant height (122 cm), thousand grains weight (4.97 g) and grain yield (2455 Kg ha^{-1}) as compared with other sowing dates. The interaction effect between small millet crops and sowing windows showed that the economic yield (grain yield) of foxtail millet and prosomillet were found to be highest when sown during July 2nd FN (3530 kg/ha and 1876 kg/ha respectively). But for little millet the highest grain yield was observed when sown at July 1st FN(2024 kg/ha).

Introduction

Small millets are traditional and unique crops of drytracts of India. Small millets are cultivated both for food and fodder purpose. They are traditionally indispensable component of dry farming system in India. Small millets, though called poor man's crops are nutritionally comparable and are even superior to other cereals especially with respect to amino acids, proteins, phosphorous, thiamine and other nutrients, besides high calorific value, the slow digestible carbohydrates make food for long sustenance Small millets helps to alleviate malnutrition and to enhance nutritional security and breaks excessive dependence on few major food crops for this purpose. Small millets widely cultivated in india are finger millet [*Eleusine coracana* (L.)], little millet *Panicum sumatrance*), kodo millet [*Paspalum scrobiculatum* (L.)], foxtail millet [*Setaria italica* (L.)], barnyard millet [*Echinochloa frumentacea* (L.)] and proso millet [*Panicum miliaceum* (L.)]. Besides the nutritional importance of small millets, they have additional advantages like, small millets varieties having short duration can fit into any

cropping systems even in orchards, widely spaced crops, the water consumption of small millets is comparatively low compared to other cereals, less prone to pests and diseases. Small millets are now becoming popularized and their now coming back to the plates of common peoples. Small millets are regaining their importance in agriculture. A change is consumption pattern is observed. These small millets are generally grown under rainfed conditions in low fertility conditions the average productivity is very low. Keeping in view of nutritional advantage of there is a rapid increase in demand. In this connection research on the best management practices has to be emhasized. Sowing time has an important role on production and productivity of crops. Crops sown at optimum time has the advantage of being exposed to congenial climate at all growth stages and this inturns improves the productivity of crop. This is in similar with findings of Upadhyay *et al.,* (2001) and stated that the bajra sown at exact window without any delay had given higher grain yield. Reduction in yield was observed under delayed sowings. Timely sowing generally ensures sufficient time for root development and vegetative growth and has the advantage to escape from peak period of crop weed competition thus provided optimum harvesting of available soil nutrient and radiant energy. (Thompson and Kelly, 1957), Crop sown late is normally affected by moisture stress. Generally small millet crops are grown during july, Due to change in climate scenario there is a requirement to revisit the sowing time for small millets. The present research has been taken to assess the performance of 3 small millets to different sowings window and to find out the best time for small millets.

Materials and Methods

Field experiment entitled "Assessing the influence of sowing windows on growth and yield of small millets" was carried during kharif, 2019 at Regional Agricultural Research Station, Nandyal. The design used for laying of experiment is split-plot design with three replications. Main plots consists of three small crops *viz.,* Foxtail millet, little millet and proso millet. Sub plots consists of six sowing windows *i.e.,* July 1st FN, July 2nd FN, August 1st FN, August 2nd FN, September 1st FN, September 2nd FN. The soils are deep vertisols. The experimental site is located at 18^{0}29`N latitude, 78^{0}29'E longitude and at an altitude of 202 above MSL, in the scarce rainfall zone of Andhra Pradesh. The soils are alkaline in reaction (8.2), low in nitrogen (180 kg ha^{-1}), medium in available phosphorous (48.2 kg ha^{-1}) and potassium (366 kg ha^{-1}). The crops were raised by following package of practices of respective crops. 20 kg Nitrogen and 20 kg P_2O_5 were applied basally at the time of sowing, remaining 20 kg N were applied at 25 DAS. During kharif season, the maximum temperature ranged between 35.8^{0}C to 30.1^{0}C with an average of 32.5^{0}C. Whereas, the minimum temperature during crop season ranged between 19.6^{0}C to 25.6^{0}C with an average of 22.9^{0}C. the maximum relative humidity ranged between 90% to 80.5% with an average of 86.6%. whereas, the minimum relative humidity ranged between 50.5% to 71.3% with an average of 61.1%.

Average wind speed varied from 0.1 km/hr to 9.9 km/hr with an average of 4.5 km/hr. Evaporation ranged from 2 mm/day to 6.3 km/hr with an average of 3.2 km/hr. The gross plot size was 4.5 cm X 3.0 cm and net plot sizes was 2.4 m x 4.2 m. All the cultivars are were dibbled at a spacing of 30cmX10cm during kharif, 2019. During crop growth period an total amount of 913.8 mm of rainfall was received in 43 rainy days. A common spacing of 30cm X 10cm was maintained for all small millet crops. Sowings were done on 13.07.2019, 26.07.2019,

13.08.2019, 30.08.2019, 13.09.2019, 30.09.2019 at different fortnight intervals from July 1st FN to September 2nd FN

Results and Discussion

Plant height

The plant height was not significantly influenced both by the small millet crops and sowing windows. Numerically the highest plant height was recorded with little millet (122 cm) followed by foxtail millet (119 cm) and the lowest were noticed in proso millet (1114 cm). Among sowing windows maximum plant height (123 cm) was found when sown during july 1st FN. These results are in confirmation with the findings of Patil (2018) (Table 1).

1000 seed weight

Significantly higher 1000 seed weight was found with proso millet (4.97 g) and was comparable with foxtail millet (3.21 g) and the lowest test weight was noticed with little millet (2.34 g). Among different sowing windows the highest was found with S2 *i.e.* sowing during July 2nd FN (3.65 g) and it was on par with all other sowing windows

Table.1 Performance of small millets as influenced sowing windows (2019-20)

Treatments	Plant height (cm)	1000 seed weight (g)	No. of Productive tillers	Days to maturity	Harvest index (%)	Grain yield (kg/ha)	Straw yield (kg/ha)
Main plots							
1.Foxtail millet	119	3.21	2.67	74	45.38	2679	3186
2.Little millet	122	2.34	5.67	92	40.88	1823	2628
3.Proso millet	114	4.97	5.61	75	40.11	1564	2337
SEm+	3.3	0.06	0.21	0.18	1.24	81.23	88.21
CD (P=0.05)	NS	0.27	0.81	0.74	NS	316.57	346.59
CV (%)	8.31	5.93	6.44	2.68	5.26	11.96	9.74
Sub plots							
1. July 1st FN	123	3.56	5.12	79	43.88	2180	2882
2. July 2nd FN	119	3.65	5.46	81	44.11	2455	2987
3.Aug 1st FN	120	3.59	4.58	80	42.11	2058	2757
4.Aug 2nd FN	119	3.53	4.44	81	41.66	1958	2692
5.Sep 1st FN	119	3.41	4.27	79	41.33	1800	2553
6. Sep 2nd FN	113	3.32	4.04	80	40.66	1681	2434
SEm+	4.5	0.09	0.45	0.58	1.17	87.14	89.06
CD (P=0.05)	NS	0.271	0.16	NS	NS	251.62	258.71
CV (%)	8.07	5.68	7.58	3.03	5.82	9.14	6.99
Interaction CXS							
SEm+	2.9	0.12	0.49	0.45	3.02	139.66	110
CD (P=0.05)	NS	NS	NS	NS	NS	340.51	NS
Interaction SXC							
SEm+	4.9	0.15	0.32	0.93	2.23	112.89	109
CD (P=0.05)	NS	NS	NS	NS	NS	360.18	NS

Table.2 Interaction effect for grain yield (kg/ha) as influenced by sowing windows

	July 1st FN	July 2nd FN	Aug 1st	Aug 2nd	Sept 1st	Sep 2nd	Mean
Foxtail millet	2765	3530	2715	2518	2370	2176	2679
Little millet	2024	1958	1853	1829	1701	1575	1823
Proso millet	1752	1876	1604	1526	1330	1293	1563
Mean	2180	2455	2058	1958	1800	1681	
Interaction of CXS			SEm±	139.69	CD (P=0.05)	340.51	

Table.3 Economics of small millets as influenced by sowing windows

Treatments	Gross returns (Rs/ ha)	Net returns (Rs./ ha)	B:C ratio
C1S1	52470	32920	2.68
C1S2	66356	48456	3.71
C1S3	51472	31922	2.63
C1S4	47855	29955	2.67
C1S5	45045	25495	2.30
C1S6	41520	23620	2.32
C2S1	38750	19200	1.98
C2S2	37488	19588	2.09
C2S3	35459	15909	1.81
C2S4	34973	17073	1.95
C2S5	32655	13105	1.67
C2S6	30274	12374	1.69
C3S1	33497	13947	1.71
C3S2	35915	18015	2.01
C3S3	30833	11283	1.58
C3S4	29366	11466	1.64
C3S5	25670	6120	1.31
C3S6	24870	6970	1.39

Productive tillers

Significantly higher number of productive tillers were found with July 2nd FN sowing (5.46). The next highest was found with July 1st FN sowing (5.12). Among different small millets the highest number of productive tillers was found in little millet (5.67) and was on par with prosomillet (5.61). The reason might be due to crop sown early may enjoy favourable micro-climatic conditions in terms of temperature and other climatic parameters during various crop growth stages and ensures better growth of the crop in critical stages and thus reflected in yield. Similar results were observed by Andhale *et al.*, (2007 b), Patel *et al.*, (2004).

Days to maturity

The days to maturity varied among small millet crops. Little millet crop matured in 92

days. Prosomillet in 75 days and foxtail millet in 74 days. With respective to sowing windows the days maturity was not significantly influenced (Table 2).

Harvest index

Harvest index was not significantly influenced by small millet crops and sowing windows

Grain yield

Among different small millets tested significantly higher grain yield was recorded with the small millet crop, foxtail millet (2679 kg/ha) followed by little millet (1823 kg/ha) however it was on par with proso millet (1564 kg/ha). With respective to sowing windows significantly higher grain yield was recorded when small millet crops are sown during July 2nd FN (2455 kg/ha) followed by July 1st FN sowings (2180 kg/ha). Rao *et al.,* (1991) also confirmed that there is decline in grain yield of small millets with delay in sowing

Effect of interaction on grain yield

Maximum grain yield of foxtail millet and prosomillet were recorded when sown during July 2nd FN (3530 kg/ha and 1876 kg/ha respectively). But for little millet the highest grain yield was observed when sown at July 1st FN(2024 kg/ha). The crop sown in july 2nd FN exposed to congenial microclimate viz., significantly more absorption of photosynthetically active radiation (PAR) resulted in higher light use efficiency (LUE) ultimately increasing photosynthetic rate and significant improvement in important growth and yield attributes. Delayed sowing results in adverse situation of all these parameters by late sown crops and resulted in decreased values of these yield contributing characters. Similar results were envisaged by Kaushik and Gautam (1984), (Siddig *et al.,* 2013) and (Maiti and Soto, 1990).

Straw yield

Among 3 small millets foxtail millet has given higher straw yield (2679 kg/ha). The next highest was with little millet (2628 kg/ha). The lowest was recorded with prosomillet. Straw yield of small millets were found to be highest sown during 2nd FN (2987 kg/ha) followed by July 1st FN sowings (2882 kg/ha)

Economics

The highest gross returns (66356 Rs./ha), net returns (48456 Rs./ha) and B:C ratio(3.71) were found to be highest when foxtail millet sown during July 2nd FN followed by foxtail millet sown during July 1st FN sowings with Rs. 32920 ha^{-1} and 2.68 B:C ratio. The reason might be due to higher yield of foxtail millet sown during July 2nd FN. The results are in confirmation with findings of Sukhadia and Dhoble (1992) (Table 3).

From the present study, it can be inferred that for getting higher profitable production in terms of yield and economics, small millets should be sown during July month in *kharif*. The appropriate time sowing is essential for getting higher yields. Early sown crops relatively gives higher yield attributes and yield. Yield reduction was clearly observed in late sown crops.

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