



Yield and Economics of Pearlmillet (*Pennisetum glaucum*) as Influenced by Integrated Nutrient Management and Sowing Dates under Rainfed Condition

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ABSTRACT

An experiment was conducted to assess the different date of sowing viz; June 15th (D₁), June 30th (D₂), July 15th (D₃) and July 30th (D₄) and different sources of integrated nutrient management. The result revealed that the growth parameters, yield and economics were significantly influenced by various sowing dates and different integrated nutrient management. Sowing on June 30th recorded the higher yield and net returns and B:C ratio compared to other dates of sowing. The crop treated with 100 % RDF + pressmud @ 2.5 t ha⁻¹ obtain higher yields and net returns over other treatments but it was over treatment having 100 % RDF alone.

Key words: Pearlmillet, Sowing dates, INM, Growth, Yield and Economics

INTRODUCTION

Pearlmillet (*Pennisetum glaucum*) is an important millet crop grown mostly during *kharif* season under rainfed condition. It is efficient in its utilization of soil moisture and has a higher level of heat tolerance, thus considered a better crop for rainfed areas particularly in light textured and well drained soils. Those soils are less retentive of soil moisture and generally poor in fertility level, therefore, crop productivity is low. Rain moisture conservation is most important concern in such areas. The balanced and optimum use of fertilizers is very important for

good harvest of rainfed pearlmillet. Research in India has indicated integrated use of organic and inorganic manures for sustaining productivity of soil and crops. The application of pressmud and FYM in the soil helps in increasing the fertility of the soil as well as the physical condition including its water holding capacity. Availability of nutrients increases and their availability to crop are increased. Organic manures, which were perhaps the major sources of plant nutrients in traditional agriculture, received less emphasized with the advent of high analysis chemical fertilizers.

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Without detracting from the fact that chemical fertilizer will continue to be main instrument for quickening the pace for agricultural production. The recent researches indicate that a judicious combination of organic manures and fertilizers can better maintain the long-term soil fertility and sustain high levels of productivity. Therefore, use of both organic manures of chemical; fertilizers in appropriate proportion assumes special significance as complementary and supplementary to each other in crop production. Another factor time of sowing is a non monetary input plays significant role in production and productivity of any crop. Pearl millet traditionally is an indispensable component of dry-farming system and is considered as more efficient in utilization of soil moisture, with higher level of heat tolerance than sorghum and maize. It occupies a distinct position in the agricultural economy of the country. Pearl millet is usually grown under rainfed conditions and if sown with first monsoon rain, flowering may coincide with rains, which results in very poor yields. Direct seeding offers such advantages as faster and easier planting, reduced labor, earlier crop maturity by 7–10 days, more efficient water use and higher tolerance of water deficit, less methane emission and often higher profit in areas with an assured water supply. The sowing date for direct seeding of pearl millet plays vital role in improving its growth and increasing the yield.

MATERIAL AND METHODS

The present investigation carried out during two consecutive seasons of 2014-15 and 2015-16 at college farm, Professor Jayashankar Telangana State Agricultural University, Hyderabad, Telangana. The experimental site was sandy clay loam in texture, slightly alkaline in reaction, low in organic carbon as well as available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in strip plot design with three replication in *kharif* keeping integrated nutrient management sources 100% RDF (M₁), 100 % RDF + FYM @ 5 t ha⁻¹ (M₂) and 100 % RDF + pressmud @ 2.5 t ha⁻¹ (M₃) as main

treatments and sowing dates viz., June 15th (D₁), June 30th (D₂), July 15th (D₃) and July 30th (D₄) as sub-plot treatments in pearl millet. PHB-3 Hybrid of pearl millet was sown according to the dates decided in the treatment, maintaining 45 cm row-to-row and 15 cm plant to plant distance with the seed rate of 5 kg ha⁻¹.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of INM on growth characteristics of pearl millet

The various treatments had a favorable influence on plant height and dry matter accumulation presented in. Conjoint use of 2.5 t pressmud and inorganic fertilizers (100 % RDF + pressmud @ 2.5 t ha⁻¹) gave the maximum values of these growth parameters (Table 1). Application of 2.5 t ha⁻¹ pressmud along with chemical (100 % NPK) fertilizers enhanced the height of pearl millet plant over 100 % NPK alone treatment in both the years. Significantly higher dry matter production viz., 7829 kg ha⁻¹ and 8762 kg ha⁻¹ at harvest during 2014 and 2015, respectively was accumulated due to the application of 100 % RDF + pressmud @ 2.5 t ha⁻¹ (M₃) compared to 100 % RDF (M₁). The increase in growth parameters may be attributed to press mud and FYM combined with fertilizers might have released the nutrients enriching the soil by providing sufficient amount of nutrients that are required for various metabolic processes. This resulted in better mobilization of carbohydrates, amino acids and proteins. Which stimulated rapid cell division and cell elongation and leading to higher intermodal elongation and finally enhanced the plant height and dry matter production. These results are in conformity with Narolia and Poonia⁶.

Effect of sowing dates on growth characteristics of pearl millet

All the vegetative parameters like plant height (159.4 and 164.7 cm) and dry matter production (8294 and 9172 kg ha⁻¹) at harvest

during 2014 and 2015 of study, respectively showed significantly highest values with 30th June sowing compared to 15th June and 15th July and the lowest values for all the vegetative parameters were recorded with 30th July sowing (Table 1). Increase in plant height and dry matter production with June 30th sowing had experienced with better weather prolonged photoperiod, for vegetative growth resulted in maximum plant height and dry matter production as compared to delayed sowing dates. These results are in line with those of Amanullah Jan *et al.*¹.

Effect of INM on yield components and yield of pearl millet

Among the different integrated nutrient management treatments, application of 100 % RDF + pressmud @ 2.5 t ha⁻¹ (M₃) produced higher ear head length (cm) viz. 23 and 25.4, maximum weight of grain ear head⁻¹ (14.3 and 16.8 g) as well as 1000-grain weight (5.97 and 7.54 g) which was significantly higher than those observed under other sources of nutrients during 2014 and 2015. The beneficial effect of yield attributes might also be due to the supply of all the essential nutrients by press mud and FYM that might have resulted in higher manufacture of food and its subsequent partitioning of photosynthates towards sink (Table 2). The finding of present investigation are supported by Kumar and Gautam³ in pearl millet. Significantly highest grain (3055 and 3274 kg ha⁻¹) and straw (5121 and 5314 kg ha⁻¹) yields as well as greater harvest index of 37.7 and 38.3 % of pearl millet were obtained with the application of 100 % RDF + pressmud @ 2.5 t ha⁻¹ (M₃) followed by 100 % RDF + FYM @ 5 t ha⁻¹ (Table 3). Whereas, the lowest grain and straw yields was produced by the crop devoid of organic manures. Significant increase in grain and straw yield of pearl millet with fertilizers coupled with organic manures might have supplied nutrients improving crop growth, uptake and yield attributes. Similar results were reported by a Satyajeet *et al.*⁸, and Lakum *et al.*⁴.

Effect of sowing dates on yield and yield components of pearl millet

Yield contributing characters like ear head length, weight of grain ear head⁻¹ and 1000 grain weight were also superior in 30th June sowing with maximum values 22.8, 24.9 cm, 14.7 g and 6.32 g respectively during first year and 24.2, 27.1 cm, 17.7 g, 8.0 cm, respectively during second year over the other sowing dates (Table 2). Sowing of pearl millet at optimum date i.e June 30th had shown significantly better development of source in form of dry matter accumulation, which contributed to the higher grain weight. These results are in conformity with those of Deshmukh *et al.*², Grain yield (3047 and 3437 kg ha⁻¹), straw yield (5221 and 5499 kg ha⁻¹) and harvest index (37.2 and 38.8 %) of pearl millet was found significantly higher in June 30th over rest of the sowing dates during 2014 and 2015 presented in (Table 3). The higher grain yield with June 30th sowing was probably due to good seed set favored by warm weather prevailed during at maturity. Similar results were reported by Maurya *et al.*⁵. Delayed sowing reduced grain yield due to restricted vegetative growth of the crop and poor grain setting.

Effect of INM on economics on pearl millet

The application of 100 % RDF + pressmud @ 2.5 t ha⁻¹ brought out the significantly maximum gross returns (Rs. 38,192 and 41,378 ha⁻¹) and net returns (Rs.16, 130 and 19,676 ha⁻¹) which was markedly different over other treatments (Table 4). The minimum gross returns and net returns was accrued 100 % RDF alone during both years. Different sources of INM treatments caused significant variations in B:C ratio of pearl millet during both years. Application of 100 % RDF + pressmud 2.5 t ha⁻¹ resulted in the maximum amount of B:C ratio (1.73 and 1.89) and it was at par with 100 % RDF + FYM @ 5 t ha⁻¹ (1.69 and 1.88), which was found to be significantly greater over those recorded with 100 % RDF . Higher level of biomass accrual and efficient translocation to the reproductive parts due to supply of adequate nutrients through integrated nutrient management might

be responsible for production of elevated yield attributes and thereby yield which resulted in higher monetary returns and B:C ratio. Similar findings were reported by Pramod⁷.

Effect of sowing dates on economics on pearl millet

The pearl millet sowing on June 30th brought out the significantly maximum gross returns (Rs. 38,092 and 43,826 ha⁻¹), net returns (Rs.19,364 and 25,098 ha⁻¹) and B:C ratio (2.02 and 2.34) which was markedly different over other treatments (Table 4). The minimum gross returns and net returns was accrued under July 30th sowing during both years. Optimum time of sowing and favorable weather conditions might have lead to proportionate increase in growth parameters like dry matter production, leaf area index and

number of tillers resulting in more nutrient concentration and nutrient availability in the root zone. Hence higher nutrient content in the produce and higher biomass production of crop and nutrient uptake might be the pertinent reason for higher yields and which resulted in gross returns, net returns and B:C ratio. These results corroborate to the findings of Yadav and Varshney⁹.

Interaction effect between integrated nutrient management and sowing dates of pearl millet was not found significant in any crop character studied. However, the combination of both best factors i.e. sowing under June 30th with the application of 100 % RDF + pressmud @ 2.5 t ha⁻¹ has given highest crop yields and earned maximum net return from rainfed pearl millet cultivation.

Table 1: Effect of INM and sowing dates on plant height and dry matter Production of pearl millet

Treatments	Plant height (cm)		Dry matter Production (kg ha ⁻¹)	
	2014	2015	2014	2015
Main treatments (INM)				
M ₁ -100% RDF	126.0	127.4	6132	6632
M ₂ -100% RDF + FYM @ 5 t ha ⁻¹	138.7	144.2	7130	7630
M ₃ -100% RDF + Press mud @ 2.5 t ha ⁻¹	151.0	155.6	7829	8762
SE m (±)	2.6	2.3	202	270
CD (P=0.05%)	10.2	8.9	687	936
Sub treatments (Dates of Sowing)				
D ₁ – June 15 th	131.6	134.9	6562	7118
D ₂ – June 30 th	159.4	164.7	8294	9172
D ₃ – July 15 th	150.9	151.8	7480	8125
D ₄ – July 30 th	112.2	118.3	5784	6284
SE m (±)	2.4	2.8	221	213
CD (P=0.05%)	8.3	9.8	763	835
Interaction effect				
Main at same level of sub				
SE m (±)	4.9	4.0	327	331
CD (P=0.05%)	NS	NS	NS	NS
Sub at same level of Main				
SE m (±)	4.4	3.6	309	317
CD (P=0.05%)	NS	NS	NS	NS

Table 2: Effect of INM and sowing dates on yield attributes of pearl millet

Treatments	2014			2015		
	Ear head length (cm)	Weight of grain / Ear head (g)	1000 grain weight (g)	Ear head length (cm)	Weight of grain / Ear head (g)	1000 grain weight (g)
Manures						
M ₁ -100% RDF	18.3	11.7	4.29	20.9	14.3	5.39
M ₂ -100% RDF + FYM @ 5 t ha ⁻¹	20.6	12.9	5.27	23.1	15.4	6.62
M ₃ -100% RDF + Press mud @ 2.5 t ha ⁻¹	23.0	14.3	5.97	25.4	16.8	7.54
SE m (±)	0.5	0.42	0.08	0.4	0.34	0.15
CD (P=0.05%)	1.8	1.25	0.31	1.6	1.02	0.44
Dates of Sowing						
D ₁ – June 15 th	19.6	12.4	4.64	22.0	14.9	5.79
D ₂ – June 30 th	24.9	14.7	6.32	27.1	17.7	8.00
D ₃ – July 15 th	22.3	13.6	5.74	24.8	16.3	7.48
D ₄ – July 30 th	15.8	11.2	4.01	18.5	13.2	4.80
SE m (±)	0.4	0.40	0.09	0.5	0.54	0.15
CD (P=0.05%)	1.5	1.05	0.32	1.8	1.40	0.41
Interaction effect						
Main at same level of sub						
SE m (±)	0.55	1.15	0.16	0.90	1.01	0.16
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Sub at same level of Main						
SE m (±)	0.51	0.99	0.14	0.80	0.84	0.14
CD (P=0.05%)	NS	NS	NS	NS	NS	NS

Table 3: Effect of INM and sowing dates on grain and straw yield and harvest index of pearl millet

Treatments	2014			2015		
	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	HI (%)	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	HI (%)
Main treatments (INM)						
M ₁ -100% RDF	1985	3506	36.0	2207	3712	36.8
M ₂ -100% RDF + FYM @ 5 t ha ⁻¹	2483	4323	36.7	2704	4607	37.3
M ₃ -100% RDF + Press mud @ 2.5 t ha ⁻¹	3055	5121	37.7	3274	5314	38.3
SE m (±)	95	132	1.0	97	138	1.2
CD (P=0.05%)	374	517	NS	380	542	NS
Sub treatments (Dates of Sowing)						
D ₁ – June 15 th	2343	4060	36.6	2459	4205	37.0
D ₂ – June 30 th	3047	5221	37.2	3437	5499	38.8
D ₃ – July 15 th	2740	4705	37.0	3004	4929	38.2
D ₄ – July 30 th	1900	3281	36.6	2013	3544	35.8
SE m (±)	88	144	1.2	116	159	1.2
CD (P=0.05%)	305	499	NS	402	549	NS
Interaction effect						
Main at same level of sub						
SE m (±)	258	264	2.1	279	443	3.1
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Sub at same level of Main						
SE m (±)	207	235	1.9	263	363	2.6
CD (P=0.05%)	NS	NS	NS	NS	NS	NS

Table 4: Effect of INM and sowing dates on economics of pearl millet

Treatments	2014			2015		
	Gross returns (₹/ha)	Net returns (₹/ha)	B:C ratio	Gross returns (₹/ha)	Net returns (₹/ha)	B:C ratio
Main treatments (INM)						
M ₁ -100% RDF	24811	8999	1.57	28145	12333	1.78
M ₂ -100% RDF + FYM @ 5 t ha ⁻¹	31032	12720	1.69	34474	16162	1.88
M ₃ -100% RDF + Press mud @ 2.5 t ha ⁻¹	38192	16130	1.73	41738	19676	1.89
SE m (±)	1042	538	0.04	1156	978	0.04
CD (P=0.05%)	4091	2111	0.12	4541	3839	0.13
Sub treatments (Dates of Sowing)						
D ₁ – June 15 th	29286	10557	1.57	31350	12621	1.66
D ₂ – June 30 th	38092	19364	2.02	43826	25098	2.34
D ₃ – July 15 th	34252	15523	1.82	38300	19571	2.05
D ₄ – July 30 th	23750	5022	1.25	25665	6936	1.35
SE m (±)	1088	761	0.07	1398	1106	0.08
CD (P=0.05%)	3765	2635	0.18	4838	3828	0.22
Interaction effect						
Main at same level of sub						
SE m (±)	3292	2442	0.18	3345	1745	0.18
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
Sub at same level of Main						
SE m (±)	2700	1941	0.15	2774	1601	0.14
CD (P=0.05%)	NS	NS	NS	NS	NS	NS

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