



Original Research Article

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## Effect of Integrated Nutrient Management and Dates of Sowing on Growth and Yield of Pearl millet (*Pennisetum glaucum*)

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### ABSTRACT

#### Keywords

Pearlmillet, INM and Dates of sowing

#### Article Info

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A field experiment was carried out in Kharif season (2014-15 and 2015-16) at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJ TSAU), Rajendranagar, Hyderabad, India, to evaluate the effect of sowing dates and integrated nutrition on growth and productivity of *kharif* pearl millet. Experimental results revealed that pearl millet crop, out of the three INM main treatments, 100 % RDF + press mud @ 2.5 tons ha<sup>-1</sup> i.e., M3 and among dates of sowing, pearl millet sown on June 30th (D2) improved the growth parameters viz., plant height, number of tillers m<sup>-2</sup> and dry matter production as well as yield attributes like ear head length, weight of grains ear head<sup>-1</sup> and 1000-grain weight which significantly resulted in highest grain, straw yield, harvest index.

### Introduction

In India, pearl millet is the fifth most important cereal grain crop next to rice, wheat, maize and sorghum. Today, it is gaining more attention due to increasing evidence of less seasonal rainfall, terminal heat, frequent occurrence of extreme weather events coupled with scanty water resources. Pearl millet traditionally is an indispensable component dry-farming system and is considered as more efficient in utilization of soil moisture, with higher level of heat tolerance than sorghum and maize (Chaudhary and Gautam, 2007). Millets are mainly grown by marginal and small farmers. Low productivity is mainly due

to inadequate nutrient supply. Non-judicious use of chemical fertilizers declines soil organic matter, physical-chemical properties, pollutes surface and ground water there by reducing its productivity (Singh, 2002). Besides, fertilizers are becoming costlier and difficult for the resource poor farmers to apply recommended dose of fertilizers. Under such condition, integrated nutrient management (INM) has assumed great importance and has vital significance for the maintenance of soil productivity.

The productivity of pearl millet is very low as compared to important pearl millet growing countries in world. It is, therefore, necessary to increase the production and productivity of

pearl millet by adopting scientific innovations. Sowing very early in season may not be advantageous. Also delayed sowing invariably reduces crop yield. Sowing the crop at optimum time increases yield due to suitable environment at all the growth stages of the crop. Flowering is induced after sufficient vegetative growth. Moisture stress or dry spells may be avoided during critical growth stages. Therefore, optimum sowing time plays an important role in pearl millet crop production.

## Materials and Methods

The study was conducted during *kharif* with geographically situated at 17°19' N Latitude, 78° 28' E Longitude and at an altitude of 542.3 m above mean sea level. According to Troll's climatic classification, it falls under semi-arid tropics. The soil of experimental site was sandy clay loam with pH 7.6, electrical conductivity 0.88 dSm<sup>-1</sup>, low organic carbon (0.44%), low available nitrogen (217 kg ha<sup>-1</sup>) and medium phosphorus (60 kg ha<sup>-1</sup>) and high in potassium (307 kg ha<sup>-1</sup>). The experiment was laid out in strip plot design with three main treatments (INM) and four sub-treatments (dates of sowing), replicated thrice. The three main treatments (INM) were M<sub>1</sub>-100 % RDF, M<sub>2</sub>-100 % RDF + FYM @ 5 t ha<sup>-1</sup> and M<sub>3</sub>-100 % RDF + Press mud @ 2.5 t ha<sup>-1</sup>. The recommended doses of fertilizer (RDF) *i.e.*, 60:30:20 kg NPK ha<sup>-1</sup> was applied through urea, single super phosphate (SSP) and murate of potash (MOP) respectively, Sub treatments: Dates of sowing (4) D<sub>1</sub> – June 15<sup>th</sup>, D<sub>2</sub> – June 30<sup>th</sup>, D<sub>3</sub> – July 15<sup>th</sup> and D<sub>4</sub> – July 30<sup>th</sup>.

## Results and Discussion

As per the results shown in table 1, 2 and 3 the two factors significantly affected the response measurements either individually (main treatment effects and sub treatment effect). Integrated nutrient management and dates of

sowing showed significant variation with all the growth and yield characters individually but interaction effect of all the parameters of pearl millet crop as influenced by integrated nutrient management and dates of sowing was found to be non significant in all crop growth stages.

## Effects on growth characters

### Effect of integrated nutrient management

#### Growth characters

Integrated nutrient management has a significant effect on the growth characters in both the years. Plant height, number of tillers m<sup>-2</sup> and dry matter production (kg ha<sup>-1</sup>) were significantly higher with the M<sub>3</sub> (100 % RDF + press mud @ 2.5 t ha<sup>-1</sup>) than those in the M<sub>2</sub> (100 % RDF + FYM @ 5 t ha<sup>-1</sup>) and 100% RDF in both years (Table 1).

#### Yield parameters

Among the different integrated nutrient management treatments M<sub>3</sub> *i.e.*, (100 % RDF + press mud @ 2.5 t ha<sup>-1</sup>) significantly recorded higher ear head length (cm) of 23 and 25.4 cm during 2014 and 2015, respectively as compared to other treatments. Whereas, the lower value of ear head length (23 and 25.4 cm) was observed with 100 % RDF treated plots with no organic manure. Application of 100 % RDF + press mud @ 2.5 t ha<sup>-1</sup> (M<sub>3</sub>) produced maximum weight of grain ear head<sup>-1</sup> (14.3 and 16.8 g) as well as 1000-grain weight (5.97 and 7.54 g) which was significantly higher over other two main treatments during 2014 and 2015 (Table 2).

#### Yield

Pearl millet grain and straw yields differed significantly because of integrated nutrient management in both years. The highest seed, biological yield and harvest index were

recorded with the application of M<sub>3</sub> *i.e.*, (100 % RDF + press mud @ 2.5 t ha<sup>-1</sup>), which was significantly superior to the application of M<sub>2</sub> *i.e.*, (100 % RDF + FYM @ 5 t ha<sup>-1</sup>) and 100% RDF during both years (Table 3).

**Effect of date of sowing**

**Growth characters:** Pearl millet growth characters viz., plant height, number of tillers m<sup>-2</sup> and dry matter production (kg ha<sup>-1</sup>) were

significantly affected by different dates of sowing.

During the first year, these growth characters were higher with 30<sup>th</sup> June sown crop and significantly superior to the 15<sup>th</sup> July, 15<sup>th</sup> June and 30<sup>th</sup> July sown crops (Table 1). Similar results were reported in the second year.

**Table.1** Effect of INM and dates of sowing on growth parameters of pearl millet

Treatments	Plant height (cm)		No. of tillers (m <sup>-2</sup> )		Dry matter production (kg ha <sup>-1</sup> )	
	2014	2015	2014	2015	2014	2015
<b>Main treatments (INM)</b>						
M <sub>1</sub> -100 % RDF	126.0	130.4	22.1	24.7	6249	6449
M <sub>2</sub> -100 % RDF + FYM @ 5 t ha <sup>-1</sup>	138.7	144.2	24.8	27.6	7038	7238
M <sub>3</sub> -100 % RDF + Pressmud @ 2.5 t ha <sup>-1</sup>	151.0	155.6	28.0	31.8	7737	7937
SE m (±)	2.6	2.3	0.56	0.71	202	270
CD (P=0.05%)	10.2	8.9	2.19	2.69	687	936
<b>Sub treatments (Dates of Sowing)</b>						
D <sub>1</sub> – June 15 <sup>th</sup>	131.6	134.9	24.0	26.9	6562	6762
D <sub>2</sub> – June 30 <sup>th</sup>	159.4	164.7	28.1	31.6	8205	8405
D <sub>3</sub> – July 15 <sup>th</sup>	150.9	155.8	26.0	28.6	7480	7680
D <sub>4</sub> – July 30 <sup>th</sup>	112.2	118.3	21.8	25.1	5784	5984
SE m (±)	2.4	2.8	0.50	0.83	221	213
CD (P=0.05%)	8.3	9.8	1.74	1.97	763	745
<b>Interaction effect</b>						
<b>Main at same level of sub</b>						
SE m (±)	4.9	4.0	1.3	1.8	222	331
CD (P=0.05%)	NS	NS	NS	NS	NS	NS
<b>Sub at same level of Main</b>						
SE m (±)	4.4	3.6	1.1	1.6	210	317
CD (P=0.05%)	NS	NS	NS	NS	NS	NS

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

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

**Table.3** Effect of INM and dates of sowing on grain and straw yield (kg ha<sup>-1</sup>) and harvest index (%) of pearl millet

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

**Yield parameters**

Similarly, significantly higher values of ear head length, weight of grain per ear head and 1000 grain weight (test weight (g)) were recorded for 30<sup>th</sup> June sown crop in both the years, whereas lowest values of these

characters were recorded for 30<sup>th</sup> July sown crop in both the years (Table 2).

**Yield**

Sowing dates showed significant effects on seed and biological yield of pearl millet in

both the years (Table 3). Grain yield (3047 and 3437 kg ha<sup>-1</sup>), straw yield (5221 and 5499 kg ha<sup>-1</sup>) and harvest index (37.2 and 38.8 %) of pearl millet was found significantly higher with June 30<sup>th</sup> (D<sub>2</sub>) over rest of the sowing dates during 2014 and 2015.

Improvement in growth characters is considered to be pre-requisite to increased yield of any crop. Significant effect on the increase on the plant height with the application of NPK may be attributed to the fact that nitrogen being an essential constituent of plant tissue favours rapid cell division and its enlargement, which together with the adequate quantity of phosphorus and potassium helps in the rapid cell division and better development of the cell size. Further, the beneficial effect of FYM and press mud may be attributed to the fact that it supplied available plant nutrients and had solubilizing effect on fixed forms of nutrients thus making the nutrients available for increased intermodal length thus improving plant height and dry matter production of crop. These results are in conformity with Khan *et al.*, (2000).

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. The significant increase in test weight may be attributed to better grain filling and bold sized seed due to improved nutrient supply. The results are corroborative to those reported by Patel *et al.*, (2014). The application of pressmud compost to agricultural fields is likely to improve soil health by adding macro and micronutrients and organic matter to soil ultimately leads to crop productivity by increased the quality of grains by increasing the protein and Ca contents, similar results confirmed by Mishra *et al.*, 1982.

All the growth parameters were influenced owing to different date of sowing. This was probably due to better growth environment caused by slightly lower temperature and better soil moisture regime. Time of sowing also plays an important role to fully exploit the genetic potentiality of variety as it provides optimum growing conditions such as temperature, light, humidity and rainfall. Sowing date determines the time available for vegetative phase before the onset of flowering, which is mainly influenced by the photoperiod. The growth duration although has not affected the elongation (height) but was reflected in the number of branches per plant. Increase in plant height, tillers m<sup>-2</sup> and dry matter production with June 30<sup>th</sup> sowing date which may be due to enjoying relatively more time by the plant and sufficient rainfall in the growing season, which favoured more vegetative growth of the crop. Optimum sowing time *i.e.*, June 15<sup>th</sup> of pearl millet crop by prolonged photoperiod at vegetative growth resulting in maximum ear head length, higher grain weight and higher test weight as compared to early and late sowing dates. These results are in agreement with those reported by Jan *et al.*, (2015) The higher grain and straw yield and harvest index with June 30<sup>th</sup> sowing was probably due to good seed set favored by warm weather prevailed during at maturity. Similar results were reported by Maurya *et al.*, (2016).

In conclusion, the study revealed that crop sown on 30<sup>th</sup> June with application of, 100 % RDF with press mud @ 2.5 t ha<sup>-1</sup> had maximum plant height, number of tillers, dry matter production, grain and straw yield by pearl millet.

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