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Identification of Suitable Pearl Millet (*Pennisetum glaucum L.*) Hybrids with Optimum Dose of Nitrogen for Higher Yield under Summer Sown Condition of Southern Telangana

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A B S T R A C T

A field Study on response of three pearl millet hybrids to the four levels of nitrogen was conducted at College farm, College of Agriculture, Rajendranagar, Hyderabad during the summer season of 2010-11. The study comprised of three hybrids Vikas, Hanuman and XB-20plus at four levels of nitrogen (0, 40, 80, 120 kgha^{-1}). The design of experiment was split plot design with hybrids as main plot treatments and the levels of nitrogen as sub-plot treatments. Analysis was carried out for grain yield and yield contributing factors i.e. number of spikes per m^2, spike length, grain weight. It was concluded that all the mentioned yield attributing characters except test weight, were superior with hybrid Hanuman (Test weight was found to be at par with all three hybrids). These yield attributing characters including test weight was found superior with the level of 120 kg N ha^{-1}. Grain yield was recorded highest with hybrid Hanuman over the other two hybrids and among the nitrogen levels, it was with application of 120 kg N ha^{-1}.

Introduction

Pearl millet is an important food crop of the arid and semi-arid regions in India. It is well adapted to the harsh climates characterized by less rainfall and higher heat. It can be owed to its C_4 photosynthetic pathway, however, its efficiency of soil moisture utilization and degree of heat tolerance is higher than the contemporary C_4 crops like maize and sorghum. Thus, the crop can be an important part of crop rotation in summer season. The grain of pearl millet contains 11.31-19.62 per cent protein, 35.69 per cent starch, 2-2.7 per cent total sugar, 3-4.6 per cent fats and good amount of phosphorous and iron. In India, this crop is grown in an area of 8.73 million hectares and production of 8.89 million tones

with a productivity of 1018 kg ha^{-1} (CMIE, 2010). The major pearl millet growing states in India are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh, Haryana, Karnataka, Tamil Nadu, Madhya Pradesh and Andhra Pradesh. In Andhra Pradesh, it is grown in an area of 0.06 million hectare with production of 0.06 million tones with a productivity of 1000 kg ha^{-1} (CMIE, 2010).

Pearl millet is most suited for the summer season in arid and semi-arid regions due to its ephemeral nature and higher degree of heat tolerance. The choice of variety/hybrid is an important prerequisite for the higher yields. The soils of arid and semi-arid regions are inherently deficit in organic carbon due to increased rate of decomposition of organic matter owing to higher temperature. Considering the important relationship between the organic matter and nitrogen, it can be concluded that these soils are deficient in nitrogen too. Recent studies have shown that newly developed hybrids of pearl millet are more responsive to the nitrogenous fertilizers. The full exploitation of hybrid vigour and economizing the each incremental dose of nitrogen are equally important at farmer's field. The southern region of Telangana state presents the optimum climatic conditions for summer pearl millet crop and it forms the important component of cereal system.

Materials and Methods

A field experiment was conducted on the College farm, College of Agriculture, Rajendranagar, Professor Jayashankar Telangana State Agriculture University (Formerly ANGRAU), Hyderabad during the summer season of 2010-11. The soil of the experimental site was sandy clay loam, slightly alkaline in reaction, low in organic carbon, low in nitrogen and high in available phosphorous and medium in available potassium. The experiment was conducted with split plot design with three main plot treatments comprising of three hybrids i.e. H1: Vikas; H2: Hanuman and H3: XB-20plus and sub-plot treatments with four graded levels of nitrogen i.e. N1: 0 $kgha^{-1}$; N2: 40 $kgha^{-1}$; N3:80$kgha^{-1}$ and N4:120 $kgha^{-1}$. Thus, there were twelve treatment combinations. The experiment consisted of three replications.

The recommended dose of nitrogen fertilizer is 80 $kgNha^{-1}$. Hybrid Vikas (H1) is having duration of 75 days with yield potential of 20-25 qha^{-1}. Hybrid Hanuman (H2) is having duration of 85 days with yield potential of 25-30 $qtha^{-1}$ and that of hybrid XB-20plus is of 78-80 days duration with yield potential of 20-25 $qtha^{-1}$.

The tillage practices were as per the local one with one tractor drawn cultivator followed by animal drawn harrow. The seeds were sown at spacing of 45 cms ×15 cms with depth of 2-3 cms. Nitrogen was applied in split i.e. ½ at sowing and ½ at 30 DAS and phosphorous and potassium were applied as basal @ 40 kg $P2O5$ ha^{-1} and 30 kg $K2O$ ha^{-1}, respectively. Irrigation were applied with first two after 10 and 20 DAS, and the rest at the interval of 7 days. Atrazine @ 1.0 kg ai ha^{-1} was applied as pre-emergence and manual weeding at 30 DAS. The data recorded was statistically analyzed with the ANOVA technique for split plot design as suggested by Panse and Sukhatme (1978) at 5 per cent level of significance.

Results and Discussion

Yield attributes

Four yield attributes were analysed i.e. number of spikes m^{-2}; spike length; grain weight per spike and test weight. The effect of hybrids and levels on yield attributes was found significant, however, their interaction effect was found non-significant (Table 1).

Number of spikes m^{-2}, spike length and grain weight per spike was found to significantly higher for hybrid Hanuman (H1), followed by hybrid XB-20 plus and significantly lower in hybrid Vikas (H1). However, the test weight was found to be constant for all the three. The results were in confirmation with Bar *et al.*, (1988), Sharma *et al.*, (1999), Kumar *et al.*, (2004) and Pathan *et al.*, (2010) (Table 1).

Each incremental dose of nitrogen from 0 kg ha^{-1} to 120 kg ha^{-1} has seen significant increase in the yield attributing character. 120 kg N ha^{-1} has reported the highest yield attributes in range of 45.6 per cent for number of spikes m^{-2}; 55 per cent for spike length; 78.7 per cent for grain length and 21 per cent for test weight. Among all the yield attributes, test weight has seen the least increase. This can be attributed to its determination by genetic potential. The results were in confirmation with Sharma *et al.*, (1999) and Yakadari and Reddy (2009).

Table.1 Effect of different pearl millet hybrids and nitrogen levels on the spike length (cm), number of spikes m-2, 1000 grain weight (g) and grain weight per ear (g)

Treatment	Spike length (cm)	Number of spikes m^{-2}	1000 grain weight (g)	Grain weight per ear (g)
Hybrids				
Vikas (H1)	18.4	31.0	7.7	14.7
Hanuman (H2)	22.2	40.0	8.2	19.0
XB 20 plus	19.9	36.0	7.8	16.4
SEm±	0.25	0.60	0.21	0.13
CD (P= 0.05)	0.97	2.30	NS	0.52
Nitrogen levels ($kgha^{-1}$)				
0	15.8	28.7	7.1	12.2
40	18.6	33.7	7.6	15.0
80	21.7	38.5	8.1	17.8
120	24.5	41.8	8.6	21.8
SEm±	0.49	0.53	0.12	0.22
CD (P= 0.05)	1.45	1.60	0.26	0.64
Interaction (H×N)				
Sub at same main				
SEm±	0.49	1.2	0.22	0.26
CD (P= 0.05)	NS	NS	NS	NS
Main at same or different sub				
SEm±	0.77	1.0	0.38	0.35
CD (P= 0.05)	NS	NS	NS	NS

Table.2 Effect of different pearl millet hybrids and nitrogen levels on grain yield (kg ha^{-1}), stover yield (kgha^{-1}) and harvest index (per cent)

Treatment	grain yield (kg ha^{-1})	stover yield (kgha^{-1})	harvest index (per cent)
Hybrids			
Vikas (H1)	1530	4396	34.4
Hanuman (H2)	2067	5102	40.1
XB 20 plus	1809	4678	38.3
SEm±	76.7	63.5	0.99
CD (P= 0.05)	221.6	170.0	3.80
Nitrogen levels (kgha-1)			
0	1260	4273	29.4
40	1629	4506	36.0
80	1879	4760	39.5
120	2439	5361	45.4
SEm±	57.0	86.4	1.3
CD (P= 0.05)	169.3	257.0	3.8
Interaction (H×N)			
Sub at same main			
SEm±	113.5	87.0	1.98
CD (P= 0.05)	NS	NS	NS
Main at same or different sub			
SEm±	102.6	136.6	2.18
CD (P= 0.05)	NS	NS	NS

Grain yield

Grain yield for all the three hybrids differed significantly with highest being reported in Hybrid Hanuman (H2). The mean yield of this hybrid was recorded at 2067 kgha^{-1}, which was 14.4 per cent and 35.5 per cent higher when compared to hybrid XB 20 plus (H3) and Hybrid Vikas (H1), respectively. The yield enhancement was attributed to significantly higher number of yield attributing characters. The results were in confirmation with Mohammad (1998), Satyajit *et al.*, (2007), Rathore *et al.*, (2008) and Pathan *et al.*, (2010) (Table 2).

This was continuous and significant enhancement of yield levels with each increased dose of nitrogen from 40 kg ha^{-1} to 120 kg ha^{-1}, with maximum at 120 kg N ha^{-1}. The maximum enhancement of yield was recorded with 29.8 per cent between 80 kg N ha^{-1} to 120 kg N ha^{-1}, followed by 29 per cent between 0 kg N ha^{-1} to 40 kg N ha^{-1}, and 15.3 per cent between 40 kg N ha^{-1} to 80 kg Nha^{-1}. The results were in confirmation with Mohammad (1998), Sehwag *et al.*, (2003), Kumar *et al.*, (2004) and Girase *et al.*, (2010) (Table 2).

Stover yield (kgha-1)

The stover yields were in accordance with the grain yield i.e. Hybrid Hanuman (H2) was significantly superior to other two hybrids, and hybrid XB 20 plus (H3) was significantly superior to hybrid Vikas (H1). Hybrid Hanuman put forth significant stover yields

with 18.6 and 8.97 per cent when compared to hybrid Vikas (H1) and hybrid XB 20 plus (H3), respectively. The results were in confirmation with Bar *et al.,* (1988), Sharma *et al.,* (1999) and Kumar *et al.,* (2004) (Table 2).

The results indicated the application of increased levels of nitrogen from 0 kg ha^{-1} to 120 kg ha^{-1} progressively increased the stover yield significantly. The maximum difference of 1088 kg N ha^{-1} was noticed with 120 kg N ha^{-1} when compared with 0 kg N ha^{-1}. The results were in confirmation with Vyas *et al.,* (1992) and Sehwag *et al.,* (2003) (Table 2).

Harvest Index (Per cent)

Hybrid Hanuman (H2) recorded significantly higher harvest index (i.e. 40.1 per cent) over hybrid Vikas (H1), however, the same was at par with hybrid XB 20 plus (H3). The difference among the hybrids can be attributed to the difference in assimilate partitioning efficiency of hybrids. The results were in confirmation with Yadav *et al.,* (2004) (Table 2).

There was significant increase in harvest index from 0 kg N ha^{-1} to 120 kg N ha^{-1}, except when it was enhanced between 40 kg N ha^{-1} to 80 kg N ha^{-1} (Table 2).

Hybrids have the potential to surpass the yield levels of the traditional and improved varieties. However, their potential can be achieved with optimum nutrition. In dryland tracts, the deficiency of nitrogen is the most common. From the above study, now it can be concluded that the hybrid H2 (Hanuman) with nitrogen dose 120 kg ha^{-1} is the most suitable of the southern Telangana region.

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