

## Effect of Levels and Times of Nitrogen Application on Pearl Millet Under Rainfed Conditions

R.C. GAUTAM\*

An experiment was conducted at the Regional Station of Indian Agricultural Research Institute, Coimbatore during *Rabi* seasons of 1974 and 1975 to study the effect of levels and times of nitrogen application on hybrid pearl-millet under rainfed conditions. It is evident from these results that pearl-millet may be grown in *rabi* season in Tamil Nadu. Pearl-millet responded up to 80 kg nitrogen per hectare. Split application of nitrogen proved superior over application of full amount of nitrogen at planting. Two splits i.e. half N at planting and remaining half 3 weeks after planting or three splits i.e. half N at planting, one-fourth 3 weeks after and remaining one-fourth 6 weeks after planting proved superior to the split where half N was applied at planting and another half 6 weeks after planting.

Pearl-millet (*Pennisetum typhoides* (Burm.F.) stapf & C.E. Hubb) constitutes the mainstay in dry land areas. Efficient utilization of nitrogenous fertilizers by crop plants is also partly contributed by its time of application, particularly in dry land areas. Splitting of nitrogen may save the fertilizers from leaching if there are heavy rains during the early part of the crop season and it may also save the fertilizer if there is any sign of drought in the middle of the crop season (Bains, 1962 and I.A.R.I 1970). Further, split applications evenly supply the nitrogen to the crop plants during their growth and development stages. (I.C.A.R. 1972). Very limited information is available on this aspect for rainfed pearl millet crop grown in South Indian conditions. Therefore, this experiment was undertaken to compare different times of nitrogen application on pearl millet.

### MATERIAL AND METHODS

The field experiment was conducted at the Regional Station of Indian Agricultural Research Institute, Coimbatore during the *Rabi* seasons (September-December) of 1974 and 1975. The treatments comprised two levels of nitrogen viz. 40 and 80 kg N per hectare and four times of its application viz. full at planting (TA-1); half at planting + half three weeks after planting (TA-2); half at planting + one-fourth three weeks + one-fourth six weeks after planting (TA-3) and half at planting + half six weeks after planting (TA-4). In all, there were eight treatment combinations which were compared in randomized block design with four replications. The soil of the experimental field was medium brown loam containing 0.36 per cent organic carbon, 38.2

\* Scientist-2, Division of Agronomy, Indian Agricultural Research Institute New Delhi-110012.

TABLE I. Mean weekly relative humidity, minimum and maximum temperatures and weekly rainfall

Months	1974				1975				
	Rainfall (mm)	R.H. %	Temp.		Rainfall (mm)	R.H. %	Temp.		
			Mini	Maxi			Mini	Maxi	
September	I week	15.0	91.1	22.6	31.4	03	85.1	21.3	30.5
	II week	6.7	89.1	21.6	31.1	4.0	88.5	20.3	30.2
	III week	52.4	89.2	22.2	29.8	53.1	96.0	21.3	30.0
	IV week	10.2	91.1	21.9	29.4	1.8	87.0	22.1	29.9
October	I week	7.8	92.5	21.6	31.0	0.3	89.7	21.5	30.3
	II week	12.0	88.8	21.9	31.5	5.2	90.1	21.5	30.7
	III week	26.8	82.5	19.4	30.9	27.9	87.1	21.3	29.9
	IV week	35.5	85.8	19.2	31.4	18.3	91.1	21.1	28.8
November	I week	2.2	79.3	19.3	30.8	75.9	22.4	20.3	29.1
	II week	8.2	83.8	21.2	30.9	4.4	95.3	18.8	29.8
	III week	0.2	85.6	16.2	31.2	8.7	83.0	20.2	29.3
	IV week	0.0	94.0	20.7	30.1	0.2	89.1	19.4	29.4
December	I week	—	88.5	18.1	28.9	—	89.1	18.0	29.9
	II week	—	88.0	18.2	23.7	—	88.0	15.9	29.6
	III week	—	85.0	16.2	28.2	4.3	82.6	19.2	27.1
	IV week	3.5	89.8	17.7	27.9	—	85.8	15.4	25.4

kg/ha available phosphorus and 658 kg/ha  $K_2O$  with 8.4 pH and E.C. of 0.22 mmhos/cm. NHB-3 seeds were used in both the years and sowings were done in the third week of September with the onset of North-East monsoon. The meteorological data for the crop seasons are presented in Table I. Sowing was done by *Kera* method in rows 45cm apart and a population 175,000 plants per hectare was maintained at the final thinning i.e. 20 days after planting. A uniform dose of 40 kg each of  $P_2O_5$  and  $K_2O$  per hectare was applied at the time of sowing.

## RESULTS AND DISCUSSION

Weather data presented in Table I clearly shows that *rabi* season was quite suitable for growing rainfed crops of pearl-millet in Tamil Nadu. Rainfall ranging from 200 to 230 mm of intensity was received during the crop seasons through North-East monsoon. Tem-

perature also did not fall below 16°C during these months (Table I). Experimental crop of pearl millet completed its 50 per cent flowering in the stipulated time.

Application of 80 kg N per hectare significantly enhanced the grain yield of hybrid pearl-millet over 40 kg N per hectare in both the seasons. This shows that hybrids are highly responsive to nitrogen which may be ascribed to the significant improvement in the grain weight per plant and 1000-grain weight (Table II). Secondly, the amount of rainfall received during growth period of the crop was quite adequate for maximum utilization of applied nitrogen. Experiments conducted at other centres (Athwal *et al.* 1971 and I.C.A.R. 1975) have also revealed that under adequate rainfall, hybrid pearl millet responded upto 80 kg N per hectare or more but under limited moisture conditions the

TABLE II. Growth and yield attributes as affected by rate and times of N application

Treatments	Height of plant (cm)		No. of tillers /plant		No. of total tiller/m		Grain wt/ plant (gm)		1000 grain wt. (gm)		Days to 50% flowering	
	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
<b>(a)N (kg/ha)</b>												
1-40	105.8	120.3	5.2	6.0	38.9	35.6	15.2	12.2	5.8	4.5	48.9	43.0
2-80	106.9	122.9	5.4	6.4	39.7	37.9	18.5	14.7	6.9	5.9	49.0	48.7
SEm $\pm$	1.8	1.5	0.63	0.27	1.1	1.7	1.0	0.54	0.23	0.1	1.2	2.6
C.D. 5%	—	—	—	—	—	—	2.9	1.38	0.70	0.3	—	—
<b>(b)Time of Nitrogen application</b>												
TA-1-Full at planting	107.3	120.9	4.8	5.9	38.9	34.2	16.2	12.1	5.2	4.2	49.0	48.2
TA-2- $\frac{1}{2}$ at planting $\frac{1}{2}$ at 3 weeks	107.4	121.6	5.5	6.4	39.0	38.2	19.2	14.1	6.8	5.7	49.0	48.2
TA-3- $\frac{1}{3}$ at planting $\frac{1}{3}$ at 3 weeks $\frac{1}{3}$ at 6 weeks	105.4	122.4	5.6	6.1	39.4	38.2	18.5	13.8	6.8	5.7	49.0	48.5
TA-4- $\frac{1}{2}$ at planting $\frac{1}{2}$ at 6 weeks	105.2	121.3	5.4	6.3	40.3	36.2	14.0	13.7	6.4	5.2	48.5	48.5
SEm $\pm$	2.2	1.9	0.83	0.39	1.4	2.6	1.1	0.68	0.40	0.28	2.7	3.9
CD 5%	—	—	—	—	—	—	3.0	1.63	1.12	0.88	—	—

response of this crop to nitrogen was restricted up to 40 kg level only.

Time of application of nitrogen appreciably influenced the grain weight per plant, 1000-grain weight and grain yield of pearl-millet. Treatments TA-2 and TA-3 in 1974 and TA-2 in 1975 were found to be significantly superior over TA-1. Superiority of split application of nitrogen over application of the full dose at planting might be due to greater availability of nitrogen to the crop plants at various growth and development stages resulting in more grain weight per plant, bolder grains (1000-grain weight) which ultimately were reflected in more grain yield. Higher yield of bajra with two split doses viz. 1/2

at planting and the other half at flag leaf stage, and three splits viz. 1/3 at planting, 1/3 three weeks after planting and remaining 1/3 at earing stage have been reported by Kinra (1964) and Athwal *et al.* (1971), respectively.

A perusal of data of two seasons (Table III) further revealed that treatment T-4 (1/2 of N applied at planting and other half six weeks after planting) and treatment T-1 (full amount applied at planting) did not differ significantly from each other. Split application of nitrogen three weeks after planting was found to be most critical as the grain yield was reduced significantly by omitting the nitrogen application at this stage and applying six weeks after planting

TABLE III. Grain and stover yields of pearl-millet as affected by rate and time of N application

Treatments	Grain yield (q/ha)			Stover yield (q/ha)		
	1974	1975	Mean	1974	1975	Mean
<b>(a) N (kg/ha)</b>						
i) 40	20.3	16.1	18.2	96.2	70.9	83.5
ii) 80	22.8	19.7	21.3	100.7	74.0	87.3
SEm ±	0.67	0.63		2.7	2.5	
CD 5%	1.95	1.83		—	—	
<b>(b) Time of N application</b>						
TA-1 - Full at planting	19.8	16.6	18.2	98.1	70.0	84.0
TA-2 - $\frac{1}{2}$ at planting	22.1	19.5	20.8	100.6	72.5	86.5
TA-3 - $\frac{1}{2}$ at planting	22.9	18.9	20.9	98.7	72.5	85.6
TA-4 - $\frac{1}{2}$ at planting	21.4	16.7	19.0	96.5	75.0	85.7
SEm ±	0.65	0.88		3.8	3.5	
CD 5%	1.72	2.48		—	—	

(T-4). Late application of nitrogen resulted in production of new panicles late in the season without proper grain setting. Low yield from full amount applied at planting might be due to leaching losses of nitrogen during rainy season and availability of less amount of N for later growth and grain formation. Stover yield was neither influenced significantly by doses of N nor by split application of nitrogen (Table III). Interaction effects (levels x Time of nitrogen (Table III). Interaction effects (levels x Time of N application) were, however, not found significant in any of the seasons.

## REFERENCES

- ATAWAL, A.S., G.S. SINGH JASBIR and GILL. 1971. Time of nitrogen application to hybrid-bajra. *Indian J. Agron.* 16 : 284-87.
- BAINS, S.S. 1962. Fertilizer use under rainfed conditions. *Indian Fmg.* 12 : 23-24.
- I.A.R.I. 1970. A new technology for dryland farming. Published by Indian Agricultural Research Institute, New Delhi-12 pp. 125.
- I.C.A.R. 1972. Progress report of All India Coordinated Millet Improvement Programme presented in the workshop held at Nagpur in 1972.
- KINRA, K.L. 1964. Effect of different times of application of N on bajra. *Agric. Res.* 42: 94-95.