

Influence of Time and Dose of Nitrogen Application on Yield of Bajra

V. K. BALAKRISHNAN¹, Y. B. MORACHAN² and T. R. SRINIVASAN²

During monsoon season, 56.25 kg N/ha applied in three splits at 25, 40 and 55 days gave the highest yield, while during summer 50 kg N/ha applied in two splits at 25 and 40 days recorded the maximum yield of HB 3 bajra. Response curves were also fitted for both the seasons and based on the equations, optimum dose of N was found to be 61.3 and 59.2 kg/ha for monsoon and summer seasons respectively. However, considering the cost input and value of produce, the economic dose was found to be around 52 kg N/ha for both the seasons.

To minimise losses of nitrogen by leaching, fixation etc. and to assure adequate availability at critical stages of growth, split application of fertiliser is advocated for different crops. Athwal *et al.* (1971) reported that the best combination for increasing the number of tillers and matured ears per plant and ultimately grain yield of hybrid bajra was 160 kg N/ha applied in three split doses, *i. e.* one third at sowing, one third at three weeks after sowing and one third at earing stage. However, Jacquinet (1972) recommends single application for better yield. Chundawat and Shekhawat (1972) found that soil application at seedling stage was as good as split application. The above review indicates that the results are not conclusive and further detailed study may be necessary. Hence the present investigation was undertaken.

MATERIALS AND METHODS

To study the effect of nitrogen

dose in relation to time of application to Bajra (HB 3), experiments were conducted during 1974 monsoon and 1975 summer seasons under irrigation. The soil was medium fertile with reference to available N P K. The experiment was laid out in randomised block design replicated four times. In all there were fourteen treatments (Table) of different levels of nitrogen ranging from 12.5 to 100 kg N/ha applied in 2, 3 and 4 splits with a control of no nitrogen. The treatmental effect on various growth and yield characters were assessed along with yield particulars. The data are discussed in this paper.

RESULTS AND DISCUSSION

Grain yield: The average grain yield during the monsoon season was 2195 kg/ha while in summer it was 2426 kg/ha (Table). The increase in grain yield during summer was mainly due to favourable seasonal influence on yield

¹ 2. Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore-641004

TABLE. Effect of treatments on yield characters and yield

Dose of N	No. of splits	Productive tillers		Length of earhead		Grain yield kg/ha		Straw yield kg/ha		
		Sum-mer	Mon-soon	Sum-mer	Mon-soon	Sum-mer	Mon-soon	Sum-mer	Mon-soon	
T ₁	0	2.75	2.35	13.3	13.7	2023	1818	3085	2761	
@ T ₂	70.00	2	4.40	3.20	14.5	16.6	2541	2257	3240	3557
T ₃	25.00	4	4.05	2.60	14.2	14.2	2153	2048	3263	3043
T ₄	18.75	3	2.90	2.60	14.1	15.1	2135	1936	3351	2877
T ₅	12.50	2	3.15	2.85	15.0	13.5	2201	2107	3706	3225
T ₆	50.00	4	5.05	3.55	17.3	16.2	2818	2322	3307	3572
T ₇	37.50	3	3.10	2.40	15.3	14.7	2238	2009	3374	3051
T ₈	25.00	2	3.65	3.15	15.3	14.9	2426	2322	3240	3209
T ₉	75.00	4	3.10	3.65	15.1	16.3	2664	2451	3557	3534
T ₁₀	56.25	3	3.90	3.55	16.1	15.5	2800	2535	3573	3590
T ₁₁	37.50	2	4.55	2.40	15.7	16.4	2583	2147	3329	2915
T ₁₂	100.00	4	3.35	3.10	15.2	16.2	2360	2114	3329	3842
T ₁₃	75.00	3	3.05	3.30	13.8	15.3	2241	2435	3329	3939
T ₁₄	50.00	2	5.15	3.70	15.8	15.3	2775	2226	3085	3321
Mean			3.70	3.03	15.1	15.3	2426	2195	3340	3310
SED			0.57**	0.27**	0.9**	1.0*	168**	180**	168	270**
C. D. (P=0.05)			1.14	0.54	1.8	2.0	341	364	N.S.	546

- * Significant at 5% level
 ** Significant at 1% level
 N.S. Not significant
 4 splits applied at planting, 25th, 40th and 55th day
 3 splits applied at 25th, 40th and 55th day
 2 splits applied at 25th and 40th day
 @ Applied 45 kg at planting and 25 kg at 25th day

components like total productive tillers and length of earhead. Further during summer season, there was bright sunshine and higher temperature ranges. These factors would have been more favourable for grain formation.

Regarding the treatmental effects it was observed that during monsoon season, it was significant. However the indications are in favour of T₁₀ i.e. 56.25 kg N/ha applied in three splits i.e. at 25, and 55 days after sowing.

This was followed by 75 kg in 3 splits including basal dressing.

In case of summer season, the highest yield of 2818 kg/ha was recorded in T₆ i.e. 56.25 kg N/ha in two splits. All these treatments were on par with each other. There was reduction in yield at lower doses of nitrogen in both the seasons. Further the higher doses beyond 75 kg N/ha in general also reduced the grain yield.

Nitrogen is essential for all vital activities. Hence, when increased dose of nitrogen was applied, this had enhanced the production of various growth attributes as could be seen from the data presented in Table. The sum total of all the beneficial effects of nitrogen on these attributes were also reflected on the increased grain production. Such a beneficial effect of increased N in splits on grain yield of *bajra* had been reported earlier by several workers (Gill *et al.*, 1973; Mahendrapal and Kaushik, 1973; Srivastava *et al.*, 1974).

However, very high dose of nitrogen may not be advantageous in all cases. It was reported by Ramakrishnan *et al.* (1974) that higher level of nitrogen beyond the optimum level made the crop to put forth greater vegetative growth. The trend was also seen in the present case as could be seen from higher straw yield and dry matter production under 75 and 100 kg N/ha which are discussed in later pages. The results are in conformity with those of earlier workers (Patel and Sutaria, 1972; Ranjodh Singh *et al.*, 1973).

In order to confirm the trend of yield in relation to nitrogen, response curves were fitted for both the seasons. The response was found to be quadratic type are given below:

$$\begin{aligned} \text{I Monsoon } Y &= 1809 + 18.39x - 0.15x^2 \\ \text{II Summer } Y &= 1992 + 21.31x - 0.1795x^2 \end{aligned}$$

Where Y is the estimated yield and x is the nitrogen dose in kg/ha.

The optimum dose based on the equation was found to be 61.3 and 59.2 kg for monsoon and summer seasons respectively. Further, in view of the cost of fertiliser the economic dose was also worked out by using the formula

$$\frac{1}{2c} \frac{(q-b)}{P}$$

Where q = the cost of fertiliser i.e.

Rs. 5/kg of N

P = cost of grain i.e. Rs. 2/kg

b & c are the coefficient of $x + x^2$ in the equations.

The calculated economic dose of nitrogen was found to be 53.0 and 51.9 kg/ha for monsoon and summer seasons respectively. It could be seen from the results that at the present cost structures, both economic and optimum doses are almost same and hence a dose of 52.0 kg N/ha in two splits at 25 and 50 days during monsoon can be recommended to get higher grain yield.

Straw yield: There was no difference between two seasons in the straw yield (Table). The treatment effect was seen only in case of monsoon season wherein the trend was in favour of higher dose, with four splits application. In the case of 4 splits, the last dose was applied at flowering stage which made the plants to put forth side shoots. This would have reduced the nutrient availability to the main flower head for grain formation. In case of summer season due to higher temperature conditions, the microbial activity would have been more resulting in higher release of soil nitrogen. This would have caused a sufficiency level in the nutrient status in the soil in all

plots resulting in uniform availability. The results of present study are in conformity with those of Kandasamy *et al.* (1974), Ramakrishnan *et al.* (1974) and Sankaran and Kaliappa (1974).

The Senior Author thank the Tamil Nadu Agricultural University, Coimbatore for granting permission to publish the article which formed part of M. Sc. (Ag.) thesis submitted by him.

REFERENCES

- ATHWAL, A. S., JASBIR SINGH AND C.S. GILL. 1971. Time of nitrogen application to hybrid bajra. *Indian J. Agron.* 16: 284-87.
- CHUNDAWAT, G. S. and G. S. SHEKHAWAT. 1972. Effect of N and its method of application on yield of hybrid bajra on sandy loam soils of Rajasthan. *Indian J. Agron.* 17: 79-82.
- GILL, A. S., R. C. LUTHRA and VIJAYAKUMAR. 1973. Comparative response of hybrid variety of bajra (*Pennisetum typhoides*) to nitrogen levels. *Res.* 10: 184-89.
- JACQUINOT, L. 1972. Results and perspectives of research conducted in Senegal into the potential of grain millet (*Pennisetum typhoides*). *Agron. Trop.* 27: 815-21.
- KANDASAMY, D. S., M. S. THANGAM, M. S. RAMAKRISHNAN, K. K. CHANDRA-GIRI, T. R. SRINIVASAN and S. VARISAI MOHAMMAD. 1974. Response of Pearl millet to major nutrients. *Madras agric. J.* 61: 353-58.
- MAHENDRAPAL and S. K. KAUSHIK. 1973. Nitrogen fertilisation and plant density in hybrid pearl millet under irrigated condition. *Indian J. agric. Sci.* 43: 266-70.
- PATEL, A. S. and SUTARIYA. 1972. Response of hybrid pearl millet to N, P and K in different agro climatic zones of Gujarat. *Indian J. agric. Sci.* 42: 1024-27.
- RAMAKRISHNAN, M. S., Y. B. MORACHAN and T. R. SRINIVASAN. 1974. Studies on the response of graded doses of nitrogen on the yield of Hybrid bajra-1 (*Pennisetum typhoides* S & H). *Madras agric. J.* 61: 761-63.
- RANJODH SINGH, N. T. SINGH and A. S. GILL. 1973. Note on the effect of nitrogen and spacing on the performance of rainfed-hybrid bajra. *Indian J. agric. Res.* 7: 215-16.
- SANKARAN, S. and R. KALIAPPA. 1974. Studies on the response of graded doses of nitrogen on the yield of hybrid bajra-1 (*Pennisetum typhoides* S & H). *Madras agric. J.* 61: 761-63.
- SRIVASTAVA, U. S. L., SARDAR SINGH and S. C. YADAV. 1974. Response of pearl millet (*Pennisetum typhoides* S & H) hybrids to nitrogen levels. *Indian J. Agron.* 19: 255-57.