https://doi.org/10.29321/MAJ.10.A03154

Madras agric. J. 64 (1) : 80—83. February, 1977

Levels and Time of Nitrogen Application in Rainfed Pearl Millet (*Pennise tumtyphoides*)

PANJAB SINGH[1]

An attempt was made to economise the use of N in pearl millet production under rainfed conditions. Nitrogen applied at 40 and 80 Kg/ha yielded 2 to 2.5 times higher grain over no N application. Under sub-optimal and higher rainfall years. 40 Kg N/ha was as effective as 80 Kg N/ha in increasing grain yields especially in the event of early stage drought. A level of 40 Kg N/ha applied half as basal and another half during third/fourth week after planting proved economical for hybrid pearl millet. Withholding the second spilt of N in the event of early-stage prolonged drought leading to crop failure also saved 50 per cent N. Application at or beyond sixth week of crop growth stage added to stalk yields only.

At the present juncture, when fertilizer costs have gone up by 80-100 per cent, using available nutrients more efficiently than in past becomes obligatory. The use of fertilizers otherwise might not be economically viable, especially in arid and semi-arid lands, where rains are poor, erratic and uneven. Quantity and the distribution of rains do affect the efficiency in use of applied N but level and methods of fertilizer application could also be tailored as per the need of the crop to increase efficiency. Research work on use of nitrogenous fertilizer in pearl millet was concentrated mainly under irrigated or under higher rainfall conditions. Under such conditions Singh and Mehta (1959), Singh and Maurya (1969) and Pal and Kaushik (1973) have reported the response of local varieties upto 40 Kg N/ha while the hybrids responded up to 160 kg. Pal *et al*., (1973) have indicated that the response is locational because the same variety (HB-1) responded up to 90 kg at Ludhiana and Hissar but upto 130 Kg at Tamil Nadu. Kandaswami *et al*., (1974) also report ed that 140 Kg N/ha was the optimum N under Tamil Nadu conditions. Certain findings under rainfed conditions (Anon. 1972; Mahapatra, 1972) do indicate that the crop responded up to 25 and 40 Kg level of nitrogen but these are mainly related to higher rainfall areas. Limited information is available for semi-arid lands where rainfall is poor and erratic. This project, initiated in 1972, aimed at answering such a question as to the economical level and time of N application to hybrid pearl millet grown under rainfed conditions of semi-arid regions.

MATERIALS AND METHODS

Field experiment was conducted during *Kharif*, 1972-75. The farm soil was loamy sand, 150 cm deep. It

1. Central Arid Zone Research Institute, Jodhpur.

contained 0.15 per cent organic carbon, 14 kg/ha available phosphorus, 181 Kg/ha available potassium, pH 7.5, conductivity 20.7 per cent field capacity (by weight) 9.6 per cent and permanent wilting point 2.5 per cent. The climate of the area is dry, hot with high wind velocity during May and June. Year-wise rainfall received and its distribution indicate that though the amount of rain received in 1972 was more or less equal to the average rainfall of the season, 90 per cent of it was received within 10 days in the second fortnight of August resulting in the onset of an early drought for nearly 35 days. In 1973 the quantity received was nearly 50 per cent higher than the normal rainfall but a drought period of about 30 days set in, late in the season. In 1974, however, rain received was only about half of the normal rainfall but the crop experienced a long drought starting from third week onward till tenth week of crop growth and a rainfall of 16.5 mm in middle of the drought of nearly two months period only could save the crop. In 1975 on the other hand, the total rain received was nearly 80 per cent higher than the normal rainfall and well distributed over crop season. The crop, therefore, experienced three drought conditions- *viz.*, early in 1973, early and mid in 1974, late stages of crop in 1973 and one droughtless condition in 1975 during the four years of experimentation.

Pearl millet (HB-3 old) was sown in the first week of July 1972, 1973 and 1975 and in the second week of July 1974 depending on receipt of monsoon rains. The following nitrogen treatments were tried in a randomised block design with four replications.

Treatments (Kg N/ha)		At planting	After sowing	
			3 weeks	6 weeks
T_1	40	40	—	—
T_2	40	20	20	—
T_3	40	20	10	10
T_4	40	20	—	20
T_5	80	80	—	—
T_6	80	40	40	—
T_7	80	40	20	20
T_8	80	40	—	40
T_9	Control	—	—	—

A basal dose of half of nitrogen as per the treatment and 50 Kg/ha each of P_2O_5 and K_2O were placed in bands at sowing approximately 5 cm below and and 5 cm to one side of the seed row through urea, superphosphate and muriate of potash respectively. Remaining half of the nitrogen was side placed at crop growth stages as per the treatment. BHC 10 per cent at 25 kg/ha was applied along with the basal dose of fertilizer as a preventive measure against soil pests. Final stand of the plant at 14 days after sowing was maintained at 12 cm apart in lines spaced at 50 cm to give uniform plant population.

RESULTS AND DISCUSSION

As a result of early drought no yield was obtained in 1972. The crop was sown only with 27 mm presowing

TABLE. Effect of nitrogen treatments on grain and stalk yields and yield contributing characters of Pearl millet

Treatment	1973				1974				1975			
	A	B	C	D	A	B	C	D	A	B	C	D
T_1	20.23	50.00	23.03	6.42	7.58	31.25	18.00	5.30	22.43	76.39	20.83	5.70
T_2	22.53	50.00	23.81	6.70	8.86	41.66	16.33	6.05	24.03	72.92	21.39	6.10
T_3	21.11	47.22	25.44	6.58	7.17	25.00	17.22	5.40	25.70	88.20	19.00	6.00
T_4	21.11	50.00	24.31	7.20	8.25	35.42	16.56	5.40	23.54	74.87	19.94	6.60
T_5	21.11	56.99	26.36	6.30	9.22	31.92	20.72	5.00	23.96	106.67	22.72	6.20
T_6	28.89	61 66	28.25	6.90	10.97	43.06	18.22	4.85	28.20	82.37	23.06	5.90
T_7	29.77	52.77	26.17	7.02	10.08	31.94	17.00	4.96	28.89	98.34	21.61	6.10
T_8	25.89	56.44	27.28	6.90	6.70	29.17	17.17	5.20	23.62	82.78	20.56	6.00
T_9	11.44	33.11	21.92	4.70	3.92	19.45	18.06	4.00	16.63	53.47	15.83	6.40
C.D. at 5%	4.56	8.23	NS	0.51	2.86	8.21	NS	0.68	5.11	21.95	NS	3.18

A—Grain yield (q/ha) C—No. of ears/m² NS=Not Significant
B—Stalk yield (q/ha) D—1000 grain weight (g)

rains but the dealy in commencement of next rain till 35 days after sowing resulted in development of severe soil moisture stress both within the vicinity of young roots and also deep below the roots. For nearly a fortnight the moisture content at 30 cm depth was noted to remain below the wilting point moisture content and resulted in slow dehydration and severe moisture strees in plants leading to complete crop failure within a period of six weeks. Heavy rainfall of more than 200 mm during sixth and seventh weeks after planting was not of any use to plants since the distribution of rains was primarily responsible for the failure of crops. In such cases also it will be advisable to follow split application to save 50 percent of nitrogen because crop failure due to failure of rains, is not uncommon.

In 1973, a year with well distributed rainfall in early stage, 40 and 80 Kg N/ha in two splits increased the grain yield by 97 and 152.5 per cent over no nitrogen application (Table). Also 80 Kg N applied in two splits increased the grain and straw yield significantly over 40 Kg N. Average response per unit of nitrogen applied was 50 Kg grain/Kg N applied for 40 Kg N level and 36 Kg grain/Kg N for 80 Kg N in two splits. In poor rainfall year of 1974, and a high rainfall year of 1975 with good distribution, it was observed that application of 40 Kg N/ha in two splits was as effective as 80 Kg N/ha. Yield differences in drought years of 1974 were mainly due to differences in weight of individual grains whereas in 1975 it was due to ear numbers. Application of N during sixth week or later contributed to stalk yields only. Post-sowing early rains in 1973 had higher response of crops to higher doses of nitrogen. In case of early stage drought and/or in the event of late rains, these differences were not noticeable. Early drought caused water stress and plants could not maintain initial high vigour for utilizing nitrogen higher than 40 Kg N/ha and therefore, this level was non-effective in increasing grain yields. In 1973, however, because of well distributed post-fertilizer application rains, efficiency of fertilizer use was higher and better availability of soil moisture along with nitrogen increased the grain yield appreciably. The 1974 drought following fertilizer application decreased nitrogen utilization efficiency resulting in poor plant development and low yields (Table). It was also observed that fertilized plants produced bolder grains compared to non-fertilized ones and the weight increased further if the plants were not exposed to moisture stress especially at grain development stage as in 1973 and 1974. A long drought period during 1974, both in early and in late stage reduced the number of ears per unit area besides decreasing the weight of individual grains. These factors were mainly responsible for decreased grain yield under such dry conditions. Initial presowing soil moisture, stimulates the early vigour in plants which could evade the adverse effects of short period early, mid or late drought. Drought in the later stage of the crop growth in 1973 did not have much adverse effect on grain yields due to higher soil moisture reserve in soil profile which took care of the needs of the crop during grain maturity period.

Application of fertilizer should, therefore, be synchronised with the receipt of rains for higher efficiency. Application of 40 Kg N/ha half as basal and another half during third or fourth week after planting, depending on rains, would be an economical proposition.

The author is grateful to Dr H. S. Mann, Director, Central Arid Zone Research Institute, Jodhpur for providing necessary facilities and guidance.

REFERENCES

ANONYMOUS. 1972. Progress Report. *Kharif 1972. Dry Fmg. Res. Main Centre.* C. A. Z. R. I. Jodhpur. p. 17-20.

KANDASWAMI, O. S., M. S. THANGAM, M. S. RAMAKRISHNAN, K. K. CHANDRAGIRI, T. R. SRINIVASAN, and S. VARISAI MOHAMMAD. 1974. Response of pearl millet to major nutrients. *Madras agric. J.* 61 : 353-58.

MAHAPATRA, I. C. 1972. Fertilizer practices for millets under rainfed conditions. *All India Coordinated Sorghum and Millet Workshop, Nagpur, April.* p. 24-29.

PAL, M. R. K. CHAUDHARY, MAHABIR PRASAD and S. K. KAUSHIK. 1973. Response of pearl millet hybrids to nitrogen and economics of fertilization in different agroclimatic conditions. *Indian J. Agron.* **18** : 119-24.

PAL, M. and S. K. KAUSHIK. 1973. Nitrogen fertilization and plant density in hybrid pearl millet under irrigated conditions. *Indian J. agric. Sci.* **43** : 266 - 70.

SINGH, H. C. and B. N. MEHTA. 1959. Comparative studies on the effect of ammonium chloride and other fertilizers on yield and crude protein content of pearl millet (*Pennisetum typhoides*, Staff and Hubb.) *Indian J. Agron.* **4** : 105-13.

SINGH, V. and R. A. MAURYA. 1969. Response of hybrid bajra to varing levels of plant population and level of N. *Indian J. Agron.* **3** : 246.