

## Study on the Effect of time of Application and Doses of Nitrogen on Yield and Protein Content of Pearl millet (*Pennisetum typhoides* Staff and Hubb)

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The study on the effect of nitrogen doses and their time of application on Bajra has revealed that increase in nitrogen dose increased the yield and protein content. Higher protein content was found at early stage than at the maturity of the crop. Significant increase in yield and protein was directly correlated with the increase of nitrogen in number of subsequent split doses. However, maximum yield and protein content was found in 120 kg/ha. applied in three split doses.

Nitrogen plays an important role in limiting crop production in soils of India. (Stewart, 1947). Shukla *et al* (1970), Gautam *et al* (1964), Ghose *et al* (1960) and Sharma *et al* (1966) recommended application of nitrogen in split doses for various crops. An increase in protein content of grain also has been observed by application of nitrogenous fertilizers (Swaminathan, 1969)

Further Webster and Davis (1956) reported that protein percentage was higher at early stage of growth before flowering of sorghum forage. Looking to these responses it was described to study the response of doses and time of application of nitrogenous fertilizer on grain yield and protein content of hybrid Bajra in semiarid region of Rajasthan. The results obtained are presented in this paper.

### MATERIAL AND METHODS

An experiment was laid out at Regional Station of Agricultural Research,

Sumerpur in R.B. design having six replications in 5m x 5m plot size during kharif 1972. The soil was sandy loam and poor in fertility level, pH and conductivity of the soil was 7.5 and 0.15 mm hos/cm. respectively. Organic carbon content of the soil was 0.3% and available phosphorus was 34.6 Kg/ha. HB-1 Bajra variety was sown. The following were the particulars of the treatments :

1. 40 Kg of N/ha applied as basal dose (T<sub>1</sub>)
2. 40 Kg of N/ha. applied 1/2 as basal + 1/2 after one month of sowing (T<sub>2</sub>)
3. 40 Kg of N/ha applied 1/3 as basal + 1/3 after one month of sowing + 1/3 after two months of sowing (T<sub>3</sub>).
4. 80 Kg of N/ha. applied as T<sub>1</sub>.
5. 80 Kg of N/ha applied as T<sub>2</sub>.
6. 80 Kg of N/ha. applied as T<sub>3</sub>.

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7. 120 Kg of N/ha. applied as T<sub>1</sub>.
8. 120 Kg of N/ha applied as T<sub>2</sub>.
9. 120 Kg of N/ha applied as T<sub>3</sub>.

Grain and fodder weight were recorded after harvest of the crop. Plant samples collected after 30 days of sowing and at maturity were analysed by Kjeldahl method (Jackson, 1967) and crude protein was calculated by multiplying nitrogen figures by 6.25.

### RESULTS AND DISCUSSION

**Effect on grain and Straw yield:**  
Data presented in Table I indicated that

TABLE I. Grain yield as influenced by different levels and time of application of nitrogen

| Levels of N<br>kg/ha | Grain Yield<br>kg/ha | Time of application<br>of N  | Grain yield<br>kg/ha |
|----------------------|----------------------|--|----------------------|
| 40                   | 802                  | Basal (T <sub>1</sub> )  | 143                  |
| 80                   | 920                  | 1/2 Basal+1/2 after<br>one month of sowing (T <sub>2</sub> )                   | 930                  |
| 120                  | 1118                 | 1/3 Basal+1/3 after<br>one month of sowing + 1/3 after two<br>months of sowing | 1067                 |
| C.D. at<br>5%        | 110                  |  | 110                  |

nitrogen fertilization increased the grain yield significantly indicating that the soil was deficient in nitrogen. Significant increase in yield was obtained in all the treatments. Maximum grain yield of 1118 Kg/ha was obtained when nitrogen was applied at the rate of 120 Kg/ha and was statistically superior to 80

and 40 Kg/ha. Similar increase in yield has been reported by Vyas *et al.* (1972), Kandaswamy *et al.* (1974) and with nitrogen application.

Split doses of nitrogen at different time was found better than the nitrogen application in single dose. Nitrogen applied in two split doses (T<sub>2</sub>) increased the yield over T<sub>1</sub> non-significantly. Significant increase in yield was obtained in T<sub>3</sub> where nitrogen was applied in three split doses. Yield obtained in three split dose application was 1067 Kg/ha. Table II. which corroborate the findings of Shukla *et al.* (1970) and Gautam *et al.* (1964) in hybrid maize and Sharma *et al.* (1966) in wheat Data presented in Table II indicated non-significant

TABLE II. Effect of various treatments on grain and straw yield kg/ha

| Treat-<br>ments | N 40  |       | N 80  |       | N 120 |       |
|-----------------|-------|-------|-------|-------|-------|-------|
|                 | Grain | Straw | Grain | Straw | Grain | Straw |
| T1              | 696   | 3574  | 807   | 4195  | 1027  | 4755  |
| T2              | 829   | 4091  | 891   | 4979  | 1070  | 4816  |
| T3              | 880   | 4557  | 1067  | 4546  | 1256  | 5205  |
| C.D. at 5%      |       |       |       |       |       |       |
| Grain           | 191   |       |       |       |       |       |
| Straw           | 380   |       |       |       |       |       |

increase in fodder yield when nitrogen was applied in split doses at different time in all the treatments. Highest fodder yield of 5205 Kg/ha. was obtained in case of T<sub>3</sub> where 120 Kg N/ha. was applied in three split doses. Grain yield was influenced by application of nitrogen in split doses at all the three levels, maximum grain yield of 1256

TABLE III. Percentage crude protein content in plant and grain as influenced by various treatments

| Treatments | N 40                |             |       | N 80                |             |       | N 120               |             |       |
|------------|---------------------|-------------|-------|---------------------|-------------|-------|---------------------|-------------|-------|
|            | Plants              |             |       | Plants              |             |       | Plants              |             |       |
|            | 30 day after sowing | at maturity | Grain | 30 day after sowing | at maturity | Grain | 30 day after sowing | at maturity | Grain |
| T1         | 15.37               | 2.53        | 10.85 | 16.87               | 2.72        | 11.55 | 18.12               | 2.88        | 11.90 |
| T2         | 13.56               | 2.36        | 11.02 | 15.18               | 2.83        | 11.72 | 15.62               | 3.07        | 12.42 |
| T3         | 11.87               | 2.59        | 11.16 | 13.62               | 2.92        | 11.85 | 14.68               | 3.43        | 13.25 |

Kg/ha. was recorded in the treatment N 120 applied in three split doses. There were no significant increase in grain yield in 40 Kg/ha. applied as T<sub>2</sub> or T<sub>3</sub>. However, significant increases in yield was obtained where nitrogen was applied at the rate of 80 Kg and 120 Kg/ha. in three split doses over single dose.

#### Effect on Protein Content

Protein content was maximum in the plant analysed after 30 days of sowing (Table III) but the protein content was decreased at maturity stage. (Vijay Kumar *et al.* 1973). But with the increase in nitrogen fertilization progressive increase in the protein content was found at both the stages of plant growth. An increase of grain protein was also obtained with the increase in nitrogen application. (Khanna 1966)

With split dose application of nitrogen protein content was found to be decreased in plants collected after 30 days of sowing. A reverse trend in protein content was obtained at harvest stage both in plant and grain. Maximum pro-

tein percentage in grain was observed in case of nitrogen application in three split doses at all the three levels of nitrogen. Maximum yield and protein content obtained in the treatments N-120, (T<sub>3</sub>) indicates that there was no luxury consumption of nitrogen when it was applied at the rate of 120 Kg/ha. in three split doses. It might have been due to approximate coincidence of three timings of nitrogen application with peak period of N absorption. Gautam *et al.* (1964) and Shukla *et al.* (1970) have also reported application of nitrogen in three splits to be superior to two splits and single dose application of nitrogen in case of protein content of maize grain. Similarly Sharma *et al.* (1964) concluded that the split application of nitrogen increased protein percentage in wheat grain.

#### Uptake of Nitrogen

The results of uptake of nitrogen are given in Table IV. Nitrogen uptake was found to increase with the increase in nitrogen levels and no. of splits

TABLE IV. Estimated removal of nitrogen by straw and grain (kg/ha)

| Treatments | N 40  |       |       | N 80  |       |       | N 120 |       |       |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | Straw | Grain | Total | Straw | Grain | Total | Straw | Grain | Total |
| T1         | 14.5  | 12.1  | 26.6  | 18.2  | 14.9  | 33.1  | 21.9  | 19.5  | 41.4  |
| T2         | 15.4  | 14.6  | 30.0  | 22.5  | 16.7  | 39.2  | 23.6  | 21.2  | 44.8  |
| T3         | 18.9  | 15.7  | 34.6  | 21.2  | 20.1  | 41.3  | 28.6  | 26.6  | 55.2  |

of its applications. Out of total uptake 43 to 48 per cent of nitrogen was removed by grain. Puntamkar *et al.* (1965) reported 45-55 per cent of total uptake of N by maize grain. Minimum nitrogen was removed in case of single dose nitrogen application at all the fertilizer levels. Maximum nitrogen 55.2 per cent was removed when nitrogen was applied at the rate of 120 Kg/ha. in three split doses.

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