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# Nitrogen Management for Rainfed Sorghum

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Sorghum is an important crop in dryland agriculture. Nitrogenous fertilizers play most important role in crop production per unit area and economical remuneration in cereals. The application of 90 kg N $ha^{-1}$ in two splits was recommended for sorghum to get optimum yield and maximum net profit in North Saurashtra Agroclimatic Zone (Anon, 1981). The rainfall in this area is erratic in nature and uneven in distribution and hence, sometimes, moisture is inadequate for utilization of fertilizer. Under such situation, the recommended dose need to be splited more as per moisture availability in the soil. A split application of nitrogen, if feasible, would also reduce the risk by way of investment for the fertilizer under dryland condition. Therefore, the field experiment was conducted in randomized block design with three replications for six successive years from 1989-90 to 1994-95 at Main Dry Farming Research Station, Targhadia to find out optimum proportion, time and method of application of nitrogenous fertilizer to *kharif* sorghum. The soils of the experimental field was deep, well drained, clayey in texture, non saline (EC 0.23 to 0.49) and alkaline in nature (pH 7.80 to 8.20), low to medium in organic carbon (0.32 to 0.50%), low in available phosphorus (15.0 to 23.3 kg $P_2O_5$ $ha^{-1}$) and medium to high in available potash (225 to 450 kg $K_2O$ $ha^{-1}$).

The recommended dose of nitrogen (90 kg $ha^{-1}$) through urea was arranged in following treatments :

Viz.,

$T_1$ — 100% at sowing.

$T_2$ — 75% at sowing time + 25% at tillering (25 – 30 days after sowing).

$T_3$ — 50% at sowing time + 50% at tillering (25-30 days after sowing).

$T_4$ — 50% at sowing time + 25% at tillering (25-30 days after sowing + 25% at leaf/penical emergence stage.

$T_5$ — 25% at sowing time + 75% at tillering (25-30 days after sowing).

$T_6$ — 25% at sowing time + 50% at tillering (25-30 days after sowing) + 25% at flag leaf/penical emergence stage.

$T_7$ — 50% at sowing time + 25% at tillering (25-30 days after sowing) + 25% at flag leaf/penical emergence (through spray).

$T_8$ — 25% at sowing time + 50% at tillering (25-30 days after sowing) + 25% at flag leaf/penical emergence (through spray).

A basal dose of phosphorus @ 30 kg $ha^{-1}$ was applied through single superphosphate. The data (Table 1) indicated that the application of nitrogen at different stages of crop growth in

TABLE 1

**Effect of split application of nitrogen on yield (q/ha$^{-1}$) and economics of rainfed sorghum.**

| Sr. No. | Treatment | 1989-90 | | 1990-91 | | 1991-92 | | 1992-93 | | 1993-94 | | 1994-95 | | Pooled | | Gross return Rs/ha$^{-1}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grain | Fodder | Grain | Fodder | Grain | Fodder | Grain | Fodder | Grain | Fodder | Grain | Fodder | Grain | Fodder | |
| 1 | $T_1$ | 10.05 | 127.09 | 07.05 | 60.84 | 3.74 | 097.88 | — | 15.83 | 1.05 | 35.27 | 0.95 | 40.56 | 4.57 | 62.91 | 14867 |
| 2 | $T_2$ | 11.96 | 141.75 | 07.71 | 61.74 | 3.49 | 097.60 | — | 21.16 | 090 | 39.68 | 0.92 | 45.85 | 5.00 | 67.86 | 16072 |
| 3 | $T_3$ | 09.94 | 125.66 | 06.43 | 67.88 | 3.10 | 093.47 | — | 22.93 | 0.90 | 33.16 | 1.34 | 45.85 | 4.34 | 64.82 | 15134 |
| 4 | $T_4$ | 09.26 | 136.77 | 09.17 | 58.20 | 2.26 | 093.47 | — | 31.75 | 0.92 | 39.93 | 0.88 | 48.50 | 4.50 | 68.10 | 15870 |
| 5 | $T_5$ | 07.35 | 143.33 | 07.67 | 68.36 | 2.40 | 094.75 | — | 22.05 | 1.41 | 39.51 | 1.60 | 52.91 | 4.09. | 70.15 | 16075 |
| 6 | $T_6$ | 08.15 | 128.81 | 11.20 | 80.79 | 2.54 | 099.65 | — | 22.05 | 1.50 | 40.92 | 0.81 | 49.38 | 4.84 | 70.27 | 16475 |
| 7 | $T_7$ | 07.40 | 110.00 | 03.17 | 49.37 | 2.73 | 103.17 | — | 15.87 | 1.06 | 35.09 | 1.00 | 45.85 | 3.07 | 59.89 | 13513 |
| 8 | $T_8$ | 11.43 | 113.49 | 04.99 | 64.49 | 2.62 | 091.71 | — | 19.84 | 0.81 | 33.86 | 1.59 | 02.91 | 4.28 | 62.72 | 14684 |
| S. Em. + | | 1.37 | 17.23 | 2.51 | 6.86 | 0.42 | 4.08 | — | 4.70 | 0.15 | 3.58 | 0.34 | 6.02 | 0.59 | 3.92 | — |
| C. D. 5% | | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. | — | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. | N.S. | — |
| C. V. % | | 22.30 | 23.30 | 60.70 | 18.60 | 25.55 | 7.34 | — | 37.96 | 25.28 | 16.72 | 55.40 | 21.87 | 52.00 | 21.00 | — |

**Note :** Selling price of sorghum grain and fodder are computed @ Rs. 500 and 200 per quintal, respectively.

various quantity showed non-significant differences in grain and fodder yields of sorghum during all the years of experimentation and also in pooled. Similar finding was also reported by Jadhav *et al.*, (1991). However, maximum gross return of Rs. 16475 ha$^{-1}$ was obtained when recommended dose of N (90 kg ha$^{-1}$) was splited as 25% at sowing time + 50% at tillering stage + 25% at flag leaf/penical emergence. On these basis, present recommended dose of N @ 90 kg ha$^{-1}$ in 3 splits is confirmed for the zone. However, the rain fall during last week of July and first week of August is much higher as compared to earlier or later period of monsoon (Table 2) and hence, higher profile moisture would be available to utilize applied quantity of nitrogen during these period. While low quantity as basal application is sufficient as starter dose, which also check the need of more water if dry spell may be occur on later stage growth of the crop. So that, it is advisable that application of nitrogen to *kharif* sorghum can be adjusted either as 25% at sowing + 50% at tillering stage + 25% at flag leaf/penical emergence stage or 25% at sowing + 75% at tillering stage on availability of fertilizer, financial position of farmers and soil moisture condition which reduce risk by way of investment on the nitrogenous fertilizer under dryland condition.

TABLE 2

**Rainfall (mm) and its distribution during the crop season.**

| Month | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|
| May | — | 62.0 (2) | — | — | — | — |
| June | 82.3 (4) | 48.6 (1) | 25.2 (1) | 28.4 (2) | 46.6 (3) | 97.5 (8) |
| July | — | 59.4 (3) | 240.2 (9) | 361.8 (13) | 160.0 (7) | 456.1 (17) |
| August | 344.1 (3) | 28.8 (8) | 71.2 (9) | 63.2 (7) | — | 99.7 (9) |
| September | 48.1 (5) | 103.0 (9) | 11.9 (1) | 88.7 (4) | 134.9 (5) | 228.7 (9) |
| October | 140.8 (8) | 26.5 (2) | — | 22.4 (1) | 19.3 (3) | — |
| Total | 615.3 (30) | 528.3 (25) | 348.5 (20) | 564.5 (27) | 400.8 (18) | 882.0 (43) |

Figures in parentheses indicate number of rainy days.

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