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# Nitrogen management in rainfed maize

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**ABSTRACT :** Performance of a pre release maize hybrid DHM-115 was assessed by effecting changes in the application schedule of nitrogen fertilizer in eight different treatments including RDF during 2008 and 2009 *Kharif* seasons at Maize Research Centre, ARI, Rajendranagar, Hyderabad. The data revealed that $T_5$ treatment (Nitrogen @ 20 kg/ha at each rain in addition to a basal dose of 100 kg/ha) was significantly superior in terms of growth parameters like plant height, dry matter per plant, yield attributing characters like cob length, cob girth, number of rows per cob, number of seeds per row and 100 seed weight and cob, grain and stover yields and it was at par with $T_4$ treatment (Nitrogen in 2 splits (1/2 basal +1/2 at tasseling) during both the years and also in pooled data. The results clearly indicated that nitrogen requirement and its use varies significantly from hybrid to hybrid particularly under rainfed conditions and the blanket recommendations may not hold valid for all the hybrids.

**Key Words :** Maize hybrid, Nitrogen management, *Kharif*, Rainfed situation, Growth parameters, Yield attributes, Yield

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Maize (*Zea mays* L.) is the third most important cereal crop next to rice and wheat and has the highest production potential among the cereals (Muthu Kumar *et al*., 2005). The crop is mostly grown under rainfed situations during *Khairf* season and hence the productivity is largely dependent on its nutrient management. Nitrogen is universally deficient in majority of Indian soils and has beneficial effect on growth, yield and yield attributing characters of maize (Singh *et al*., 2000 and Thind *et al.*, 2002). Application of N fertilizer has been effective for increasing crop production (Manuel *et al.*, 2000), especially in the rainfed cropping systems in arid and semiarid areas (Dang, 1999; Zhang *et al.*, 1994).

Therefore, it is very much essential not only to standardize the nitrogen requirement of any newly developed hybrid but also to assess its use efficiency particularly when the technology is meant for rainfed conditions. It is with this objective that the present study was conducted and the results of the same are discussed in this paper.

## RESEARCH PROCEDURE

The field experiment was carried out in a randomized block design with 8 treatments at Maize Research Centre, Agricultural Research Institute, Rajendranagar, Hyderabad during *Kharif* seasons of 2008 and 2009 under rainfed situation. The treatments were $T_1$- RDF(2/3rd basal+1/3rd at 30-40 DAS), $T_2$-N in 3 splits (1/2 basal+1/4$^{th}$ at kneehigh+1/4$^{th}$ at tasseling), $T_3$-N in 3 splits (1/3$^{rd}$ basal +1/3$^{rd}$ at kneehigh+1/3$^{rd}$ at tasseling), $T_4$- N in 2 splits (1/2 basal +1/2 at tasseling), $T_5$-N@ 20 kg/ha at each rain in addition to a basal dose of 100 kg/ha, $T_6$-$T_1$+Foliar spray of urea@2%, $T_7$-$T_1$+foliar spray of $KNO_3$ @1% , $T_8$-$T_1$ + K in 2 splits(1/2 basal + 1/2 at tasseling). Short duration pre-release maize hybrid DHM-115 was used in the experiment. The soil of the experimental field was low in organic carbon (0.38%) and available N (255.7 kg ha$^{-1}$), medium in available P (23.4 kg ha$^{-1}$) and high in available K (156.7 kg ha$^{-1}$) contents with clay loam in texture and slightly alkaline with a pH of 7.8 during both the years. A total precipitation of 855 mm in 36 rainy days was received during 2008 *Kharif* season, while it was 505 mm in 27 rainy days during 2009 season. The recommended dose of fertilizer was 180-60-50 kg N, $P_2O_5$ and $K_2O$/ ha. Nitrogen was given as per the treatments except in $T_5$. In $T_5$ nitrogen was applied with every rain keeping a minimum interval of 10 days. Likewise 5 splits of nitrogen were given during 2008 and 6 splits were given during 2009. Thus, through this treatment a total nitrogen of 200 and 220 kg/ha was given during 2008 and 2009, respectively. $P_2O_5$ @ 60 kg/ha was applied as basal at the time of sowing. $K_2O$ was applied basally except in $T_8$ treatment. The crop was planted as per the inter and intra row spacing (75x20 cm) to have desired population by hand dibbling @ 2 seeds/hill. Finally the plants were thinned to single plant/hill. Weeds were controlled by one pre emergence spray of atrazine @ 3 kg/ha. Earthing up was done 30 days after sowing which partly helped in uprooting and burial of weeds and in covering the top dressed urea followed by one hand weeding at 45 days after sowing. There was no incidence of major pests and diseases during the crop growth period. However, prophylactic measures were taken to prevent the stem borer (*Chilo partellus*) by spraying endosulphon @ 2 ml/l at 15 days after sowing. Five plants from each net plot were labelled randomly and observations on plant height, dry matter and yield attributes were recorded from the selected plants.

## RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been discussed in the following sub heads:

### Growth parameters:

Among the growth parameters plant height was significantly higher in $T_5$ which was at par with $T_4$ in both the years and also in pooled data (215 and 196 cm, respectively). Dry matter accumulation is one of the important parameters reflecting the growth of a crop. The optimum accumulation of dry matter followed by adequate partitioning of assimilates to the sink leads to higher grain yield. In the present study also dry matter accumulation was significantly higher in $T_5$ treatment (244 g) but it was at par with $T_4$ (239 g). An increase in leaf area with increasing nitrogen level might be attributed to better dry matter production with higher nitrogen availability (Vedivel *et al*., 2001). Days to 50 per cent silking was significantly higher in $T_5$ which was at par with $T_4$ in both the years and also in pooled data (58 and 57, respectively) probably due to prolonged vegetative phase (Table 1) induced by nitrogen application.

### Yield attributes and yield:

Yield attributes like cob length, cob girth, number of rows per cob and number of seeds per row were significantly higher with $T_5$ treatment during both the years and also in pooled data (16.8 cm, 13.9 cm, 13.0 and 34, respectively) which was at par with $T_4$ treatment (16.5 cm, 13.7 cm, 13.0 and 32, respectively). Application of higher dose of nitrogen must have increased its availability in soil resulting in higher uptake by plants and production of larger leaves, more photosynthesis and dry matter accumulation which ultimately influenced the yield attributes. $T_5$ and $T_4$ recorded significantly higher and at par 100 seed weight in both the years and also in pooled data (29.4 and 29.2 g, respectively) (Table 2).

**Table 1 : Plant height (cm), dry matter g/plant, days to 50% silking and 100 seed weight (g) of rainfed maize as influenced by different nitrogen management techniques**

| Treatments | Plant height (cm) | | | Dry matter (g/plant) | | | Days to 50% silking | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | Pooled mean | 2008 | 2009 | Mean | 2008 | 2009 | Pooled mean |
| $T_1$-RDF(2/3rd B+1/3rd 30-40 DAS) | 111 | 210 | 160 | 166 | 242 | 204 | 57 | 56 | 57 |
| $T_2$-N in 3 splits (1/2 B+1/4 K+1/4 T) | 130 | 216 | 173 | 174 | 263 | 219 | 57 | 56 | 57 |
| $T_3$-N in 3 splits (1/3B+1/3K+1/3T) | 135 | 230 | 183 | 184.0 | 279 | 232 | 55 | 57 | 56 |
| $T_4$ N in 2 splits (50 B+50 T) | 153 | 239 | 196 | 191 | 286 | 239 | 56 | 57 | 57 |
| $T_5$-N@ 20 kg/ha at each rain | 166 | 263 | 215 | 194 | 293 | 244 | 57 | 58 | 58 |
| $T_6$-$T_1$+foliar spray of urea@2% | 141 | 214 | 178 | 179 | 252 | 215 | 56 | 56 | 56 |
| $T_7$-$T_1$+foliar spray of $KNO_3$ @1% | 120 | 209 | 164 | 161 | 246 | 204 | 56 | 57 | 57 |
| $T_8$-$T_1$ + K in 2 splits(1/2 B + 1/2T) | 125 | 216 | 170 | 164 | 269 | 217 | 55 | 58 | 57 |
| C.D. (P=0.05) | 23 | 25 | 20 | 10 | 11 | 13 | 2 | 1 | 1 |

**Table 2 : Yield attributing characters of rainfed maize as influenced by different nitrogen management techniques**

| Treatments | Cob length (cm) | | | Cob girth (cm) | | | No. of rows/Cob | | | No. of seeds/row | | | 100 seed weight (g) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | Mean | 2008 | 2009 | Mean | 2008 | 2009 | Mean | 2008 | 2009 | Mean | 2008 | 2009 | Mean |
| $T_1$-RDF(2/3rd B+1/3rd 30-40 DAS) | 12.6 | 15.3 | 13.9 | 12.1 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 21 | 22 | 21 | 25.3 | 26.7 | 26 |
| $T_2$-N in 3 splits (1/2 B+1/4 K+1/4 T) | 13.5 | 16.3 | 14.9 | 12.8 | 12.7 | 12.7 | 12.0 | 13.0 | 12.0 | 25 | 28 | 26 | 26.8 | 27.5 | 27.1 |
| $T_3$-N in 3 splits (1/3B+1/3K+1/3T) | 13.3 | 17.2 | 15.2 | 12.6 | 13.4 | 13.0 | 12.0 | 13.0 | 12.0 | 22 | 34 | 28 | 26.2 | 29 | 27.6 |
| $T_4$ N in 2 splits (50 B+50 T) | 15.1 | 18.0 | 16.5 | 13.6 | 13.9 | 13.7 | 13.0 | 14.0 | 13.0 | 29 | 36 | 32 | 28.4 | 30.1 | 29.2 |
| $T_5$-N@ 20 kg/ha at each rain | 15.2 | 18.5 | 16.8 | 13.8 | 14.1 | 13.9 | 13.0 | 14.0 | 13.0 | 30 | 38 | 34 | 28.5 | 30.4 | 29.4 |
| $T_6$-$T_1$+foliar spray of urea@2% | 14.1 | 15.5 | 14.8 | 13.2 | 12.3 | 12.7 | 13.0 | 13.0 | 13.0 | 27 | 27 | 27 | 27.2 | 27 | 27.1 |
| $T_7$-$T_1$+foliar spray of $KNO_3$ @1% | 12.5 | 14.9 | 13.7 | 12.2 | 12.0 | 12.1 | 12.0 | 12.0 | 12.0 | 20 | 21 | 21 | 25.1 | 26.3 | 25.7 |
| $T_8$-$T_1$ + K in 2 splits(1/2 B + 1/2T) | 13.0 | 16.5 | 14.7 | 12.3 | 12.7 | 12.5 | 12.0 | 13.0 | 12.0 | 21 | 31 | 26 | 25.7 | 27.8 | 26.7 |
| C.D. (P=0.05) | 1.0 | 1.2 | 0.9 | 0.5 | 0.6 | 0.4 | 0.6 | 0.7 | 0.6 | 2.0 | 3.0 | 4.0 | 1.1 | 0.9 | 0.8 |

**Table 3 : Cob, grain and stover yield (t/ha) of rainfed maize as influenced by different nitrogen management techniques**

| Treatments | Cob yield (t/ha) | | | Grain yield (t/ha) | | | Stover yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | Pooled mean | 2008 | 2009 | Pooled mean | 2008 | 2009 | Mean |
| $T_1$-RDF(2/3rd B+1/3rd 30-40 DAS) | 2.7 | 4.4 | 3.6 | 2.0 | 3.4 | 2.7 | 4.3 | 6.4 | 5.3 |
| $T_2$-N in 3 splits (1/2 B+1/4 K+1/4 T) | 3.9 | 6.3 | 5.1 | 2.5 | 4.4 | 3.5 | 4.8 | 6.9 | 5.8 |
| $T_3$-N in 3 splits (1/3B+1/3K+1/3T) | 5.2 | 7.1 | 6.1 | 2.4 | 5.3 | 3.9 | 5.5 | 7.7 | 6.6 |
| $T_4$ N in 2 splits (50 B+50 T) | 5.7 | 7.5 | 6.6 | 4.1 | 5.9 | 5.0 | 6.1 | 7.9 | 7.0 |
| $T_5$-N@ 20 kg/ha at each rain | 6.3 | 8.0 | 7.1 | 4.3 | 6.1 | 5.2 | 6.5 | 8.2 | 7.3 |
| $T_6$-$T_1$+foliar spray of urea@2% | 4.6 | 5.2 | 4.9 | 3.6 | 3.7 | 3.6 | 5.3 | 6.6 | 6.0 |
| $T_7$-$T_1$+foliar spray of $KNO_3$ @1% | 2.6 | 4.6 | 3.6 | 2.0 | 3.2 | 2.6 | 4.0 | 6.4 | 5.2 |
| $T_8$-$T_1$ + K in 2 splits(1/2 B + 1/2T) | 2.7 | 6.5 | 4.6 | 2.1 | 4.5 | 3.3 | 4.2 | 7.2 | 5.7 |
| C.D. (P=0.05) | 0.6 | 0.5 | 0.5 | 0.3 | 0.7 | 0.8 | 0.4 | 0.3 | 0.4 |

Cob, grain and stover yields were significantly higher in $T_5$ (7.1, 5.2 and 7.3 t/ha, respectively) which was at par with $T_4$ (6.6, 5.0 and 7.0 t/ha, respectively) during both the years and also in pooled data (Table 3). Yielding ability is one of the most important quantitative character and it depends upon the development of other plant characters *viz*., leaf area, chlorophyll content, photosynthesis and dry matter accumulation, which in turn resulted into higher growth parameters (Sahoo and Guru, 1998). Cumulative effect of need based and gradual application of nitrogen during critical growth stages of the crop might have improved utilization efficiency leading to greater uptake and lesser losses under $T_5$ and $T_4$ treatments. Consequently improvement in the growth parameters and yield attributes was noticed which inturn might be responsible for increased cob, grain and stover yields under these treatments compared to rest of the treatments.

The findings of the experiment clearly indicate that top dressing of nitrogen in late growth stages showed better translocation of dry matter to the economic portion as is evident from improved photosynthetic efficiency during seed setting and seed filling which inturn had influenced both the sink capacity and sink size in the newly developed maize hybrid.

## LITERATURE CITED

**Dang, T.H.** (1999). Effects of fertilization on water use efficiency of winter wheat in arid highland. *Eco-Agric. Res.* (in Chinese), **7**(2): 28-31.

**Manuel, M.T.,** Naboa, V., Alcakde, C. and Arai, S. (2000). Field response of groundnut and maize to fertilization and soil physico-chemical properties in different classes of Philippine soils. *Commun. Soil Sci. Plant Anal.,* **31** (11-14): 2291-2299.

**Muthukumar, V.B.**, Velayudham, K. and Thavaprakash, N.(2005). Growth and yield of baby corn (*Zea mays* L.) as influenced by plant growth regulators and different time of nitrogen application. *Res. J. Agric. and Biol. Sci.,* **1**(4): 303-7.

**Sahoo, N.C.** and Guru, S.K. (1998). Physiological basis of yield variation in short duration cultivars of rice. *Indian J. Plant Physiol.,* **3** (1): 36-41.

**Singh, D.P.,** Rana, N.S. and Singh, R.P. (2000). Dry matter production and nutrient uptake in winter maize (*Zea mays* L.) based intercropping system under different levels of nitrogen. *Indian J. Agron.,* **45** : 676-680.

**Thind, S.S,** Singh, Manmohan, Sidhu, A.S. and Chhibba, P.M. (2002). Influence of continuous application of organic manure and nitrogen fertilization on crop yield, N uptake and nutrient status under maize – wheat rotation. *J. Res. Punjab Agril. Univ.,* **39**(3): 211-212.

**Vedivel, N.,** Subhain, P. and Velayutham, A. (2001). Effect of integrated nitrogen – management practices on the growth and yield of rainfed, winter maize (*Zea mays* L.). *Indian J. Agron*., **45**(2): 250-254.

**Zhang, Q.,** Jin, Q.Y., Yang, J.L. and Li, L.J. (1994). The techniques of fertilization to corn in rainfed land under the plastic – mulching cultivation. *Agric. Res. Arid Areas* (in Chinese), **12**(2): 27-31.

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