Indian Journal of Agricultural Sciences **80** (7): 649–51, July 2010

Impact of scheduling nitrogen on productivity of single cross maize (*Zea mays*) hybrids*

DILIP SINGH[1]

Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan 313 001

Received: 20 April 2010; Accepted: 11 May 2010

Key words: Economics, Hybrids, N Efficiencies, N Scheduling, Productivity

In India maize (*Zea mays* L.) is grown on an area of 8.12 million ha with a total production of 19.77 million tonnes and productivity of 2.43 tonnes/ha. Indian maize programme has now given focus on single cross hybrids and since 1990, large number of single cross hybrids of normal and quality protein maize have been released which increased maize production by 31 % and productivity by 27 % over the last year (DMR 2009). The area under single cross hybrids at present is 20 % and is likely to increase very fast. Comparison of hybrids and their parents indicate that hybrids are more susceptible to low nitrogen than inbred (Zaidi *et al*. 2003). In hybrids progenies nitrogen stress before flowering reduces leaf area and photosynthesis, nitrogen stress during flowering stage results in kernel and ear abortion, whereas stress during grain filling accelerates leaf sencence, reduce photosynthesis and kernel weight (Zaidi *et al*. 2005). Thus for enhancing grain yield of single cross hybrids nitrogen fertilization has emerged as a serious matter of concern for maize growing farmers. At present only three split application of nitrogen, viz 1/3 at sowing, 1/3 at knee high stage and 1/3 at initiation of tasseling is recommended, whereas Geleto *et al*. (1996) reported superiority of more split application of nitrogen in enhancing grain yield and the practice is widely recommended in many crops. Thus the present study was carried out to study the impact of scheduling of nitrogen on yield and nitrogen use efficiencies, and economics of single cross hybrids.

The field experiment was conducted during rainy (*kharif*) seasons of 2007 and 2008 at the instructional farm the College of Agriculture, Udaipur which represents a typical sub-tropical climate. The soil was clay loam, alkaline (*p*H 8.6) in reaction, medium in available N (261.4 kg/ha), available P (11.5 kg/ha) and available K (292.6 kg/ha). The bulk density and organic carbon content were 1.34 and 0.75 % respectively. The experiment consisted of 4 treatments having different split application of nitrogen was conducted in randomized block design with 5 replication (Table 1).The 100 % recommended dose of fertilizer was 120 kg N + 40 kg P_2O_5/ha. Full dose of phosphorus was applied at the time of sowing through single super phosphate, whereas nitrogen was applied as per treatment. The quality protein maize single cross hybrids 'HQPM 1' was used as test crop. The variety having yield potential of 4–5 tonnes/ha, matures in 100–110 days was released for cultivation all over India during 2005. Pre-emergence application of atrazine 0.5 kg/ha, followed by one hoeing and weeding at 25 days after sowing was carried out in order to control weeds. The crop was sown in first fort night of July at 60 cm × 25 cm spacing in 5 m × 3 m plot and harvested in October during both the year. First 4 stages of nitrogen application were coincides with rains, however, for application of nitrogen at early grain-filling stage one light irrigation was given during both the years.

Plant height of single cross hybrid was influenced significantly under scheduling of nitrogen application (Table 2). Highest plant height was recorded under 5 split application of nitrogen in ratio of 10:30:30:20:10 (T_2) which was at par with 5 split application of nitrogen in ratio of 5:30:40:15:10 (T_3) and 20:25:30:20:5 (T_4) but proved significantly higher over control by 6.85 %. However, other growth parameters, viz plants/15 m^2, cobs/15 m^2 and cobs/plant failed to influence due to different schedules of nitrogen application.

Table 1 Detail of nitrogen scheduling

Treatment (per cent of N application rate)	Stage of nitrogen application				
	Basal (%)	Four leaf stage (%)	Eight leaf stage (%)	Tassel emergence (%)	Early grain filling (%)
T_1 (33:0:33:33:0) control	33	Nil	33	33	Nil
T_2 (10:30:30:20:10)	10	30	30	20	10
T_3 (5:30:40:15:10)	5	30	40	15	10
T_4 (20:25:30:20:5)	20	25	30	20	5

*Short note

[1]Associate Professor (e mail: dilipagron@yahoo.com), Department of Agronomy, RCA, Udaipur

Table 2 Effect of nitrogen scheduling on growth, yield attributes and yield of single cross hybrid 'HQPM 1' (pooled over 2 years)

Treatment	No. of plant/ 15 m^2	No. of cob/ 15 m^2	Plant height (cm)	Cobs/ plant	Length of cob (cm)	Grains/ cob	Girth of cob (cm)	Test weight (g)	Stover yield (tonnes/ha)	Grain yield (tonnes/ha)
T_1 (33:0:33:33:0) (control)	91.3	94.5	213.1	1.00	17.77	404	13.41	127.6	4.99	3.31
T_2 (10:30:30:20:10)	91.4	95.3	227.7	1.04	20.08	440	14.26	140.6	5.98	3.93
T_3 (5:30:40:15:10)	91.9	96.4	226.0	1.04	19.55	427	14.21	137.7	5.69	3.79
T_4 (20:25:30:20:5)	91.3	94.7	222.5	1.02	19.04	425	13.28	137.5	5.63	3.68
CD (*P*=0.05)	NS	NS	6.830	NS	0.962	16.78	0.477	27.802	0.343	0.235

Table 3 Effect of nitrogen scheduling on nitrogen content, uptake, recovery fraction, agronomic and physiological efficiency and economics of single cross hybrid 'HQPM 1' (pooled over 2 years)

Treatment	N content in grain (%)	N uptake by grain (kg/ha)	NUE (Mean)	AE (kg of grain/ kg of N added)	RF (kg of N added/kg of N absorbed)	PE (kg of grain/ kg of N absorbed)	Net returns (Rs '000/ha)	B:C ratio
T_1 (33:0:33:33:0) (control)	1.757	58.23		22.15	2.38	55.98	20.98	1.91
T_2 (10:30:30:20:10)	1.869	73.49	4.37	26.25	2.04	53.90	27.08	2.21
T_3 (5:30:40:15:10)	1.788	67.77	3.53	25.41	2.21	55.49	25.19	2.07
T_4 (20:25:30:20:5)	1.763	66.90	3.55	24.88	2.29	56.53	23.91	1.98
CD (*P*=0.05)	0.076	3.879		1.536	NS	NS	1.875	0.142

AE, Agronomic efficiency; PE, physiological efficiency; RF, recovery fraction; NUE, nitrogen use efficiency; B : C, benefit : cost ratio

Application of nitrogen in ratio of 10:30:30:20:10 (T_2) significantly improved length and girth of cob over control and 5 split application of nitrogen in ratio of 20:25:30:20:5 (T_4) by 13.00, 5.46 and 6.30, 7.38 %, respectively. However, T_2 was found at par with 5 split application of nitrogen in ratio of 5:30:40:15:10 (T_3). Highest test weight and grains/ cob were recorded under 5 split application of nitrogen in ratio of 10:30:30:20:10 (T_2) which was at par with other two 5 split application of nitrogen (T_3 and T_4) but proved significantly higher over control. Alike this, highest grain and stover yield were recorded under 5 split application of nitrogen in ratio of 10:30:30:20:10 (T_2), which was significantly higher over control and T_4 but it was found at par with 5:30:40:15:10 (T_3) ratio of nitrogen application. Among timings of nitrogen application better performance of 5 split applications in ratio of 10:30:30:20:10 was obvious in single cross hybrids due to availability of nitrogen from early stage to grain filling stage which increased content and uptake nitrogen, test weight and reduced ear and grain abortion (Zaidi *et al.* 2005).

N content and uptake differed significantly among timings of nitrogen application. Five split application of nitrogen in ratio of 10:30:30:20:10 (T_2) recorded maximum nitrogen content and its accumulation in grain, which were significantly higher over the other timings of N application. Little reduction of nitrogen in early stage and applying the same in early grain filling stage resulted in enhanced nitrogen content in grain consequently test weight, grain yield and uptake of nitrogen (Table 3). Shivanker *et al.* (2000) also reported similar results in rice.

Agronomic efficiency and nitrogen use efficiency were high, where amount of nitrogen was supplied in more split. With more split application, nutrient absorption increased and as a result the yield of crop was improved, consequently improving the agronomic efficiencies. This is in agreement with findings of Mondal *et al.* (2008).

There was not much difference in physiological efficiency and recovery fraction. Maximum physiological efficiency and recovery fraction were recorded under 3 split application of nitrogen (T_1) and the same declined under more split application of nitrogen (T_3, T_4 and T_2). Pandey *et al*.(2008) also reported similar results in wheat.

Economic returns from single cross hybrid under different nitrogen scheduling varied significantly due to effect of treatment on performance of crop. The highest net returns and B:C ratio were recorded under 5 split application of nitrogen in ratio of 10:30:30:20:10 (T_2) which were significantly higher over the other timings of nitrogen application. This was obvious due to more splitting of nitrogen with no commensurate increase in cost of treatment.

SUMMARY

A field experiment was conducted during rainy season *(kharif)* 2007and 2008 under partially irrigated condition to study impact of nitrogen scheduling on productivity, N content uptake and economics of single cross hybrid.

Maximum grain yield, N content and uptake by grain were recorded under 5 split application of recommended dose of nitrogen in ratio of 10:30:30:20:10 as basal, 4 leaf emergence, 8 leaf emergence, tassel emergence and early grain filling stages respectively. Thus it is concluded that to obtain maximum net returns and B:C ratio from single cross hybrid 'HQPM 1' nitrogen should be applied in 5 split application in ratio of 10:30:30:20:10 at basal, 4 leaf emergence, 8 leaf emergence, tassel emergence and early grain-filling stages.

REFERENCES

DMR 2008. Singal Cross Hybrids Maize, Bulletin, Directorate of Maize Research, Pusa Campus, New Delhi.pp1-3.

Geleto T, Tahner D G, Mamo T and Gebeyehu G 1995. Response of rainfed bread and durum wheat to source, level and timing of nitrogen application on N uptake, recovery and efficiencies. *Fertilizer Research* **44**: 195–204

Mondal S S, Jana P and Chandra P. 2008. Integrated nutrient management for sustaining productivity and soil fertility build-up in rice (*Oryza sativa*)–Lathyrus (*Lathyrus sativa*)- sesame (*Sesamum indicum*) cropping system. *Indian Journal of Agricultural Sciences* **78**: 534–6.

Pandey I B, Paswan S, Sinha N K and Pandey R K. 2008. Response of late showed wheat (*Tritcum aestivum*) varieties to nitrogen levels. *Indian Journal of Agricultural Science* **78**: 537–9.

Shivankar S K, Joshi R P and Shivankar R S .2000. Effect of biofertilizer and level of nitrogen and phosphorus on yield and uptake of N and P by wheat under irrigated condition. *Journal of Soil and Crop* **10**: 292–4

Zaidi P H, Mani P, Selvan R S, Singh R P, and Singh N N. 2005. Problem of low nitrogen stress tolerance in tropical maize (*in*) *Stresses on Maize in Tropics,* Directorate of Maize Research, New Delhi, pp137–7.

Zaidi P H, Srinivasan G and Sanchez C. 2003. Relationship between line *per se* and cross performance under low nitrogen fertility in tropical maize (*Zea mays*) *Maydica* **48**: 221–1