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Effect of Population Densities and Fertilizers on the Yield of Hybrid and Composite Maize

By

K. MEENAKSHI [1], A. K. FAZLULLAH KHAN [2] and R. APPADURAI [3]

ABSTRACT

Studies were made at Coimbatore, for four consecutive seasons to fix an optimum fertilizer schedule and population density for hybrid and composite maize under Tamil Nadu conditions. NPK schedule of 132–66–44 kg/ha along with a spacing of 40 × 25 cm, was found to be the best for maximum grain yields during summer season and 88–44–29 kg/ha, along with a spacing of 60 × 30 cm, for the monsoon season. In general, all the varieties yielded nearly 1000 kg/ha, more during the monsoon season than in summer season.

INTRODUCTION

The introduction of hybrid maize has given an impetus to the spread of maize in Coimbatore, Tiruchirappalli, Salem and Madurai districts in Tamil Nadu. A fertilizer schedule of 132–66–44 kg/ha NPK and a population density with a spacing of 60 × 30 cm as adopted in the Northern states were followed for both summer and monsoon seasons. Moolani and Behl (1968) and Tripathi (1971) have reported the yield and quality normally differ in maize under different fertilizer schedules and population levels. Prithiviraj *et al.* (1971) indicated that under Karnataka conditions a higher plant population with 60 × 18 cm spacing recorded a higher yield compared to low plant population with 60 × 36 cm spacing, and that *Deccan* yielded more than *Amber* with a higher fertilizer dose. Alessi and Power (1974) showed that row spacing and maturity class significantly affected dry matter production but only plant population influenced grain yield.

To determine if any modifications would be necessary under Tamil Nadu conditions, studies were initiated on the response of hybrid and composite maize to different levels of fertilizer schedules and population densities with a view to fix up optimum levels for increasing productivity.

MATERIALS AND METHODS

Two hybrids of maize i. e., *Deccan* and *Hi-Starch* and one composite *Amber* were tested under three fertilizer schedules [NPK: 88-44-29 (M_1); 132–66–44 (M_2) and 176–88–58 (M_3) kg/ha] and three levels of spacing (40 × 25 cm; 60 × 30 cm and 80 × 35 cm) in a 3^3 confounded factorial design with two replications for four consecutive seasons commencing from monsoon 1969, at the Millet Breeding Station, Coimbatore. The summer crop was sown during March and the monsoon season crop during August and raised under irrigated cropping. A plot size of 10.4 × 4.8m

1 and 3 Associate Professors in Agricultural Botany 2. Instructor in Millets, Tamil Nadu Agricultural University, Coimbatore - 641003.

was adopted and uniform cultural practices were given to all the plots. The nitrogenous fertilizers were applied in two split doses, one third at sowing and the balance a month later while both P and K were applied as basal dose. Irrigations were given once in 7 to 10 days depending upon soil moisture and rainfall for the crop in all the seasons. The data on grain yield were statistically analysed using the standard statistical methods for the design (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

Season: The best season for maize appeared to be the monsoon season than the summer, under Coimbatore conditions. In the monsoon season, on an average 1000 kg/ha of more grain yield was recorded than that of the summer crop (Table 1a).

Genotypes: In three seasons out of four, hybrids *Deccan* and *Hi-Starch* were on par and were significantly superior to the composite *Amber*. In monsoon '70 season *Deccan* was significantly superior. The hybrids yielded about 800 to 900 kg more than the composite in both the seasons (Table 1a).

Fertilizers: In all the four seasons, the differences in yield due to fertilizers were not significant. However, on an average, during the monsoon season, the lower NPK schedule of 88–44–29 gave higher yields and during the summer seasons, 132–66–44 dose gave higher yields than the others. In both the seasons, the highest dose of 176-88-58 reduced the yield (Table 1b).

TABLE 1 (a) Average grain yield pooled over seasons in Genotype × Fertilizer schedule interactions

Variety	SUMMER				MONSOON			
	M_1	M_2	M_3	Average	M_1	M_2	M_3	Average
Deccan	5276	5635	5385	5432	6871	6939	6214	6675
Hi-Starch	5214	5508	5584	5435	6430	6094	6152	6225
Amber	4557	4874	4592	4674	5687	5468	5811	5655
Mean	5016	5339	5187	5180	6330	6156	6059	6182

TABLE 1 (b) Average grain yield pooled over seasons in Genotype × spacing interaction

Variety	SUMMER				MONSOON			
	40×25	60×30	80×35	Average	40×25	60×30	80×35	Average
Deccan	5873	5327	5095	5432	6844	6861	6319	6675
Hi-Starch	5924	5406	4974	5435	6081	6515	6080	6225
Amber	4898	4838	4287	4674	5714	5736	5516	5655
Mean	5564	5190	4785	5180	6213	6371	5972	6182

Spacing: In all the four seasons, the differences due to spacing were not significant. The widest spacing of 80 × 35 cm with a low population density resulted in the lowest yield in all the seasons, whereas, the spacing of 60 × 30 cm gave higher yields during monsoon seasons and during the summer seasons 40 × 25 cm spacing gave the highest yield (Table 1c).

TABLE 1 (c) Average grain yield pooled over seasons in Spacing × Fertilizer schedule interaction

Spacing	SUMMER				MONSOON			
	M_1	M_2	M_3	Average	M_1	M_2	M_3	Average
40×25 cm	5351	5655	5687	5564	6471	5994	6174	6213
60×30 cm	5068	5374	5130	5190	6343	6429	6341	6371
80×35 cm	4626	4988	4742	4785	6174	6077	5663	5972
Mean	5016	5339	5187	5180	6330	6156	6059	6182

Genotype × Fertilizers: The hybrids *Deccan* and *Hi-Starch* gave higher yields with the NPK schedule of 88–44–29 in monsoon season and with 132–66–44 in summer season, while *Amber* did well with 132–66–44 in summer and with 176–88–58 in monsoon season. Irrespective of the seasons, *Deccan* gave more yield with 88–44–29 and 132–66–44 and *Hi-Starch* with 176–88–58.

Genotype × Spacing: *Deccan* gave the highest and almost the same yield in 40×25 cm and 60 × 30 cm spacings during monsoon season and in 40×25 cm spacing, in summer season. *Hi-Starch* gave the highest yield in 40×25 cm and 60×30 cm spacing in summer and monsoon seasons respectively. *Amber* gave almost similar yields in 40×25 cm and 60×30 cm spacings in both the seasons. For all the three genotypes, the yields were considerably low in the low density of 80×35 cm spacing.

Spacing × Fertilizers: The interaction was significant in only one season (Table 2). On an average, during summer, in all the three fertilizer schedules, higher yields were recorded under 40×25 cm. During monsoon seasons, under the NPK schedule of 88–44–29, 40×25 cm spacing gave slightly higher yields than the other two spacings and in 132–66–44 and 176–88–58 dose, higher yields were obtained in 60×30 cm spacing.

During monsoon season with 40×25 cm spacing, there resulted a steady decrease in yield as the dose of fertilizers increased. On the contrary in summer there was an increase in yield with increasing doses of fertilizers and NPK schedule of 132–66–44 kg/ha seemed to be optimum. In 80×35 cm spacing, during monsoon season, there was a steady decrease in yield as the doses of fertilizers increased, while in summer there was a slight increase in yield from 88–44–29 to 132–66–44

TABLE 2. Grain yield recorded in the different seasons, in kg/ha

Particulars		Monsoon '69	Monsoon '70	Summer '70	Summer '71
Deccan M_1	40×25 cm	6951	7742	5685	6464
	60×30 cm	5846	7440	4326	5506
	80×35 cm	6815	6430	4669	4901
Deccan M_2	40×25 cm	5626	7750	5815	6059
	60×30 cm	7561	7698	5368	5729
	80×35 cm	5982	7015	5763	5074
Deccan M_3	40×25 cm	6339	6657	5681	5530
	60×30 cm	5638	6985	4228	6706
	80×35 cm	5062	6602	4889	5276
Hi-Starch M_1	40×25 cm	5773	6887	5208	5244
	60×30 cm	6883	6623	4727	6229
	80×35 cm	6031	6388	5332	4541
Hi-Starch M_2	40×25 cm	5515	6174	5803	6221
	60×30 cm	6586	5751	4865	5578
	80×35 cm	6696	5839	5282	5300
Hi-Starch M_3	40×25 cm	7033	5106	5945	7117
	60×30 cm	6161	7087	5056	5993
	80×35 cm	6126	5401	4168	5222
Amber M_1	40×25 cm	5549	5923	4533	4972
	60×30 cm	5185	6080	4286	5236
	80×35 cm	5328	6054	3579	4735
Amber M_2	40×25 cm	5448	5453	4549	5482
	60×30 cm	5362	5617	4811	5893
	80×35 cm	5165	5765	4054	4457
Amber M_3	40×25 cm	6331	5579	4605	5246
	60×30 cm	5738	6436	4276	4525
	80×35 cm	5440	5344	3906	4991
	S. E.	147	175	226	156
	C. D.	432	512	665	456

TABLE 2. (*Contd.*)

Spacings:	1. 40×25 cm	6064	6363	5314	5815
	2. 60×30 cm	6107	6635	4690	5722
	3. 80×35 cm	5850	6093	4627	4944
	Conclusion:	—	—	—	1 2 3
	S. E.	147	175	226	156
	C. D.	NS	NS	NS	456
Fertilizers:	M_1	6041	6619	4705	5325
	M_2	5995	6340	5146	5532
	M_3	5986	6133	4750	5623
	S. E.	147	175	226	156
	C. D.	NS	NS	NS	NS
Interactions:	Fertilizers × Spacing: M_1	40 60 80	NS	NS	NS
	M_2	60 80 40			
	M_3	40 60 80			
	Spacing × Fertilizers:				
	40×25 cm	M_3 M_1 M_2			
	60×30 cm	M_2 M_1 M_3			
	80×35 cm	M_1 M_2 M_3			
	S. E.	255			
	C. D.	747	NS	NS	NS

kg/ha of NPK but in 176–88–58 kg/ha of NPK, the yield declined. This may be due to that when favourable moisture conditions are available as in the monsoon season, there would be better utilization and the lower levels of fertilizers are enough to promote yields, while the higher doses of fertilizers during the monsoon season might tend to render the crop more vegetative. Coupled with a higher fertilizer dose, if a higher population density was maintained as in 40×25 cm spacing, it predisposes the plants to be barren. However, in 80×35 cm spacing, the population density itself was not sufficient and the reduction in yield with incrsased fertilizer dose might be mainly due to the direct effect of fertilizers in promoting the vegetative phase.

The results further indicated, that higher yields were obtained in monsoon than in summer and that the hybrids yielded better than the composite. During the lower yielding summer season, higher population density with 40×25 cm spacing gave higher yield than 60×30 cm currently adopted in the package of practices. The spacing of 60×30 cm was thus observed to be optimum for the monsoon season, while for the summer, a closer spacing

of 40×25 cm seemed to be the best. An increase in the population density over this level, may not give any additional yield because of the possibility of resultant barren stalks as reported by Muhr and Rost (1951) and Timmons *et al.* (1966).

During the summer season when the soil moisture level is low, the NPK schedule now employed in the package of practices i. e., 132–66–44 kg/ha seemed to be the optimum. These results are in general agreement with similar studies by Nandpuri (1960), Singh (1967) and Sharma and Gupta (1968) who reported that increasing levels of nitrogen in addition to high population density, tended to lower the yields and increase stalk barrenness.

In the light of the above results, it is necessary that two different spacings and fertilizer schedules are to be recommended for the summer and monsoon seasons. For summer, 132–66–44 kg/ha of NPK along with a spacing of 40×25 cm and for monsoon season, a spacing of 60×30 cm along with 88–44–29 kg/ha of NPK are the best. *Deccan* performed well in monsoon and summer seasons while *Hi-Starch* is suited for summer alone.

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