Effect of Planting Geometry and Nutrient Levels on Yield and Economics of Quality Protein Maize (*Zea mays* L.)

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Abstract: ***A field experiment was conducted during Kharif 2010 under irrigated condition on red sandy loam soil to study the effect of spacing and nutrient levels on growth, yield and economics of Quality Protein Maize at Zonal Agricultural Research Station, Visweshwaraiah Canal Farm, Mandya. The result indicated that, the maize yield was higher in closer spacing of 45 cm × 30 cm (4921 kg ha^{-1}) compared to wider spacing of 60 cm × 30 cm (4556 kg ha^{-1}). Among different nutrient levels 125 % RDN recorded significantly higher grain yield (5143 kg ha^{-1}) which was on par with 100 % RDN (4829 kg ha^{-1}) and 150 % RDN (5087.93 kg).Whereas 75 % RDN recorded lower grain yield (3893.49 kg). With increase in nutrient dose from 100 % RDN to 125 % RDN, the grain yield was increased by seven per cent. Significantly higher B:C ratio was recorded with nutrient level of 125% RDN (2.12)which was on par with 100% RDN (2.11) and 150% RDN (1.93). Whereas 75 % RDN recorded lower B:C ratio (1.85). Significantly higher netreturn (Rs. 40086 ha^{-1}) was recorded with T_3 (45 x 30 cm +125 % RDN) treatment, followed by T_4 (45 cm x 30 cm + 150% RDN) Rs.38770 ha^{-1} and T_2 (45 cm x 30 cm + 100 % RDN) Rs. 37305 ha^{-1}. Significantly lower net return was recorded with T_5 (60 cm x 30 cm + 75% RDN) treatment, Rs. 25163.***

Keywords: Planting, Geometry Nutrient Levels, Yield, Economics, Quality Protein, Maize

1. Introduction

Maize (*Zea mays* L.) is the most important staple food crop of the world next to wheat and rice. Maize has been an important cereal because of its great production potential and adaptability to wide range of environments. Maize occupies an important place in Indian economy, like rice, wheat and millets.

World area under maize is 147.56 million hectares with a production of 701.27 million tonnes with an average yield of 4754 kg ha^{-1} (Muhammad Akbar et al., 2008). In India, maize is grown in an area of 8.12 m ha with an annual production of about 19.77 m t. The average productivity of maize in India is about 2400 kg ha^{-1}. In India, the area under maize is mainly concentrated in Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar, Gujarat, Karnataka and Himachal Pradesh states and it is also grown in small areas in almost all the states. In Karnataka, Maize occupies an area of 1.20 m ha, Production 3.20 m t with productivity of 2849 kg ha^{-1}. It is grown throughout the year but major area is under rain fed condition in *kharif* season (Anon., 2009). In normal maize grain the quality of protein is poor due to the presence of largest concentration of an alcohol soluble protein fraction (prolamine) also known as (Zein) in the endosperm. Zein is very low in to essential amino acids (Lysine and Tryptophan) for this purpose, a new corn type known as Quality Protein Maize (QPM) was developed by lowering the concentration of zein by 30%. As a result the protein and concentration of two essential amino acids viz., lysine and tryptophan in grain was increased in QPM genotypes as lower compared to normal grain maize genotypes. The lower productivity of maize is attributed to the lack of site specific production package and physiological limitations. Among the various factors responsible for low seed yield and quality are inadequate and lack of balanced nutrition, coupled planting geometry, plays a major role. Nitrogen plays a significant role in growth, as it is a component of chlorophyll and protein. It favorably influences the growth parameters like plant height, leaf area, leaf duration, dry mater production and finally the yield. While phosphorus being a component of ATP and ADP, acts as energy currency providing the energy required during photosynthesis and carbon assimilation. Potassium favors proper grain filling apart from its role in water retention potential.

Planting geometry is one of the major management aspects, which is limiting the yield of maize. Though nutrient and spacing requirement for maize varieties has been standardized, the information on influence of spacing and nutrient levels on growth, yield and economics of Shaktiman-4 hybrid is lacking.Keeping the above in view the investigation on quality protein maize was undertaken.

2. Material and Methods

The experiment was conducted at Zonal Agricultural Research Station, Visweshwaraiah Canal Farm, Mandya, during *Kharif* 2010. The soil was sandy loam, slightly acidic in reaction (PH 6.5), medium in available N (359.78 kg ha^{-1}), available K (178.27 kg ha^{-1}) and high in available P (49.2 kg ha^{-1}). The experiment consisted of tow spacing 45 cm x 30 cm and 60 cm x 30 cm and four nutrient levels viz. 75, 100, 125 and 150 % of recommended dose of nutrients (RDN). Fifty per cent of recommended N and all total recommended P & K was applied as basal dose at the time of sowing as per treatments, and the remaining 50 per cent of the nitrogen was applied at 30 DAS as top dressings. The QPM hybrid "Shaktiman-4" was used as test crop. In order to control weeds, Hand weeding was done twice at 15 and 30 days after sowing and 2 times inter cultivation by passing hoe was carried out at 30 and 45 days after sowing, to keep all the plots weed free throughout the crop growth period. The crop was sown at 28-05-2010 and harvested in 22-09-2010.

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3. Results and Discussion

Wider spacing of 60 cm x 30 cm has recorded higher cob length (16.43 cm) as against closer spacing of 45 cm x 30 cm (14.50 cm), Similarly, number of grains cob^{-1} increased from (516.17) in 45 cm x 30 cm spacing to (526.73) in wider spacing of 60 cm x 30 cm.Grain weight cob^{-1} varied form (133.65 g) in 45 cm x 30 cm to (139.81 g) in 60 cm x 30 cm spacing (Table 1). The increase in grain weight per cob in wider spacing of 60 cm x 30 cm was a consequence of higher 100 grain weight (28.06 g) than (27.33 g) in 45 cm x 30 cmand more numbers of rows cob^{-1} (15.05) than (14.55) in spacing 45 cm x 30 cm which is in line with the work of Reddy et al., (1987). Lower plant population resulted in longer ears, higher cob length, higher number of rows of kernels and higher seed weight cob^{-1} (Nehra, *et al.*, 1981).

Significantly higher number of cob plant^{-1} (1.13) is recorded with spacing of 60 cm x 30 cm compared to 45 cm x 30 cm (1.10).Cob weight and number of rows per cob is also recorded higher (179.52 g) and (15.05)in spacing 60 cm x 30 cm as compared to 45 cm x 30 cm spacing (171.45 g) and (14.55) respectively (Table 1). Higher grain yield (5143 kg ha^{-1}) with 125 % RDNis mainly due to higher cob length (16.72 cm), more number of cob per plant (1.16), number of seed rows per cob (15.45), number of seeds per cob (553), 100-seed weight (29 g) and seed weight per cob (145 g) as compared to 75 % RDN, 100% RDNand150 % RDN. It is in conformity with earlier work of (Yadav and Singh 2000).

Sowing at 45 cmx 30 cm spacing has recorded highest maize seed yield (4921 kg ha^{-1}) compared to wider spacing of 60 cm x 30 cm (4555 kg ha^{-1}). These results are in conformity with the findings of (Fanadzo *et al.*2010). Application of 125 % RDN recorded significantly higher grain yield (5143 kg ha^{-1}) and stover yield (7777 kg ha^{-1}) which was on par with100 % RDN (4829 kg ha^{-1} and 7741 kg ha^{-1}) and 150 % RDN (5088 kg ha^{-1} and 7764 kg ha^{-1}).Lower grain yield and stover yield recorded with 75% RDN (3893 kg ha^{-1} and 7093 kg ha^{-1}) respectively, (Table 2).Significantly higher gross return was recorded with spacing 45 cm x 30 cm + 125 % RDN (Rs. 57615ha^{-1}) followed by spacing 45 cm x 30 cm + 150% RDN (Rs.57231).Lower gross return was recorded with spacing of 60 cm x 30 cm + 75% RDN (Rs. 41249) followed by spacing of 45 cm x 30 cm +75 % RDN (Rs. 43712). Significantly higher netreturn (Rs. 40086 ha^{-1}) was recorded withspacing of 45 cm x 30 cm +125 % RDNwhich was on par with spacing 45 cm x 30 cm + 150% RDN (Rs.38770 ha^{-1}) and 45 cm x 30 cm + 100 % RDN (Rs. 37305 ha^{-1}).Lower net return was recorded with spacing of 60 cm x 30 cm + 75% RDN (Rs. 25163ha^{1}) followed by spacing 45 cm x 30 cm +75 % RDN nutrients (Rs. 28076ha^{-1}). The maximum B:C ratio was obtained withspacing of 45 cm x 30 cm +125 % RDN nutrients (2.29) followed by spacing 45 x 30 cm + 100% RDN (2.25).While the lower B:C ratio was obtained with spacing of 60 cm x 30 cm + 75% RDN (1.76) followed by spacing 45 cm x 30 cm +75 % RDN nutrients (1.79).

With increase in nutrient dose from 100 % RDN to 125 % RDN, the grain yield was increased by (7 %).With the good soil fertility level, increase in grain yield with closer spacing of 45 cm x 30 cm and higher N, P_2O_5 and K_2O levels was mainly attributed to higher number of plant per unit area which leads to more number of cobs per unit area. So with moderately increasing plant population with adequate nutrient we can increase the grain as well as stover yield, and economics of maize crop which was earlier reported by (Choudhary and Singh 2007).

Table 2: Influence of planting geometry and nutrient level on yield and economics of Quality Protein Maize

Treatment	Grain yield kg ha^{-1}	Stover yield kg ha^{-1}	Harvest index	Gross return (Rs)	Net return (Rs)	B:C ratio
Spacing						
45 cm × 30cm (S_1)	4921.26	7798.56	0.38	53112	36059	2.11
60 cm × 30cm (S_2)	4555.53	7388.84	0.37	49250	31747	1.89
S.Em.±	111.08	22.586	0.006	2.05	5.24	0.05
C.D @ 5%	336.91	68.506	NS	6.21	15.88	0.17
Nutrient levels						
75 % RDN (F_1)	3893.49	7092.55	0.35	42481	26619	1.85
100 % RDN (F_2)	4828.67	7740.69	0.38	52157	35349	2.11
125 %RDN (F_3)	5143.49	7777.73	0.39	55323	37569	2.12
150 % RDN (F_4)	5087.93	7763.84	0.39	54761	36075	1.93
S.Em.±	157.09	31.942	0.009	2.89	7.41	0.08
C.D @ 5%	476.46	96.882	0.03	8.78	22.46	0.25
Interaction						
T_1- S1F1	4009.23	7240.69	0.35	43712	28076	1.79
T_2- S1F2	4990.71	7962.91	0.38	53888	37305	2.25
T_3- S1F3	5361.08	8009.21	0.40	57615	40086	2.29
T_4- S1F4	5324.04	7981.43	0.40	57231	38770	2.10
T_5- S2F1	3777.75	6044.40	0.35	41249	25163	1.76
T_6- S2F2	4666.64	7518.47	0.38	50425	33392	1.95
T_7- S2F3	4952.89	7546.24	0.39	53032	35053	1.96
T_8- S2F4	4851.82	7546.24	0.39	52291	33380	1.84
S.Em.±	222.16	45.173	0.01	4.09	10.47	0.12
C.D @ 5%	NS	137.01	NS	12.42	31.77	0.36

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References

[1] ANONYMOUS, 2009, *Agriculture statistics* at glance, published by Directorate of Economics and Statistics. New Delhi.
[2] CHOUDHARY, J. AND SINGH, D., 2007, Effect of plant population and nutrient levels on yield and economic viability of pop corn (*Zea mays*).*Agronomy Digest***6 & 7**: (2006-2007).
[3] FANADZO, M., CHIDUZA, C. AND MNDENI, P.N.S, 2010, Effect of inter-row spacing and plant population on weed dynamics and maize (*Zea mays* L.) yield at Zanyokwe irrigation scheme, Eastern Cape, South Africa. African J Agric Res **5** (7): 518-523.
[4] MUHAMMAD AKBAR, MUHAMMAD SALEEM, FAQIR MUHAMMAD AZHAR, YASIN ASHRAF, M. ADN RASHID AHMAD, 2008, Combining ability analysis in maize under normal and high temperature condition. *J. Agric. Res*., **46** (1): 27-38.
[5] NEHRA, D.S., TOMAR, P.S., SINGH, S.M. AND PAHUJA, S.S., 1981, Effect of nitrogen levels, weed control and seed rate on yield and quality of fodder maize. *Forage Res*., **7**: 195.
[6] REDDY, B.B., REDDY, V.M., REDDY, M.R., KUMAR, A. AND SWAMY, K.B., 1987, Effect of plant population on the performance of maize hybrids at different fertility levels in a semi-arid environment. *Indian J. Agric. Sci*., **57** (10) : 705-709.
[7] YADAV, R.D.S. ADN SINGH, P.V., 2000, Studies on nutrient dose and row spacing on seed production and quality in single cross hybrid of maize: *Seed Res*., **28** (2): 140-144.

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