SHORT COMMUNICATION

EFFECT OF NUTRIENT MANAGEMENT AND TASSEL REMOVAL ON PRODUCTIVITY OF MAIZE (ZEA MAYS L)

Narendra Natwaria, Minu Mohan, K.K. Khuntiya and A.K. Sinha*

RMD College of Agriculture & Research Station, Indira Gandhi KrishiVishwavidyalaya, Ambikapur, Surguja, Chhattisgarh -497001
Email: amitsinhaagri@yahoo.co.in

Received-04.12.2021, Revised-21.12.2021, Accepted-29.12.2021

Abstract: A field experiment was conducted at Research farm, Ambikapur Chhattisgarh on maize in rabi season 2020- 21 to study the effect of nutrient management and tassel removal. The experiment was laid out in factorial randomized block design with two factors. Factor A having three levels of nutrient management and factor B having three levels of detasseling of maize which consisted of nine treatment combination each replicated thrice. First factor was of nutrient management viz., 100% RDF, 100 % RD of N & P_2O_5 and 75% K_2O *and* 75 % RDFwhereasanother factor was Detasseling viz., no tassel removal, 50% tassel removal of alternate crop within row, and 50%tassel removal of crop of alternate row. Various yield attributes such that no. of cobs, cob length, cob girth, no of grain rows cob^{-1}, number of grains row^{-1}, barrenness %, cob yield, grain yield, net return and B:C ratio was recorded highest under the treatment with F_1 i.e., 100% RDF which was found to be at par with F_2 i.e., 100% RD of N & P and 75% of K but both of these treatments were significantly superior over F_3 i.e., 75% RDF. Detasseling practice indicated that the yield parameters and cob yield, grain yield, net return and B:C ratio were observed higher under D_1 i.e., 50% tassel removal of alternate crop within row which was at par with D_2 i.e., 50% tassel removal of alternate row and both of these treatments were found significantly superior over D_0 i.e., no tassel removal. The interaction between F_1 D_1*i.e.*100% RDF and 50% tassel removal of alternate crop within rowhad maximum grain yield and proved to be better in economic return over the other treatments.

Keywords: Detasseling, Nutrient management, Rabi season, Yield attributes, Yield

INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crops occupying a prominent position in global agriculture and one of the most important staple food crops of the world and ranks next to wheat and rice also known as the "Queen of Cereals". It is cultivated in India over 8.67 million ha with 22.26 million tonnes production having an average productivity of 2566 kg/ha, contributing nearly 8 per cent in the national food basket. Maize is a wide- spaced crop, having slow growth rate inits early stage, which leads to more loss of water, and nutrient through evaporation and heavy infestation of weeds. Productivity of maize is also limited by low fertilizer efficiency, inadequacy in existing fertilizer recommendation and ignorance of nutrient balance and hence, pausing serious threat in maize production. Low soil fertility is one of the drawbacks to optimize agricultural production and productivity. Maize is voracious feeder of nutrients and productivity is mainly dependent on nutrient management. Therefore, it needs highly fertile soil to express its yield potential. Thus, it becomes necessary to supply the nutrients to crop through combined various proportions to sustain the soil health and crop productivity. The nutrient management indifferent proportions have proved its worth in maintaining higher productivity, providing greater stability to crop production and sustaining the soil health (Rao *et al*., 2002).

Among the economically important grasses, onlymaize flowers monoecious type, having its staminate inflorescence located at the apex of the plant and thepistillate inflorescence at the apex of axillary branches. The differences betweenapical and axillaryinflorescence is location, timingof differentiation and development may promote competition for resources, particularly under stressconditions. Apical structures usually havepreferential use of the resources available to theplant, more specifically, water, nutrients andphotosynthates (Paterniani, 1981). The tassel of the maize plant emerges from the enclosing whorl of leaves near the end of the vegetative phase of growth. Tassels have been removed from maize experimentally and commercially for various reasons like that detasseling is important for corn production due to the fact that it reduces the completion of light moisture and nutrient. Due to detasseling also increased the cob diameter, cob length, number of grain cob^{-1}, test weight, grain yield and straw yield.When tassel was removed and re-inserted in the whorl, the tassel no longer compare for plant nutrient but still intercepts solar radiation (Hunter *et al*., 1969).Maize crop gives good response to fertilizers and fertilizer application to maize has given significant indication in increasing yield. It was reported that the stover and grain yield of maize increased significantly with the increasing N and P from 0-150 and 0-80 kg ha^{-1}, respectively (Kumar and Singh, 2003).

MATERIALS AND METHODS

The experiment was carried out in *Rabi* 2020-21 at

*Corresponding Author

Research farm of Raj Mohini Devi College of Agriculture and Research Station, Ambikapur. (C.G) which is situated at 23^0 10' N latitude, 83°15' E longitude and at an altitude of 623 meters above the mean sea level. The soil of experimental field was sandy loam in texture with pH of 5.7, organic carbon 0.56%, 234 kg/ha available N, 8.4 kg/ha P_2O_5 and 268 kg/ha K_2O. The meteorological data recorded at meteorological observatory of the station indicated that rainfall received during the crop seasons was 61.1 mm and the maximum rainfall of 22 mm was recorded during 3rdweek of JanuaryThe experiment was laid out in factorial randomized block design with three replications and nine treatment combinations*viz.*100%RDF + no tassel removal(F_1D_0), 100%RDF+50% tassel removal within row(F_1D_1), 100%RDF+ tassel removal of alternate row(F_1D_2), 100%RD of N and P 75% K + no tassel removal(F_2D_0), 100%RD of N and P 75% K +50%tassel removal within row(F_2D_1), 100%RD of N and P 75% K +50%tassel removal within row(F_2D_2), 75%RDF+ no tassel removal(F_3D_0), 75%RDF+50% tassel removal within row(F_3D_1) and 75%RDF+ tassel removal of alternate row (F_3D_2).Nutrients were applied as per treatments. Recommended dose of fertilizer was 150: 80: 60 kg ha^{-1} N:P:K. Nutrients were applied through inorganic fertilizers viz. Iffco (12:32:16), urea (46% N) and MOP (60% K).One third of nitrogen and full dose of P_2O_5 and K_2O were applied as basal dose at the time of sowing and remained two third of nitrogen (two equal split doses) was top dressed at knee high stage (90 DAS) and at tasseling stage (105 DAS).Gap filling was done to maintain the plant population as per the requirement. Plant protection measure was adopted when needed. Tassel removal as per treatment were done just after anthesis. The crop was harvested at 172 DAS (harvestable maturity).Five plants were selected as representative plant and tagged in each plot for recording growth as well as yield attributes. These plants were harvested separately for postharvest observations and cob yield and stover yield of these plants were later added to corresponding net plot yield. Economics of different treatments were worked out taking into consideration of input costs and returns from the produce of experimental crop.All data obtained in the study were statistically analyzed using *F*- test, the procedure given by Gomez & Gomez (1984), critical difference (CD) values at *P*= 0.05 were used to determine the significance of differences between means.

RESULTS AND DISCUSSION

Yield attributes

A significant variation due to various treatment combination was observed in yield attributes (Table 1).A considerable variation in yield attributes (cob length, cob girth, no of grain rows cob^{-1} and no of grains row^{-1}) were noticeddue to various nutrient management practices and detasseling whereF_1 i.e., 100% RDF registered significantly higher yield attributes which were found to be at par with F_2 i.e., 100% RD of N & P and 75% of K but both of these treatments were significantly superior over F_3 i.e., 75% RDF.The detasseling signifies that cob length, cob girth, no ofgrains row^{-1} and no of grain rows cob^{-1} were significantly higher in D_1i.e., 50% tassel removal of alternate crop within row which was at par with D_2 i.e., 50% tassel removal of alternate row and both of these treatments were found significantly superior over D_0 i.e., no tassel removal.

The results onno of cobs ha^{-1} and barrenness % revealed that bothwere not influenced by different nutrient practices and detasseling. No significant variation in number of cobs ha^{-1} due to various nutrient management practices but comparatively higher number of cobs (81259.3 ha^{-1}) were recorded with 100% RDFi.e., F_1 followed byF_2 i.e., 100% RD of N & P and 75% of K (79511.1 ha^{-1}) and F_3 i.e., 75% RDF (76192.6 ha^{-1}). Comparatively more barrenness was observed under the treatment F_3 i.e., 75% RDF than F_2 i.e., 100% RD of N & P and 75% of K andF_1 i.e., 100% RDF. Further, detasseling treatments had no significant variations in number of cobs (ha^{-1}) and barrenness %. Comparatively higher number of cobs (81925.9 ha^{-1}) were recorded with D_1i.e., 50% tassel removal of alternate crop within rowfollowed by D_2 i.e., 50% tassel removal of alternate row (79962.9ha^{-1}) and D_0 i.e., no tassel removal (75074.1ha^{-1}). Some reports were confirmed where highest yield attributes, *viz.*, cob length (cm), cob girth (cm), grain rows/cob, grains/row, shelling per cent and 1000 grain weight (g) were significantly higher in SSNM over 50 per cent RDF but at par with 100 per cent RDF.

Yield

The highest cob yield of maize (8013.28 kg ha^{-1}) and the maximum grain yield (6450.07 kg ha^{-1}) of maize (Table 1) was recorded with 100% RDFi.e., F_1 which was on par with F_2 i.e., 100% RD of N & P and 75% of K (7461.80 kg ha^{-1}) for cob yield (6094.07 kg ha^{-1}) and for grain yield but both of these treatments were significantly superior over F_3 i.e., 75% RDF (6181.99 kg ha^{-1}) for cob yield and (4632.59 kg ha^{-1}) for grain yield. Also, maximum cob yield (7413.35 kg ha^{-1}) and maximum grain yield (5926.52 kg ha^{-1}) was obtained with D_1i.e., 50% tassel removal of alternate crop within row which was at par with D_2 i.e., 50% tassel removal of alternate row (7397.38 kg ha^{-1}) for cob yield and (5868.59 kg ha^{-1}) for grain yield but significantly superior over D_0 i.e., no tassel removal (6846.04 kg ha^{-1}) for cob yield and (5481.63 kg ha^{-1}) for grain yield.

The yield is the result of cumulative effect of growth characters and the yield attributes. The grain yield of maize positively influenced by cob length, cob girth, number of rows cob^{-1}, number of kernels row^{-1} and 100 grain weight. Yield attributes of maize were

significantly influenced by adapting different nutrient management practices and higher value were noticed with 100 % recommended dose of fertilizer along with FYM. Use of FYM not only favoured the crop plants with more availability of micro nutrients but also improve soil structure facilitating vigorous growth of crop plants. Maximum cob yield and fodder yield was obtained in 100% RDF which was significantly fair over 75% RDF and 50% RDF reported by Patel *et al*., (2020).

Interaction

The interaction effect between the nutrient practices and detasseling on grain yield (kg ha^{-1}) of crop was found to be significant(Table 3).The interaction effect of nutrient practices and detasseling on grain yield and revealed that 100% RDFi.e., F_1 + D_1i.e., 50% tassel removal of alternate crop within rowhad maximum grain yield (6781.7 kg ha^{-1}), which was at par with F_2i.e., 100% RD of N & P and 75% of K + D_1i.e., 50% tassel removal of alternate crop within row (6408.9 kg ha^{-1}) but significantly superior over rest of treatment combinations.

Economics

The gross return, net return, B: C ratio is presented in (Table 2). The maximum gross return (₹ 91452.19 ha^{-1}) the maximum net return (₹ 48053.30ha^{-1}) and the highest B: C ratio (1.15) was recorded with 100% RDF i.e., F_1 which was on par with F_2 i.e., 100% RD of N & P and 75% of K (₹ 86846.86ha^{-1}) for gross return and (₹ 45594.44 ha^{-1}) for net return with B:C ratio (1.06) but both of these treatments were significantly superior over F_3 i.e., 75% RDF (₹ 39044.54ha^{-1})for gross return and (₹ 26103.41 ha^{-1}) for net return and B:C ratio (0.76). Detasseling treatments had significant variations on gross return, net return and B:C ratio. The higher gross return (₹ 42484.31ha^{-1}), the higher net return (₹ 44314.50 ha^{-1}) and the maximum B:C ratio (1.11) was obtained with D_1i.e., 50% tassel removal of alternate crop within row which was at par with D_2 i.e., 50% tassel removal of alternate row (₹ 82227.79ha^{-1})for gross return and with B:C ratio (1.04) but significantly superior over D_0 i.e., no tassel removal (₹ 74440.60ha^{-1}) for gross return (₹ 50468ha^{-1}) for netreturn with B:C ratio(0.87).

The practical utility of any nutrient management practices can be best judged because of net return and B:C ratio. Nutrient management treatments showed significant direct yield advantage over without organic manure and minimum fertilizer treatment in maximizing net return as well as B:C ratio. This was because of more net returns than the money spent in crop production under these treatments. These results are found to be in close conformity with findings of Patel *et al*., (2020) where applicationof 5 t FYM ha^{-1} and 100% recommended dose of nutrients producedsignificantly more net return.Similarly increased net return and high B:C was obtained drip fertigation 125% RDFin summer maize by Mohan *et al*., (2018).

Table 1. Yield and yield attributes of maize as influenced by various nutrient management practices and detasseling

Treatments		Yield attributes					
		Cob length (cm)	Cob girth (cm)	No. of grain rows Cob^{-1}	No. of grains $rows^{-1}$	No of Cobs (000 ha^{-1})	Barrenness (%)
Nutrient management (F) (RDF-150: 80:60 :: N:P_2O_5:K_2O)							
F_1	***100% RDF***	17.97	16.01	13.76	36.4	81.2	4.28
F_2	***100% RD of N & P + 75% of K_2O***	16.12	15.42	13.26	35.7	79.5	3.71
F_3	***75% RDF***	11.51	13.70	11.07	31.8	76.1	4.58
Sem±		0.57	0.30	0.28	0.78	6.4	0.73
C.D. (P=0.05)		1.71	0.90	0.85	2.29	NS	NS
Detasseling (D)							
D_0	**No Tassel removal**	14.22	14.53	12.13	32.8	75.0	4.94
D_1	**50% Tassel removal of alternate crop within row**	16.26	15.78	13.48	36.8	81.9	4.31
D_2	**50% Tassel removal of alternate row**	15.12	14.82	12.47	35.2	79.9	4.31
Sem±		0.57	0.30	0.28	0.78	6.46	0.73
C.D. (P=0.05)		1.71	0.90	0.85	2.29	NS	NS

Table 2. Yields and economics of maize crop as influenced by various nutrient management practices and detasseling

		Cob yield (Kg ha^{-1})	Grain yield (Kg ha^{-1})	Net return (` ha^{-1})	B:C ratio
Nutrient management (F) (RDF-150: 80:60 :: N:P_2O_5:K_2O)					
F_1	***100% RDF***	**8013.28**	**6450.07**	**48053.30**	**1.15**
F_2	***100% RD of N & P + 75% of K_2O***	**7461.80**	**6094.07**	**45594.44**	**1.06**
F_3	***75% RDF***	**6181.99**	**4632.59**	**26103.41**	**0.76**
Sem±		**186.47**	**127.77**	**1579.29**	**0.04**
C.D. (P=0.05)		**559.07**	**383.08**	**4734.92**	**0.12**
Detasseling (D)					
D_0	**No Tassel removal**	**6846.04**	**5481.63**	**34930.50**	**0.87**
D_1	**50% Tassel removal of alternate crop within row**	**7413.35**	**5926.52**	**44314.50**	**1.11**
D_2	**50% Tassel removal of alternate row**	**7397.68**	**5868.59**	**40506.35**	**1.04**
Sem±		**186.47**	**127.77**	**1579.29**	**0.04**
C.D. (P=0.05)		**559.07**	**383.08**	**4737.92**	**0.12**

Table 3. Interaction effect between various nutrient management practices and detasseling on grain yield (kg ha^{-1})

Treatments	***Nutrient management (F)***		
Detessling	**Grain yield (kg ha^{-1})**		
	100% RDF	***100% RD of N & P + 75% of K_2O***	***75% RDF***
No Tassel removal (D_0)	**6207.1**	**5744.4**	**3593.3**
50% Tassel removal of alternate crop within row (D_1)	**6781.7**	**6408.9**	**5488.8**
50% Tassel removal of alternate row (D_2)	**6361.3**	**6128.8**	**4815.5**
SEm±	**127.7**		
CD (P=0.05)	**374.7**		

REFERENCES

Balai, M.L., Verma, A., Nepalia, V. and Kanthaliya, P.C. (2011). Productivity and quality of maize (*Zea mays*) as influenced by integrated nutrient management under continuous cropping and fertilization. *Indian Journal of Agricultural Sciences*, 81(4): 374-376.

Google Scholar

Gomez, K.A. and Gomez, A.A. (1984). Statistical procedure for Agricultural Reseach., edn 2, John Wiley & Sons, New York, p. 241-271.

Google Scholar

Hunter, R. B., Daynnard, T. B., Hume, D. J., Tanner, J. W., Hanson, D. D., Malloy, K. P. and Kannemberg, L. W. (1969). Effect of tassel removal on grain yield of corn (*Zea mays* L.). Crop. Sci., **9** : 405-406.

Google Scholar

Kumar, Lalit and Sinha, A.K. (2020). "Response of rainfed maize as influenced by various integrated nutrient management practices. *Journal of Plant Development Sciences*, 12 (8): 501-504.

Google Scholar

Mohan, M., Rathore A. L. and Jha S. K. (2018). Response of drip fertigation, intrarow seeding of legume and planting geometry on net return of summer maize. International *Journal of Pure and Applied Bioscience*, 6(2) 964-967.

Google Scholar

Patel, Anjali and Sinha, A.K. (2020). "Economic viability of Sweet corn (Zea mays L. *Sacchharata*) cultivation as influenced by integrated nutrient management. *Journal of Plant Development Sciences*, 12 (9): 543-547.

Google Scholar

Paterniani, E. (1981). Influence of tassel size on ear placementin maize. *Maydica*, 26(2): 85-91.

Google Scholar

Rao, A.S., Chand, S. and Srivastava, S. (2002). Opportunities for integrated plant nutrient supply system for crops/ cropping system in different agro-eco regions. *Fertilizer News*, 47(12): 75-78.

Google Scholar