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Response of Fodder Maize to Different Levels of Nitrogen Under Various Establishment Methods

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A B S T R A C T

The experiment was conducted to find out the planting method and nitrogen level for enhancing the seed yield of fodder maize (*Zea mays* L.). The treatment comprised of three planting methods as zero tillage (ZT), conventional tillage (CT) and bed planting (BP) and four nitrogen levels (0, 100, 125 and 150 kg N/ha. The results revealed that plant height, shelling percentage, seed and stover yield were not varied significantly with the various methods of establishment. It shows the fodder maize can be sown with ZT and BD rather sowing with conventional tillage. Successive increase of 25% N/ ha has significantly increased the seed and stover yield of maize with which significantly higher values of plant height, stover yield and shelling percentage was obtained with 150 kg N/ha. It can be concluded that the fodder maize can be sown by ZT with the application of 150 kg N/ ha for higher productivity by skipping the tillage operations at the time of sowing.

Introduction

Maize (*Zea mays* L.) is one of the important *Kharif* fodder crops, which is cultivated on about 1.00 lakh ha in Punjab. The area for green fodder production in the Punjab has increased from 8.97 (2017-18) to 9.00 (2023-24) lakh ha and the small increase in annual production was also recorded as 707 (2017-18) to 710 (2023-24) lakh tones of green fodder (Anonymous 2023). India produced 30 million tones of maize on an area 9.9 million hectares 2020-21 (agricoop.nic.in). Globally, 121 million tones of maize were produced from the 205.87 million hectares during 2023 (news.agropages.com). The global use of maize, is mainly consumed as animal feed (61%) in addition to its human feed (13%), industrial raw material (17%) and 9% in other use (OECD/FAO, 2019). It takes about 50 to 60 days to become available for harvesting.

The green fodder is considered good for milch animals. It is grown widely around cities for sale as green fodder in the market. Ever since introduction of high yielding varieties in Punjab, in 1970's, the area under maize has gradually reduced. The area and production of maize, which were respectively

555 thousand hectares and 861 thousand metric tonnes during 1970-71, gradually declined to 129 thousand hectares and 475 thousand metric tonnes, respectively during the year 2012-13. However, area under maize fodder cultivation increased about 445 thousand hectares in 2023 as compared to 2012-13.

Among the modern agro-management practices planting method and varying nitrogen rates, technique is imperative for boosting up of emergence, growth and production of corn. Planting method of establishment is one of a crucial factor for improving crop yield.

Different planting methods are practiced in the world for sowing of maize crop. In-appropriate planting method results in barren plants, ears and their size remain smaller, crop become susceptible to lodging, diseases and pests resulting in lower yield per unit area. The planting methods like zero tillage and bed planting were recommended for sowing of maize for getting equivalent or more yields in comparison of conventional method.

Considerable work has been reported on these aspects but efforts are still required to improve these techniques for getting maximum yield. Keeping in view the above, this study was planned to determine the nitrogen quantity for obtaining higher productivity by sowing the fodder maize with zero tillage and bed planting in comparison of conventional tillage.

Materials and Methods

Field experiment was carried out at the Student's Research Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana (36^0 54' North latitude and 75^0 48' East longitudes; 247 meters above mean sea level) in the *Kharif* seasons of 2012 and 2013.

The fodder maize was sown in three planting methods viz. zero tillage (ZT), bed planting (BP) and conventional tillage (CT) and four nitrogen (N) levels (0, 100, 125 and 150 kg N/ha) by keeping the planting methods in vertical strip and nitrogen levels in horizontal strip. The treatments were replicated three times in strip plot design. The soil of experimental field was sandy loam in texture and normal in pH, EC and organic carbon, medium in available N (125 kg N/ha), P (12.3 kg P_2O_5/ha) and K (115.0 kg K_20/ha) before sowing of maize.

Nitrogen was applied in the form of urea in three splits as per treatments. One third of the nitrogen was applied at sowing and other one third at knee high stage near the plant base and remaining one third at pre tasseling stage. The spacing of 50 cm was kept between rows and 20 cm among plant.

The other crop husbandry was followed as per recommendation of Punjab Agricultural University, Ludhiana. Five cobs were selected at random from each plot for measuring shelling percentage. The shelling percentage was calculated by dividing the grain weight of five cobs by the total weight of five cobs and multiplying it by 100.

Stover yield was determined by weighing the harvested crop before separation of cobs from the plants of each plot (0.7m x 3.5 m for bed sowing and 1m x 3.5 m for zero and conventional tillage methods). Grain yield (q/ha) was determined by recording the seed yield after shelling of the cobs.

Results and Discussion

Plant height

Plant height is an important index of plant growth and is often used to monitor the effect of various treatments on growth of crop. The periodic plant height data recorded at 20 days and at maturity have been presented in table1. During both the year, the plant height increased slowly upto 40 DAS with grand growth period from 40 to 60 DAS in which maximum increase in plant height has been recorded. The maximum plant height was recorded in bed planted crop followed by conventional tillage and zero tillage method (Table 1) at all the stages except 40 DAS, however the differences were non-

significant among the different methods of planting. Higher plant height in bed planted crop was attributed to efficient water and nutrient absorption as the roots were better aerated being on raised bed in comparison to the conventional tillage sown crop have been observed by Freeman *et al.,* (2007).

The same result was reported by Hassanzadeh (2013) and Fatemi (2008) they observed non significant result of different planting methods on plant height. Similar Gokmen *et al.,* (2001) also observed that bed grown crop produced taller plant as compared to other sowing methods. Aikins and Afuakwa (2010) reported that increased plant height with conventional tillage may be due to decreased soil bulk density, which increased proliferation of roots for the uptake of nutrients as well as moisture. Similarly, taller plants in conventional tilled plots were recorded as compared to zero tillage.

The different levels of nitrogen influenced the plant height at 60, 80 DAS and at maturity during 2012. Plant height of maize increased with increase in nitrogen level from 0 to 150 kg N/ ha at all the stages of the crop growth (Table1).

At 60 DAS and at harvest, application of 150 kg N/ha produced significantly taller plants over the control and 100 kg N/ha but showed at par with 125 kg N/ ha. Whereas at 80 DAS, 150 kg N/ha was at par with 125 kg N/ ha and 100 kg N/ha but significantly higher than control, which was non-significant in 2013. Higher N applications increase the cell division, cell elongation, nucleus formation as well as green foliage. It also encourages the shoot growth.

Therefore, higher doses of nitrogen increased the chlorophyll content, which increased the rate of photosynthesis and extension of stem resulting increased plant height (Diallo *et al.,* 1996).

Similar results were found by Kumar (2009) and Paradkar and Sharma (1993). Amanullah *et al.,* (2007) reported that increase in plant height with increasing number of nitrogen dose. Increasing nitrogen level from 120 kg /ha to 200 kg /ha also increased the plant height of hybrid maize varieties.

Yields and shelling percentage

Planting methods had no significant influence on grain yield, stover yield and shelling percentage of fodder maize (Table 2). BP showed better seed yield, stover yield and shelling percentage than CT and ZT.

Bed planted crop had better growth resulting in higher stover yield than the other methods of sowing. Yadav *et al.,* (2021) reported that the tillage and method of establishment has negative and positive effect on economic yield of maize.

Seed yield and shelling percentage of fodder maize was recorded with 150 kg N/ha, which was significantly higher than other nitrogen levels in both the years. Singh *et al.,* (2003); Srivastava *et al.,* (2018) and Wei *et al.,* (2019) observed a significant increase in grain yield at high N levels. Nitrogen application significantly influenced the stover yield.

The close relation between biomass yield and nitrogen availability in the soil has been reported by Delgado (2001); Akmal *et al.,* (2010). These findings are in accordance with Haque *et al.,* (1996) and Uhart and Andrade (1995) who reported that nitrogen enhances vegetative growth. Similar results have been reported by Muhammad *et al.,* (2002); Jokela *et al.,* (1989) and Chaudry and Jamil (1998).

Maize fodder gave the similar seed yield with the ZT, CT and BP. CT and BP requires intensive tillage for sowing of crop and it will enhance the cost of cultivation but not seed yield and also delay the sowing due to the seed bed preparation.

The application of 150 kg N/ha gave the significantly higher seed yield than all other N levels. Therefore, fodder maize can be sown with ZT by using 150 kg N/ha for higher seed yield at low cost by skipping the tillage operation at the time of sowing.

Table.1 Effect of planting methods and nitrogen levels on plant height at different stages of fodder maize during *Kharif* of 2012 and 2013

Treatment	Plant height (cm)									
	20 DAS		40 DAS		60 DAS		80 DAS		At harvest	
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
Planting method										
ZT	22.1	23.0	75.5	76.8	158.6	159.0	176.7	176.0	194.4	195.1
CT	23.0	23.4	83.7	84.5	160.1	160.2	185.9	186.0	201.4	200.0
BP	23.1	23.5	89.6	90.0	160.8	160.3	187.4	186.6	207.9	206.1
CD (P=0.05)	NS	NS	4.2	NS	NS	NS	NS	NS	NS	NS
Nitrogen level (kg/ha)										
0	21.5	2.6	79.1	79.5	140.0	141.0	147.9	148.3	169.6	170.1
100	22.7	22.8	80.5	80.7	159.3	160.0	192.2	193.0	208.3	200.3
125	23.2	23.5	81.9	81.3	165.8	165.2	199.4	200.1	210.5	213.1
150	23.3	23.7	90.2	82.3	168.8	168.0	201.4	200.8	216.5	215.8
CD (P=0.05)	NS	NS	NS	NS	5.3	NS	16.3	NS	7.0	NS

Table.2 Effect of planting methods and nitrogen levels on grain, stover yield and shelling percentage of fodder maize during *Kharif* of 2012 and 2013

Treatment	Grain yield (q/ha)		Shelling (%)		Stover yield (q/ha)	
	2012	2013	2012	2013	2012	2013
Planting method						
ZT	44.4	45.9	50.1	73.2	177.1	177.3
CT	44.6	46.3	50.4	73.3	178.7	179.0
BP	48.0	47.2	50.8	73.4	197.6	198.6
CD (P=0.05)	NS	NS	NS	NS	NS	NS
Nitrogen level (kg/ha)						
0	21.0	21.6	36.8	63.7	144.9	147.1
100	45.3	45.4	46.7	70.6	171.8	173.0
125	53.0	53.1	57.2	74.2	207.4	209.3
150	63.3	65.6	61.0	84.3	213.7	214.8
CD (P=0.05)	3.0	4.0	3.4	3.8	20.0	14.5

References

Annonymous (2023). Package of Practices for Crops of Punjab, *Kharif* 2023. Punjab Agricultural University, Ludhiana

Aikins S H M and Afuakwa J J (2010). Effect of four different tillage practices on cowpea population and mulches on biological yield of maize. *Pakistan J Bot* 41: 2243-49.

Akmal M, Rehman H, Farhatullah M A and Akbar H (2010). Response of maize varieties to nitrogen application for leaf area profile, crop growth, yield and yield components. *Pak J Bot* 42: 1941-47.

Amanullah (2007). Partitioning of dry matter and grain yield potential yield in maize (*Zea mays*) as influenced by plant density, rate and timing of nitrogen application. *Int J Sustain Crop Prod* 2:01-07.

Chaudry A U and Jamil M (1998). Determination of optimum level of nitrogen and its effect on maize.

Pakisthan *J Biol Sci* 1: 360-62.

Delgado R (2001). Maize growth and nitrogen uptake in different conditions of nitrogen availability in a molliso soil of Agragua state, Venezuela.

Diallo A O, Adam A, Akanvou R K and Sallah P Y K (1996). Response of maize lines evaluated under stress and non-stress environments. *In:* G. O. Edmeades, M. Banziger, H. R. Mickelson and Pena-Valdivia C B (eds.) Developing Drought and Low N Tolerance Maize. Proceedings of a Symposium, March 25-29, 1996. CIMMYT, EI Batan, Mexico. pp. 280-286.

Fatemi R (2008). Effect of different planting methods on fodder maize hybrids in saline condition. M.Sc. Thesis, Azad University of Mashhad, Mashhad, Iran.

Freeman K W, Girma K,Teal D B, Klaat A and Raun W R (2007). Winter wheat grain yield and grain nitrogen influenced by bed and conventional planting systems. *J Pl Nutr* 30: 611-22.

Gokmen S, Sencar O and Sakin M A (2001). Response of popcorn (*Zea mays* everta) to nitrogen rates and plant densities. *Turk J Agric Forest* 25:15-23.

Haque I, Jakhro A A (1996). Soil and fertilizer nitrogen. In Soil Science Basher E and R Bantel (Eds). National Book Foundation, Islamabad, Pakistan. pp 261-84.

Hassanzadeh M H, Khorasani S K and Darban A R S (2013). Effect of planting method and plant population on seed and forage yield of maize in saline condition. *Res J Environ Earth Sci* 6: 44-48.

Jokela W E and Randall G W (1989). Corn yield and residual soil nitrate as affected by time and rate of nitrogen application. *Agron J* 81: 720-26. https://doi.org/10.2134/AGRONJ1989.00021962008100050004X

Kumar A (2009). Production potential and nitrogen –use efficiency of sweet corn (*Zea mays*) as influenced by different planting densities and nitrogen levels. *Indian J Agric Sci* 79: 231-55.

Muhammad S, Bakht J, Jam M T and Shah W A (2002). NP levels effect on yield and yield component of maize varieties. *Sarhad J Agric* 18: 252-57.

OECD/FAO (2019). *OECD-FAO Agricultural Outlook Paris*: OECD Agriculture Statistic.

Paradkar V K and Sharma R K (1993). Effect of nitrogen fertilization on maize varieties under rainfed conditions. *Indian J Agron* 38: 303-04.

Singh R N, Sutaliya R, Ghatak R and Sarangi S K (2003). Effect of higher application of nitrogen and potassium over recommended level on growth, yield and yield attributes of late sown winter maize (*Zea mays* L.). *Crop Res* 26: 71-74.

Srivastava R K, Panda R K, Chakraborty A and Haider D (2017). Enhancing grain yield, biomass and nitrogen use efficiency of maize by varying sowing dates and nitrogen under rainfed and irrigated conditions. *Field Crops Res* 221: 339-349. https://doi.org/10.1016/j.fcr.2017.06.019

Uhart S A and Andrade F A (1995). Nitrogen deficiency in maize. I. Effect on crop growth development, dry matter partitioning and kernel set. *Crop Sci* 35: 1376-83. https://doi.org/10.2135/cropsci1995.0011183X003500050020x

Wei S, Wang X, Li G, gin Y, Jang D and Dong S T. (2019). Plant Density and nitrogen supply affect the grain filling parameters of maize kernels located different ear positions. *Front Plant Sci* 10:180. https://doi.org/103389/fpls.2019.00180

Yadav G. S, Das A, Babu S, Mohapatra K P, Lal R and Rajkhowa D (2021). Potential of conservation tillage and altered land configuration to improve soil properties, carbon sequestration and productivity of maize based cropping system in eastern Himalayas, India. *International Soil and Water Conservation Research*. 9(2): 279-290. https://doi.org/10.1016/j.iswcr.2020.12.003

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