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THE RESPONSE OF FODDER MAIZE (*ZEA MAYS* L.) VARIETIES TO DIFFERENT DOSES OF NITROGEN

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Abstract

An experiment was conducted to study the response of fodder maize (*Zea mays* L.) varieties to different doses of nitrogen at Lovely Professional University Phagwara, Punjab. The experiment was conducted out using a randomized block design with four replicates. Two varieties of fodder maize were used, J1006 and African tall. There were eight treatments first four was of variety 1st and last four was of variety 2nd. The plant height and stem girth of the plant were recorded at 30, 45 and 70 DAS. The treatment T4 (50% RDN+13.7-ton FYM/ha) showed progressive results at all growth parameter stages. The treatment of having a combination of organic and inorganic fertilizer showed a better result as compared to control. This is due to the presence of macro and micronutrients which increases the growth parameters. The variety of J1006 developed by PAU showed better growth parameters as compared to African tall.

Keywords **:** fodder maize, growth parameters, nitrogen.

Introduction

Maize (*Zea mays* L.) is the most important cereal crop in the world. Maize ranks 3rd in cereal crops after rice and wheat. It has greater adaptability, as it is grown worldwide in a different range of environmental conditions. It is cultivated in temperate, tropical and sub-tropical regions. The origin of maize in Central America from there it is spread to Caribbean, North and South America. In India, it was introduced by Portuguese during the 17th century. Maize is a dual-purpose crop. It is used as food for human and feed for animals. It is used in industries as raw material. Leaf and corn of fodder maize are used as feed to cows, chicken and pigs. Maize is good in ensiling as it contains high energy value. Silage is making through fermentation. The proper amount of moisture and soluble carbohydrates which converts into lactic acid is required during fermentation. Due to this, maize is most suitable for silage.

Nitrogen gives a green colour to the plants and makes them succulent. It increases the vegetative growth of the plants. Nitrogen is the element which increases the yield as well as improves the quality of the fodder maize. Nitrogen increases the plant height, a number of leaves and leaf area. Nitrogen is also helpful in the uptake of other nutrients like P and K. When maize plant is suffering from the deficiency of nitrogen it shows stunted and spare growth. The oldest leaves show yellow discoloration and necrosis (dying of cell tissue) starting at the tip of leaves. Leaching of nitrogenous fertilizers also affects the growth of the maize plant. Nitrogen is essential during its maximum growth period i.e. tasselling and silking. Koul (1997) observes a positive response from nitrogen in his experiment. With the increase in plant height, the number of leaves also increases. Nitrogen also increases the stem diameter as noted by John and Warren (1967). Nitrogen also increases the dry forage yield of the fodder maize. Nitrogen also influences the quality parameter like crude protein, crude fibre and ash content.

Nitrogen increases the fertilization in maize crop as a result yield increases. But nitrogen also increases the crude protein in the maize crop which reduces the forage quality. It is not acceptable for animals. The fertilizers like phosphorous, potassium and other nutrients which increases the yield actually it decreases the quality of forage, the excess number of elements like potassium decreases the availability of other elements like magnesium. Keeping in view all these aspects the present study in fodder maize is undertaken with following objectives: To study about effect of nitrogen application on growth and yield of fodder maize, to study the change in the chemical composition of the soil due to the different doses of nitrogen and to study about proximate composition of maize fodder.

Materials and Method

The experiment was conducted at the agricultural research farm of Lovely Professional University, Phagwara Punjab. The experiment was laid out in a randomized block design having four replications. Two varieties of fodder maize were taken i.e. J1006 and African tall. The first four treatments were of variety 1 and next four treatments were of variety 2. Two types of nitrogen fertilizer were taken organic and inorganic. Urea was taken as inorganic fertilizer and FYM was taken as organic fertilizer. The two varieties of fodder maize were used, J-1006 and African tall. There were three nitrogen rates viz. T2: 100%, T3:75%, T4:50% and T1: control, but to compensate the dose of nitrogen 25% and 50% recommended dose of FYM in T3 and T4. The observation including plant height, number of leaves and stem girth were recorded periodically at 30, 50 & 70 DAS, whereas proximate compositions were obtained after harvesting of the crop. The data collected were statistically analyzed and the treatment means were compared by Tukey's Multiple Range Test (TMRT) at 0.05 level of probability.

Results and Discussion

The experiment entitled "Response of fodder maize (*Zea mays* L.) varieties to different doses of nitrogen" was carried out during Kharif April 2018-July 2018 at the experimental farm of the Department of Agriculture, Lovely Professional University, Jalandhar, Punjab (India). The study deals with the observations regarding various characteristics of vegetative growth, yield and proximate composition of fodder maize.

Plant Height

At the stage of harvesting i.e. 70 DAS the height was significantly increased. The range of height in variety 1 was from 105 to 208.75. The treatment T4 (50% RDN + 13.7 tonnes FYM/ha) had the highest value i.e. 208.75 which was highly significant ($p<0.05$) and T1 (control) had the lowest value i.e. 105. The second highest value was observed in T2 (100% RDN) i.e. 206. Similarly, in variety 2 the range of height was from 100.5 to 158.6. The highest value was observed in T8 (50% RDN + 13.7 tonnes FYM/ha) 158.6 which was highly significant ($p<0.05$) followed by T6 (100% RDN) 152.75. The lowest value was observed in T5 (control) i.e. 100.5. At the stage of 70DAS variety, 1 increased plant height up to 21.17% as compared to variety 2.

In both the varieties, the treatment having 50% RDN+ 13.7 tonnes FYM/ha gave the maximum plant height as compare to other treatments. These were in conformity with Buriro *et al* (2014) who resulted that the organic source like FYM increases the availability of macro and micronutrients increase the protoplasmic constituents and accelerate the cell division and elongation which in turn increase the plant height. The same result was found by Hadda and Arora, 2006.

Stem girth at 70 DAS

In variety 1, the stem girth at 70 DAS was observed in the range of 1.5150 to 2.350. The highest value (2.350) of stem girth was observed in T4 (50% RDN + 13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T2 (100% RDN) which was 2.24750. The lowest value (1.5150) of stem girth was observed in T1 (control). AS compared to T1 (control), T4 increased the stem girth up to 35.53%. Similarly, in variety 2, the stem girth was recorded in the range of 1.4850 to 2.02. The highest value (2.02) of stem girth was observed in T8 (50% RDN + 13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T7 (75% RDN+25% FYM) which was 1.99. The lowest value (1.4850) of stem girth was observed in T5 (control). As compare to T5 (control), T8 increased the stem girth up to 26.48%. At the stage of 45DAS variety, 1 increased stem girth up to 8.73% as compared to variety 2. In both the varieties, the treatment having 50% RDN+ 13.7 tonnes FYM/ha gave the maximum stem girth as compare to other treatments. These were in accordance with Hadda and Arora (2006) who concluded that the organic source like FYM increase the availability of macro and micronutrients and accelerate the cell division and elongation which in turn increase the growth attributes like stem girth.

Number of leaves at 70 DAS

In variety 1, the number of leaves at 70 DAS was recorded in the range of 10.5 to 17.5. The highest value of the number of leaves (17.5) was observed in T4 (50% RDN + 13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T2 (100% RDN) which was 16.5. The lowest value of the number of leaves (10.5) was observed in T1 (control). The number of leaves of T4 was increased by 40% as compared to T1. Similarly, in variety 2, the range of the number of leaves was 9.5 from to 14.25. The highest value (14.25) was recorded in T8 (50% RDN + 13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T6 (100% RDN) which was 13.5. The lowest value (9.5) was recorded in T5 (control). The number of leaves of T8 was increased by 33.3% as compared to T5. The number of leaves of variety 1 was better than variety 2. The number of leaves was increased by 16.10%.

In both the varieties, the treatment having 50% RDN+ 13.7 tonnes FYM/ha gave the maximum number of leaves followed by RDN100%.

Stem weight (gm)

The stem weight varied in both the varieties as shown in table 4.1.2 and fig 4.1.2. In variety 1, the stem weight varied from 157 to 470.75. The highest value (470.75) was recorded in T4 (50% RDN+13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T2 (100% RDN) i.e. (463). The lowest value (157) was recorded in T1 (control). As compare to T1, T4 showed 66% increase in stem weight. Similarly, in variety 2, the stem weight varied from 127.25 to 356.75. The highest value (356.75) was observed in T8 (50% RDN+13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T6 (100% RDN) i.e. 342. The lowest value (127.25) was recorded in T5 (control). As compare to T5, T8 showed 64.33% increase in stem weight. The stem weight of variety 1 was more than variety 2. It was increased up to 25%.

Leaf weight (gm)

The leaf weight varied in both the varieties as shown in table 4.2.3 and fig 4.2.3. In variety 1, the leaf weight was varied from 68 to 177.5. The highest value (177.5) was recorded in T4 (50% RDN+ 13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T2 (100% RDN) i.e.172.5. The lowest value (68) was recorded in T1 (control). As compare to T1, T4 showed 61.7% increase in leaf weight. Similarly, in variety 2, the leaf weight varied from 59.75 to 127.25. The highest value (127.25) was observed in T8 (50% RDN+13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T6 (100% RDN) i.e. 122.75. The lowest value (59.75) was recorded in T5 (control). As compare to T5, T8 showed 53% increase in leaf weight. The leaf weight of variety 1 was more than variety 2. It was increased up to 26%.

In both the varieties, the treatment having 50% RDN+ 13.7 tonnes FYM/ha gave the maximum leaf weight as compare to other treatments. These were in accordance with Oad *et al* (2004) who reported that a combination of organic and inorganic fertilizer increases the number as well as the weight of the leaf.

Yield (tone/ha)

The yield of fodder maize was significantly different in both the varieties as table 4.2.1 and fig 4.2.1. Different nitrogen application gave different results in terms of yield. In variety 1, the yield was varied from 14.25 to 46.50. The highest value (46.50) was recorded in T4 (50% RDN+13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T2 (100% RDN) i.e. (43.25). The lowest value (14.25) was recorded in T1 (control). As compare to T1, T4 showed 63.35% increase in fodder yield. Similarly, in variety 2, the yield varied from 10.20 to 34.87. The highest value (34.87) was observed in T8 (50% RDN+13.7 tonnes FYM/ha) which was highly significant ($p<0.05$) followed by T6 (100% RDN) i.e. 31.75. The lowest value (10.20) was recorded in T5 (control). As compare to T5, T8 showed 70.74% increase in fodder yield. The yield of variety 1 was more than variety 2. It was increased up to 26.46%.

In both the varieties, the treatment having 50% RDN+ 13.7 tonnes FYM/ha and 100% RDN gave a similar yield as compare to other treatments.

Table 1.1 : Effect of different nitrogen doses on plant height and stem girth

Treatments	Plant height 70DAS (cm)	Plant girth 70 DAS (cm)	Number of leaves 70DAS	Stem weight (gm)	Leaf weight (gm)	Yield (tone/ha)
T1	105.00^{d}±1.77	1.5150^{bc}±0.050	10.50^{de}±0.66	157.00^{g}±0.10	68.00^{e}±0.90	14.25^{f}±1.96
T2	206.00^{a}±2.58	2.2475^{a}±0.058	16.50^{ab}±0.64	463.00^{b}±0.96	172.70^{a}±0.95	43.25^{ab}±1.63
T3	192.80^{b}±2.56	2.045^{ab}±0.095	14.50^{abc}±0.65	391.75^{c}±0.72	152.75^{b}±1.07	38.37^{bc}±0.82
T4	208.80^{a}±2.75	2.35^{a}±0.132	17.50^{a}±0.64	470.75^{a}±1.46	177.50^{a}±0.88	46.50^{a}±1.90
T5	100.50^{d}±0.64	1.485^{c}±0.064	9.50^{e}±0.66	127.25^{h}±0.96	59.75^{f}±0.70	10.20^{f}±1.02
T6	152.80^{c}±1.10	1.95^{abc}±0.266	13.50^{bcd}±0.650	342.00^{e}±0.97	122.75^{c}±0.96	31.75^{de}±1.16
T7	149.80^{c}±0.85	1.99^{abc}±0.042	12.25^{cde}±0.86	282.75^{f}±0.98	112.50^{d}±0.90	27.87^{e}±0.89
T8	158.70^{c}±1.65	2.02^{abc}±0.0108	14.25^{bc}±0.85	356.75^{d}±1.17	127.25^{c}±0.94	34.87^{cd}±0.62

The mean followed by different letters are significantly different at p<0.05, according to TMRT (Tukey's Multiple Range Test)
Note- T1-(control), T2- (100% RDN), T3- (75% RDN+ 6.7 tonnes FYM/ha), T4- (50% RDN+ 13.7 tonnes FYM/ha), T5-(control), T6-(100% RDN), T7- (75% RDN+ 6.7 tonnes FYM/ha) ,T8- (50% RDN+ 13.7 tonnes FYM/ha)

Conclusion

Different sources of nitrogen affected the growth and yield of fodder maize. But the integration of organic and inorganic fertilizers not only increased the growth and yield of the fodder maize but also improves the physical condition of the soil. Applying 50% RDN along with 13.7 tones FYM/ha gave better results in terms of yield. The two varieties were taken i.e. J1006 and African tall. The J1006 is superior in Punjab environmental conditions. It gave better yield and quality parameters. The other variety of African was not performed well in Punjab environmental conditions. So J1006 is best suitable in Punjab

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