

Study of Fertilizers And Manure Effect on Yield And Its Contributing Characteristics of Maize(*Zea Mays* L.)

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Abstract

A field experiment was conducted at a research farm, division of agronomy, lovely professional university, phagwara, Punjab during Rabi 2017 and 2018 on sandy loam soil with 7.83 to 7.98 p^H and 0.4dSm⁻¹. The study was done to evaluate the effect of different fertilizers on maize crop. The maize cultivar used in this study was Pioneer P3396. The trial has total 9 treatments: T₀ (control), T₁ (Urea + compost), T₂ (Urea + DAP + compost), T₃ (Urea + DAP), T₄ (Urea + DAP + MOP), T₅ (Urea + phosphorous + potassium+ compost) T₆ (compost), T₇ (MOP + SSP + compost), T₈ (Urea + MOP + compost) were arranged in randomized block design and were replicated three times. The different parameters of growth such as plant height (cm), stem girth (cm), number of leaves, leaf area, dry matter accumulation (g) and yield attributes such as cob length, number of cobs, cob width, number of grains per cob, 1000 grain weight, grain yield, straw yield, biological yield and harvest indices were evaluated. It was reported that T₅ shows the maximum records of plant height (223.76cm), stem girth (24.52cm), number of leaves (14.00), leaf area (6.2400), dry matter accumulation (261.6333g), cob length (16.6333cm), number of cobs per plant (1.60), cob width (10.90cm), number of grains per cob (373), 1000 grain weight (204.6667g), grain yield (6220kg ha⁻¹), straw yield (5880kg ha⁻¹) and biological yield (12100kg ha⁻¹). The least was recorded from control. The growth and yield response to the combine application of inorganic fertilizer and compost was higher than the other treatments.

Key words: Inorganic fertilizer, compost, DAP, MOP, SSP, yield

Introduction:

Due to rapidly increase in population the available food supplies has already stripped out so maize, the world's highest yielding cereal crop has great importance. After wheat and rice, maize is the third important cereal and is also termed as queen of cereals. Maize is known for its versatility and high nutritive value that accounts for 72% starch, 10% protein, 4.8% oil, 8.5% fiber, 3% sugar and 17% ash. It is relatively as short duration cereal crop efficiently utilize the solar energy. Generally, maize crop requires annual precipitation exceeds 600mm and sandy-loam to loam soils with good organic matter is enough to hold moisture for optimum crop growth and development. To enhance the crop production and quality balanced nutrition is an essential component of nutrient management. Application of N, P, K, S and Mg, etc and inorganic fertilizer in the form of compost in balanced form is essential for major processes like plant development and yield. Nitrogen is a vital source of protein and nucleic acids and its deficiency can lead to reduction in growth and yield. Vinod (2018) stated the application of inorganic fertilizers has resulted in reduction of porosity, microbial activity and soil quality

improvement. Also, application of NPK with Vermicompost were excellent source to fertilization than fertilizers only in soil. Faisal (2017) showed that by fertilizer application growth and yield of maize were substantially improved alongside organic manures whereas soil total organic C and total N, P, K contents increased when inorganic fertilizers were applied alone or in combination with organic manures. Also, significant and positive correlation was observed among maize grain yield and available N, P and K contents in the soil. Chukwuka (2015) revealed that growth of maize is directly related to the level of nitrogen with constant application of P and K. Chukwu *et al.*, 2012 yield and soil productivity can be escalated by the use of both organic and inorganic fertilizer. Low productivity can be due to many reasons such as mismanagement of plant nutrition. Hence there is a need of improvement in technology for getting higher maize production of better quality. We, therefore, intended to study of Fertilizers and Manure Effect on Yield and its Contributing Characteristics of Maize (*Zea mays* L.). This study will be helpful in future to enhance crop productivity with high efficiency and minimum nutrient loss.

Materials and Methods

Experiment location

The research experiment was conducted at Agricultural Research Farm, School of Agriculture, Lovely Professional University, Phagwara, Punjab during Rabi season of the year 2017-2018, August to December. Geographically, farm is situated 31.25°N latitude and 75°E longitude with an altitude of 232 meter above the mean sea level. The soil of experimental field was found to be sandy clay loam and pH of the soil varied from 7.83 to 7.98. , EC (0.4 dS m⁻¹), available phosphorus (248 kg/ ha), available nitrogen (235 Kg /ha). Geographically, farm is situated 31.25°N latitude and 75°E longitude with an altitude of 232 meter above the mean sea level. It has annual rainfall of 1919.5mm, subtropical with cool winters, hot summers and a distinct rainy season. Supplemental irrigation to the field provided through canal water as per crop water demand.

Experimental design and treatments

The experiment was conducted in Randomized Complete Block Design (RCBD) in split plots arrangement. Treatments were replicated three times. The investigation was conducted with use of Pioneer 3396 and nine treatments viz., T₀ - control, T₁ – Urea + compost @ 260gm, T₂ – Urea + DAP + compost @ 210 + 130gm, T₃ – Urea + DAP @ 210 + 130gm, T₄ – Urea + DAP + MOP @ 210gm + 130gm + 100gm, T₅ - Urea + DAP + MOP + compost @ 210 gm + 130gm + 100gm, T₆ - compost @ 5kg and T₇ – MOP + SSP + compost @ 100gm + 340gm, T₈ – Urea + MOP + compost @ 260gm + 100gm. Sowing was done in row with spacing 60 × 20cm between plots. Irrigation and all other agronomic practices were carried out uniformly throughout the growing season.

Statistical analysis

The data was recorded for various growth, yield and quality attributes and then analyzed variance as described by Panse and Sukhatme (1985) for randomized block design.

Results and discussion:

Table 01. shows the effect of different treatment combinations on growth parameters.

Plant height: Growth parameter such as plant height was recorded maximum in T₅ i.e 223.7667(90DAS). Generally plant height increases with increase in NPK. Massey and Gaur (2006) reported that there is significantly higher plant height on application of 120 kg N and 60 kg P₂O₅ ha⁻¹ as compared to 90 kg N and 45 kg P₂O₅ ha⁻¹. These results are strongly in agreement with Kannan *et al.*, 2013 reported that application of NPK has beneficial effect on growth of maize crop. The highest plant height was observed in a plot where application of NPK and compost was used.

Stem girth: stem girth was affected significantly by using different treatment combinations. Maximum stem girth was recorded in T₅ i.e., 24.5233cm. It has been observed that the major development has recorded during 30 days of growth period of 22.87cm. In later stages no significant development in stem girth (cm) has been recorded. However, in 90 days T₅ shows the maximum volume of 24.52cm.

Number of leaves: It was observed that number of leaves in maize is influenced by T₅ treatment in 30, 60 and 90 days of growth period. The maximum growth period was observed with a maximum number of leaves of 14.00 (90DAS).

Leaf area: It was observed that leaf area in maize is influenced by T₅ treatment in 30, 60 and 90 days of growth period. The highest recorded was T₅ of 6.2400 (90DAS). Minimum leaf area was recorded in control. These results are in significant with Sutaliya and Singh (2005) that the highest level of 180:90:60 kg N, P₂O₅ and K₂O ha⁻¹ the plant height, leaf area index and dry matter accumulation per plant increased significantly.

Dry matter production: The application of nitrogen has a significant effect on dry matter accumulation at 5-6 leaf stages (Szulc *et al.*, 2012). It was observed that application of T₅ does not show any significant effect on dry matter accumulation at 30 days of sowing (103.8).

However, there is increased in dry matter accumulation with the increase in number of days (60 days *i.e.*, 283.03). After 90 days of sowing it begins to decrease. The crop is responsive to the combine application of Urea @210g + DAP @130g + MOP @100g + compost. The dry matter accumulation was estimated to be 261.63.

Table 01: Effect of different treatments on the growth parameters of maize

Treatments		Plant height (cm)	Stem girth (cm)	Number of leaves	Leaf area	Dry matter production
T ₀	30DAS	44.9000	16.4767	6.6000	1.6300	60.2667
	60DAS	143.4	16.8800	8.2333	4.0767	154.4667
	90DAS	149.0333	18.6400	10.0000	3.9900	159.9667
T ₁	30DAS	73.5667	21.6833	9.3333	2.3300	89.7667
	60DAS	201.6000	21.9633	13.0667	6.0533	182.8333
	90DAS	210.6667	22.7567	13.4667	5.7333	179.5667
T ₂	30DAS	77.6333	22.210	9.8667	2.7100	101.7667
	60DAS	209.0667	22.5533	13.6667	6.3433	229.7000
	90DAS	220.0333	23.2267	13.8667	6.1633	202.9000
T ₃	30DAS	52.8000	18.6000	7.8000	1.9600	71.5333
	60DAS	182.0333	19.4667	11.2667	5.5033	168.1000
	90DAS	199.0333	20.2067	11.8000	5.3533	175.8667
T ₄	30DAS	54.4333	19.1067	7.9333	2.1000	76.9000
	60DAS	183.8000	20.0800	11.4667	5.6467	182.6333
	90DAS	200.8667	21.0367	12.2667	5.5400	190.2000
T ₅	30DAS	81.2333	22.8700	10.3333	2.7933	103.8000
	60DAS	212.9667	23.3967	13.8000	6.4467	283.0333
	90DAS	223.7667	24.5233	14.0000	6.2400	261.6333
T ₆	30DAS	58.1333	19.7767	8.1333	2.2633	83.7333
	60DAS	193.7667	21.1067	11.9333	5.8367	174.4333
	90DAS	204.6333	22.2767	12.6000	5.6633	159.0000
T ₇	30DAS	68.0333	20.5867	8.4000	2.4467	87.6667
	60DAS	195.4667	21.3733	12.6667	5.9467	194.6667
	90DAS	208.8333	22.5133	13.0000	5.8567	200.7333
T ₈	30DAS	76.7667	21.8833	10.2000	2.6367	99.4667
	60DAS	206.5000	22.1533	13.2000	6.2100	246.4667

	90DAS	215.5000	22.8967	13.8000	6.0800	259.8333
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Table 02, shows the effect of different treatment combinations on yield parameters. The different treatment combinations significantly influenced cob length. Higher cob length was observed in plot treated with T₅. The maximum cob length recorded was 16.633cm during harvesting. The Combine application of NPK and compost can be regarded best due to all the positive effects on yield attributes and growth indices as compared to other treatments used in research. These results are in agreement with Varghese *et al.*, 2006 on combined application of nitrogen with other fertilizers has shown to increase the yield attributes as well as the growth indices. Application of T₅ has shown a significant effect on the number of cobs per plant *i.e.*, 1.6. The application of T₅ has shown a positive effect on width of the cob. It has been observed that application of T₅ has attained a maximum width of cob of 10.9cm during harvesting. The number of grains per cob is observed to be maximum in T₅, *i.e.*, 373g. The grains present in the cob is induced with the application of NPK and compost. It has been observed that T₅ has maximum 1000 grain weight of 204.6667g. The grain yield, straw yield and biological yield were observed to be maximum in T₅ of 6220 kg ha⁻¹, 5880 kg ha⁻¹ and 12100 kg ha⁻¹.

Table 02: Effect of different treatments on the yield attributes

Treatment	Cob length	Number of cobs per plant	Cob width	No. of grains per cob	1000 grain weight	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)
T ₀	11.8667	1.0000	6.9000	228.0000	176.0000	3250	3900	7150
T ₁	15.3667	1.2000	10.0667	327.6667	189.3333	5125	5820	10945
T ₂	16.0000	1.2000	10.6000	351.0000	199.0000	5565	5580	11145
T ₃	13.9000	1.0000	8.7000	287.0000	181.6667	4220	5200	9420
T ₄	13.9000	1.0000	9.1000	295.0000	179.0000	4420	5235	9655
T ₅	16.6333	1.6000	10.9000	373.0000	204.6667	6220	5880	12100

T ₆	14.5000	1.2000	9.7000	303.0000	184.6667	4590	5740	10330
T ₇	14.7000	1.2000	9.8333	312.0000	191.0000	4815	5420	10235
T ₈	15.7000	1.4000	10.4000	354.0000	199.3333	5710	5635	11345

Conclusion:

From the results of present research it can be concluded that using fertilizers and manure have positive impact on growth, yield and quality characteristics of maize. They also showed that when NPK along with compost was used is the best treatment combination to increase the growth, yield and its contributing characteristics of maize and so allow to apply the recommended rate of fertilizers.

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