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# Effect of Vermicompost and Neem Cake with Inorganic Fertilizers on Growth and Yield of Maize (*Zea mays* L.) Var. S2-981

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Today, with the advancement of environment pollution and health that is obtained from the improper use of chemical fertilizer, production and use of organic fertilizer is considered as an important approach in the field of soil science in the world's interest to investors. Research was conducted by using effective management application of vermicompost and neem cake with inorganic fertilizer with objective to enhance the growth and yield of maize crop. It has been concluded from the trial that the different level of vermicompost and neem cake with inorganic fertilizers in the experiment gave the highest value. Effective results were obtained with $T_9$ treatment with combination vermicompost 10 t $ha^{-1}$, neem cake 500 kg $ha^{-1}$ with recommended dose of fertilizer NPK 120: 60: 40 kg $ha^{-1}$. This treatment result shown best plant height with the most leaves, largest stem diameter, longest cob length, heaviest 1000 seed weight, and highest

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grain yield in compared with the control treatment $T_1$ had the lowest results in all categories. $T_9$ was found to be the best for the improvement of growth and yield of maize therefore, farmers of Prayagraj region can adopt this combination to give the highest yield of Maize.

*Keywords: Growth; inorganic fertilizers; neem cake; vermicompost; yield parameters.*

## 1. INTRODUCTION

The suitable range of soil for successful cultivations of maize (*Zea Mays* L.) extends from the likes of Loamy sands all through Clay Loams and this plant has a deep and expansive root system which can penetrate the soil easily facilitating movement of air and water.To ensure that this high maintenance crop reaches its full growth potential, plenty of essential nutrients such as phosphorus should be given, and adequate nutrient reserves in the soil or application of fertilizers are necessary for a successful production. Adding organic matter such as vermicompost or neem cake can improve both the structure and fertility of the soil while enhancing growth rate leading to higher yields. Sensitive to water stress and requires well-drained soils that can hold sufficient moisture for the crop. The soil should have good water-holding capacity, infiltration rate, and drainage to support maize growth and minimize the risk of waterlogging, which can lead to reduced yields and plant mortality Kumar et al*.* [1].

By using vermicompost we can see positive effects on the physiochemical properties of soil, as well as increasing the stability and structural integrity of soil through aggregating it more effectively - as demonstrated by Saha et al. In 2007, this could effectively diminish its susceptibility to calamities such as erosion, and cold press technique extraction from the fruit and kernel residues of a neem tree results in a by-product called Neem Cake Manure. Distinctive chemical characteristics are present due to the significant amount of organic carbon as well as N and P content, and the ability of neem seed cake to improve soil's biological properties has been suggested via its organic matter content by Garba and Oyinlola [2].

The involvement of nitrogen is essential for various critical metabolic processes that occur within plants and is particularly vital during protein synthesis, but the critical function of phosphorus in storing and transferring energy has direct implications for both cell division and maize development. The building blocks of nucleic acid are phytin and phospho-lipid.

## 2. METHODOLOGY

In the year 2022 during the Zaid season, a field experiment was performed by conducting it at Sam Higginbottom University research farm form department of soil science and agricultural chemistry which is located at Prayagraj, and typically in this area, temperatures soar as high as four hundred sixty up until four hundred eighty centigrade with infrequent days that are cooler than forty-five degrees Centigrade. Anywhere from 20 to 94%, the relative humidity fluctuates, and the yearly precipitation in this area is typically around 1100mm. An RBD design layout was utilized to conduct the experiment with a total of nine treatments and the same treatment was applied three times for replication. The treatment assignments in each replication were done at random. The details of the treatment combinations are given below Table 1 and observation were recorded plant height, number of leaves, stem diameter, length of cob, seed test weight and grain yield.

## 3. RESULTS AND DISCUSSION

### 3.1 Plant Height

The response of plant height of maize recorded at 30 DAS, 60 DAS and 90 DAS detailed results were in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers. The plant height of maize was found increased significantly with the age of plants and increase in the levels of inorganic fertilizers, neem cake and vermicompost. “The maximum plant height was recorded as 60.26 cm, 83.96 cm and 170.33 cm in $T_9$ at 30 DAS, 60 DAS and 90 DAS respectively and the minimum plant height was recorded as 37.67 cm, 58.86 cm and 103.67 cm in $T_1$ (control) at 30 DAS, 60 DAS and 90 DAS respectively. Increase in plant height is due to increase in vermicompost, neem cake and inorganic fertilizers may be due to adequate supply of nutrients which in turn helps in vigorous vegetative growth of plants and subsequently increase the plant through cell elongation, cell division, photosynthesis and turbidity of plant cell” Khan et al. [3].

## 3.2 Number of Leaves

The number of leaves of maize at different days after sowing (DAS) at 30, 60 and 90 detailed results were in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers were found significantly in treatment $T_9$ was 7.13, 12.23 and 14.85 respectively. While the minimum values of the result were found in treatment $T_1$ (control) 4.4, 5.6 and 8.56 respectively. The effect of different levels of Vermicompost, neem cake and inorganic fertilizers on number of leaves of maize was also found significantly. "It is generally too beneficial to root and shoot growth of plants, increasing cell permeability and supply plant nutrients including micronutrients. Nitrogen remotes vegetative growth through cell elongation a part from cell division and expansion. It is an essential constitute of proteins and present in many other compounds of great physiological importance in plant metabolism. Phosphorus has great role in energy storage and transfer. It is improving the quality of certain fruit, forage, vegetative and grain crops and increase the disease resistance of crop" Asghar et al. [4].

## 3.3 Stem Diameter

The stem diameter of maize at different days after sowing (DAS) at 30, 60 and 90 detailed results were in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers were found significantly in treatment $T_9$ which was 1.45 cm, 2.24 cm and 2.46 cm while the minimum values of the result were found in treatment $T_1$ (control) which were 1.04 cm, 1.47 cm and 1.6cm respectively. Vermicompost, neem cake and inorganic fertilizers applications significantly increase plant height, stem girth, number of leaves and yield Law-Ogbomo [5].

## 3.4 Cob Length

The length of maize detailed results was in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers were found significantly in treatment $T_9$ which was 17.93 cm while the minimum values of the result were found in treatment $T_1$ (control) which was 8.91 cm respectively. Cob length, cob diameter, 100 grain weight and grain yield significantly (P=.05) increased with Vermicompost, neem cake and inorganic fertilizers applications gave the highest value. "Therefore, further work should be carried out to ascertain the validity of this rate of maximum productivity", Olusegun [6].

## 3.5 Test Weight

The weight of 100 seed of maize detailed results were in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers were found significantly in treatment **$T_9$** which was 28.68 g while the minimum values of the result were found in treatment $T_1$ (control) which was 19.42 g respectively. The statistical analysis of weight of 1000 seeds data indicates that there was a significant difference in weight of 1000 seed (g) interaction between vermicompost, neem cake and inorganic fertilizers. Same result also found by Ali [7].

## 3.6 Grain Yield

The grain yield of maize detailed results was in shown in Table 2 as influenced by different levels of neem cake and vermicompost with inorganic fertilizers were found significantly in treatment $T_9$ which was 45.67 q $ha^{-1}$ while the minimum values of the result were found in treatment $T_1$

**Table 1. Treatment combination**

| Treatment | Treatment combination |
|---|---|
| **$T_1$** | [Absolute Control] |
| **$T_2$** | [RDF @ 0% + Vermicompost @ 5 t $ha^{-1}$ +Neem Cake @ 250 kg $ha^{-1}$] |
| **$T_3$** | [RDF @ 0% + Vermicompost @10 t $ha^{-1}$ +Neem Cake @ 500 kg $ha^{-1}$] |
| **$T_4$** | [RDF @ 50% + Vermicompost @0 t $ha^{-1}$ + Neem Cake @ 0 kg $ha^{-1}$] |
| **$T_5$** | [RDF @ 50% + Vermicompost @5 t $ha^{-1}$ + Neem Cake @ 250 kg $ha^{-1}$] |
| **$T_6$** | [RDF @ 50% + Vermicompost @10 t $ha^{-1}$ + Neem Cake @500 kg $ha^{-1}$] |
| **$T_7$** | [RDF @100% + Vermicompost @ 0 t $ha^{-1}$ + Neem Cake @ 0 kg $ha^{-1}$] |
| **$T_8$** | [RDF @100% + Vermicompost @ 5 t $ha^{-1}$ + Neem Cake @ 250 kg $ha^{-1}$] |
| **$T_9$** | [RDF @100% + Vermicompost @10 t $ha^{-1}$ + Neem Cake @500 kg $ha^{-1}$] |

*Note: RDF 100% (120:60:40)*

**Table 2. Effect of vermicompost and neem cake with inorganic fertilizers on plant height, no of leaves, stem diameter, length of cob, weight of 1000 seeds and grain yield of maize var. S2-981 at different days interval and after maize harvest**

| S. No. | Plant height (cm) | | | No of Leaves | | | Stem diameter(cm) | | | Length of cob (cm) | Weight of 1000 seeds(g) | Grain yield (q $ha^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS | | | |
| $T_1$ | 37.67 | 58.86 | 103.67 | 4.4 | 5.60 | 8.56 | 1.04 | 1.47 | 1.6 | 8.91 | 190.42 | 21.25 |
| $T_2$ | 49.16 | 69.33 | 134.26 | 4.8 | 6.26 | 8.33 | 1.15 | 1.64 | 1.82 | 11.53 | 200.45 | 25.62 |
| $T_3$ | 51.17 | 70.12 | 137.33 | 5.23 | 8.90 | 10.55 | 1.24 | 1.81 | 1.95 | 14.16 | 230.95 | 35.56 |
| $T_4$ | 45.67 | 61.00 | 132.23 | 4.76 | 5.76 | 8.60 | 1.11 | 1.58 | 1.76 | 10.76 | 200.19 | 27.67 |
| $T_5$ | 52.53 | 71.40 | 163.23 | 6.32 | 9.21 | 11.06 | 1.27 | 1.93 | 1.98 | 15.26 | 240.15 | 36.91 |
| $T_6$ | 59.33 | 76.13 | 166.66 | 6.73 | 10.93 | 12.88 | 1.39 | 2.14 | 2.37 | 17.67 | 260.82 | 43.87 |
| $T_7$ | 50.76 | 64.26 | 135.93 | 4.72 | 6.95 | 9.55 | 1.19 | 1.74 | 1.86 | 12.06 | 210.62 | 32.62 |
| $T_8$ | 58.13 | 73.23 | 166.16 | 6.59 | 10.46 | 11.76 | 1.35 | 2.05 | 2.21 | 16.63 | 240.72 | 39.12 |
| $T_9$ | 60.26 | 83.96 | 170.33 | 7.13 | 12.23 | 14.85 | 1.45 | 2.24 | 2.46 | 17.93 | 280.68 | 45.67 |
| **F- test** | S | S | S | S | S | S | S | S | S | S | S | S |
| **S. Em. (±)** | 4.079 | 7.248 | 7.580 | 4.079 | 7.248 | 7.580 | 4.079 | 7.248 | 7.580 | 0.27 | 0.34 | 0.51 |
| **C.D. (P= 0.05)** | 11.966 | 21.261 | 22.233 | 11.966 | 21.261 | 22.233 | 11.966 | 21.261 | 22.233 | 3.3867 | 1.02 | 1.54 |

(control) which was 17.42 q $ha^1$ respectively [8,9]. The statistical analysis of grain yield data indicates that there was a significant difference in grain yield interaction between vermicompost, neem cake and inorganic fertilizers. Same result also found by Mahesh [10].

## 4. CONCLUSION

It revealed from the trial that application of Neem cake and Vermicompost with inorganic fertilizers in treatment $T_9$ was found best in increasing growth and yield of maize. Since the results is based on one season experiment, further trail is needed to substantiate the result.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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