Synopsis on

Dissertation-II

(AGR690)

# "THE IMPACT OF INORGANIC AND ORGANIC FERTILIZERS ON GROWTH AND YIELD ATTRIBUTES OF MAIZE ''

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## CERTIFICATE

This is to certified that this synopsis entitled **"The impact or inorganic and organic fertilizers on growth and yield attributes of maize (*Zea mays* L.)"**. Submitted in partial fulfillment of requirements for degree – Master of Science in Agronomy by Pushpinder Singh, Registration no. 11612066 to Department of Agronomy, School of Agriculture, Lovely Professional University, has been formulated and finalized by the student himself on the subject.

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## DECLARATION

I hereby declare that the project work entitled –"**The impact of inorganic and organic fertilizers on growth and yield attributes of maize (*Zea mays* L.)"** is an authentic record of my work carried at Lovely Professional University as requirements of Project work for the award of Degree -Master of Science in Agronomy, under the guidance of Mr. Vinay Kumar, Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

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## Introduction:

Maize (*Zea mays* L.) is an important food and feed crop of the world. Maize is the third most important cereal crop of Pakistan after wheat and rice. About (60%) maize is grown in irrigated and (36%) in rain fed areas of Pakistan. Basically it is a tropical plant but at present it is being cultivated extensively with equal success in temperate, tropical and sub-tropical regions of world. It is a short duration crop and is grown twice in a year. In Pakistan grain yield of maize is very low as compared to other maize growing countries like Italy (9530 kg ha-1), Canada (6630 kg ha-1), China (4570 kg ha-1) and Argentina producing average maize yield of 5650 kg ha-1 (*TAHIR et al., 2009*). Maize (*Zea mays L.*) belongs to family *poaceae*, is an important cereal crop of the world as well as of Pakistan.

Maize has become an important food crop and nutritional security in India. There has buildup of strong market demand and resilience of maize to various abiotic and biotic stresses, which have increased the area and maize production in the country over the past decade. Productivity of maize, however, has not increased proportionately and significant yield gaps are evident across maize growing areas in the country. Maize is an exhaustive crop and removes large amounts of plant nutrients from the soil to support great production of biomass.

Maize is multipurpose crop, provides food for human beings, feed for animals, poultry and fodder for livestock. It has high nutritional value as it contains about (72%)starch, (10%) proteins, (4.8%) oil, (8.5%) fiber, (3.0%) sugar and (1.7%) ash (Chaudhary,1983). At present, it is being cultivated on an area of 1.015 m hec with average yield of 2.893t ha-1 and total annual production is 3.313 m tons (GOP, 2007-08). There are many agronomic, edaphic and environmental factors responsible for this low yield. Among various factors responsible for low yield, plant population in the field and selection of unsuitable cultivars are of prime importance. The corn grain yield increased from 10.1 to 10.8 t ha-1 as plant density increased from 59000 to 89000 plants ha-1 (Farnham., 2001).There are a number of biotic and abiotic factors those affect maize yield considerably.

The use of organic manures alongside inorganic fertilizers often lead to increased soil organic matter (SOM), soil structure, water holding capacity and improved nutrient cycling and helps to maintain soil nutrient status, cation exchange capacity (CEC) and soil's biological activity (Saha

*et al.*, 2008) Although chemical fertilizers are important input to get higher crop productivity, but over reliance on chemical fertilizers is associated with declines in some soil properties and crop yields over time and causes serious land problems, such as soil degradation (Hepperly *et al.*, 2009). Therefore, an integrated use of inorganic fertilizers with organic manures is a sustainable approach for efficient nutrient usage which enhances efficiency of the chemical fertilizers while reducing nutrient losses (Schoebitz and Vidal, 2016).

however, it is more affected by variations in plant density than other member of the grass family (Vega et al., 2001). Maize differs in its responses to plant density (Luque et al., 2006).Liu et al. (2004) also reported that maize yield differs significantly under varying plant density levels due to difference in genetic potential. Correspondingly maize also responds differently in quality parameters like crude starch, protein and oil contents in grains (Munamava et al., 2006). Plant populations affect most growth parameters of maize even under optimal growth conditions and therefore it is considered a major factor determining the degree of competition between plants (Sangakkara et al., 2004). The grain yield per plant is decreased (Luque et al., 2006) in response to decreasing light and other environmental resources available to each plant (Ali et al., 2003). The corn grain yield typically exhibits a quadratic response to plant density with a near-linear increase across a range of low densities, a gradually decreasing rate of yield increase relative to density increase and finally a yield plateau at some relatively high plant density (*Shapiro and Wortmann, 2006).*

Several researchers reported that the effects of organic manures and biofertilizers on yield and quality characteristics are variable (*Pinter et al*. *1994, Widdicombe and Thelen 2002*). Maize DM yield and its nutritive value are influenced by numerous interactions including environment (temperature, photoperiod and light intensity), agronomic management ( plant density, sowing date, fertilizer and harvest stage), and genetic factors *Graybill et al*., (1991).Hybrid selection is a key to improve forage quality for optimum animal output (*Widdicombe and Thelen .,2002. Graybill et al. (1991*) reported that some forage quality traits, including acid detergent fiber (ADF) and neutral detergent fiber (NDF) contents, were not affected by increases in plant density. However, *Cusicanqui and Lauer (1999*) indicated that plant density had an effect on forage quality. Hence NDF content increased from 20 to 35 g/kg, and ADF content increased from 19 to 29 g/kg with increasing plant densities.

**Objectives-**

1. To study the effect of organic manures and bio fertilizers on growth parameter of maize.

2. To evaluate the effect of organic manures and biofertilizers on agronomic practices of maize.

3. To compare the effect among the different varieties on yield of maize.

**Scope of study-**

Studying and evaluating the effect of manures and bio fertilizers on growth of maize crop. We are evaluating for the best combination of organic manures and bio fertilizers. Because only the use of best organic manures can improve the yield of the maize crop. Thus we have to find out the best organic manures and bio fertilizers for the betterment of the yield of our crop

## Review of literature

*Mohammad Yazdani, Mohammad Ali Bahmanyar, Hemmatollah Pirdashti, and Mohammad Ali Esmaili et al., (2007*) Conducted an experiment at research farm of sari agricultural sciences and natural resources university, Iran. Experiment was carried out to study the effect of phosphate solubilisation microorganism and plant growth promoting rhizobacteria on yield and yield component of corn and concluded that Inoculation with rhizobacteria could be used to improve growth and grain yield of corn, reduced fertilizer cost. grain yield , biological yield , harvest index , compared to check were increased after farmyard manure application which indicates that bio fertilizer plant growth promoting rhizobacteria and phosphate solubilisation inoculation increased maize growth , seed corn yield .

*Jen-Hshuan Chen Department of Soil and Environmental Sciences, National Chung Hsing University, Taiwan, R.O.C. (2006)* conducted an experiment on "*The combined use of chemical and organic fertilizers and/or biofertilizers for crop growth and soil fertility. Nature and the characteristics of nutrient release of chemical, organic and biofertilizers* are different. Crop growth and soil fertility has its assets and drawbacks. Nutrient solubility and availability are key assets of using biofertilizers. Result is fast and direct. Biofertilizers are cheaper and combative having high nutrient content with small amount requirement. They have better root growth and soil structure and suppresses plant diseases. Azobacter and azospirillum being free living bacteria that fix atmospheric nitrogen in crops without any mutually beneficial association of two different organisms. They are ample in well drained and neutral soil.

*Kaur et al. (2005*) under a cropping sequence of millet and wheat differentiated the change of chemical and biological properties in soil acquiring FYM , poultry manure and sugarcane filter cake with chemical fertilizer application all treatments enhanced the soil organic C , N , P and K status. This study demonstrated that balanced fertilization using both organic and chemical fertilizer is crucial for maintainence of soil organic matter content and long term soil production.

*a .aldedrian et al., (2007*) moor plantation , Nigeria .conducted a pot experiment "application of organic and inorganic fertilizer for sustainable maize and cowpea yield in Nigeria "assessing the impact of five rates each of compost , inorganic fertilizer and combination of both fertilizer (OBF) on zea mays ( maize) in greenhouse using 3 cropping cycle .

Maize pursued by cowpea was used as a test crop on field. The optimum rate of organic fertilizer for sustainable maize and cowpea yield were between 5 t ha/1. Compost and OBF application led to high population of azotobacter (n-fixing bacteria) and thus its biomass.

*BH Chaudhary et al., (2016*) executed a pot house experiment to study "the effect of farm yard manure on growth and yield of fodder maize at *Department of Agricultural Chemistry and Soil Science, BACA, AAU.* With three replications, the experiment was laid out in CYD (factorial) . At 1% over no FYM application, the higher plant yield, green forage yield and dry matter yield was obtained. The green forage yield of maize was symbolically altered due to application of FYM.

*Alma's zaidi et al., (2017*) *Faculty of Agricultural Sciences, Department of Agricultural Microbiology, Aligarh Muslim University Aligarh*, India evaluated the role of nitrogen fixing plant growth-promoting rhizobacteria in sustainable production .due to high nutritional value constituting proteins, carbohydrates, vitamins and other essential elements are considered one of important constituent. In order to obtain ideal yields, agrochemicals are used frequently in cultivation .excessive use of agrochemicals has adverse effects on both soil productivity as well as productivity. Currently considered as safe and viable and inexpensive substitute to chemical fertilization, non-pathogenic nitrogen fixing plant growth promoting rhizobacteria is used.

*Abdul-Aziz r al- enazy (2017*) conducted an experiment on role of microbial inoculation and industrial by product phosphor gypsum in growth and nutrient uptake of maize grown in calcareous soil. Use of organic and bio-fertilizers has been suggested to improve their properties.

*M.amman (2017*) A field experiment was carried out at *HC&RI, TNAU, Coimbatore during (2012-13)* to study the effect of organic manures and biofertilizers on Black night shade on quality parameters. The eventual aim to be attained in any crop production programme is maximization of yield. Both by morphological and physiological parameters, complex phenomenon yield can be conceived. The effect of vermicomposting on germination, growth and yield of plants are evaluated under glass house conditions *atiyeh et al . (2000*). The increase is due to the fact that vermicomposting is commenced from organically digested plant that has loosely packed particles.

*Hashim m dhar et al . (2017)* The main objective of the study was to find out the impact of integrated nutrient management on yield and soil health in maize-wheat cropping system. The soil samples were collected from different plots of the experimental field and were analyzed for physical (bulk density, hydraulic conductivity) and chemical (organic carbon, available N, P and K) properties. Addition of NPK fertilizer the suitable time for maize sowing is June for north zone of the country. The heavy rainfall during kharif 2011 started during the second week of June which resulted delay sowing of maize. The maize crop was along with organic manure and biofertilizers improved yield and increased organic carbon content,

*Shiva and patil et al., (2017*) experiments were conducted during *2014 at Agriculture College, Navile, University of Agricultural and Horticultural Sciences, (UAHS) Shivamogg*a during Kharif 2014, to study the effect of zinc fortified organic manures on yield, quality and nutrient in rain fed maize. The experiment subsisted of 12 treatments was established in randomized complete block design and replicated thrice.

Increased dry matter production further reflected in improvement in yield attributing character, in maize cob length, cob girth, number of grain rows cob-1 , number grins row-1 and test weight are the manifestation of yield potentiality of grain yield plant-1 . In the present investigation significantly higher grain and stover yield was recorded with application of maize residue compost enriched with zinc.

tomar *et al . (2010*) ,a thrice replicated 2 year trial was conducted to study the effect of integrated nutrient management for sustainable production system of maize in indo-gangetic plain zone of India . The results revealed that combination of 100% NPK + 5 t FYM+ Azotobactor + PSB recoded higher mean growth attributes. Study suggests that maize can be successfully grown under semi-arid conditions of Western Uttar Pradesh on 100% NPK + 5 t FYM+ Azotobactor + PSB and harvest maximum productivity and profitability besides, improving used efficiency of nitrogen.

*Mohammad saleem arif (2014*) performed field experiment to evaluate effect of integrated N fertilizer regime involving chemical N fertilizer and N enriched compost either alone or combined with selected PGPR on seed quality , N use efficiency and soil fertility during 2014. The enhancement of seed quality, N use efficiencies, and soil N fertility through integrated N bio

fertilizer application emphasizes the importance of balanced crop N nutrition, ensuring sufficient N supply to sunflower with adequate N balance in soil for the next crop.

A field experiment was conducted at *Agricultural Research Station, Kathalagere, University of Agricultural Sciences,* Bangalore to study the influence of INM on yield of maize- rice cropping system .The results of 5 years(2008-09 to 2012-13) of the experiment revealed that higher maize yields were observed in T6 which received 50 % N through FYM and 50 % NPK through inorganic fertilizers in kharif and higher rice grain yields were 9 observed in kharif season in T9 by receiving 25% N through paddy straw and 75 % NPK through inorganic fertilizers.

Application of 25% recommended dose of fertilizers (20 kg N+ 60 kg P2O5+ 60 kg K2O/ha) in combination with biofertilizers, green manuring and compost @10 t/ha increased maize grain yield by 252.38% over control (no fertilizer application) and 147.62% over the application of 100% recommended dose of fertilizers alone (Kalhapure et. al., 2013).

## Materials and Methods:

**Name of experiment** "Impact of organic and inorganic fertilizers on growth and yield attributes of Maize (*Zea mays* L.)"

**Location** : Experiment will be conducted at the field of Lovely Professional University, Phagwara situated geographically at 31°14'48.0"N 75°41'45.0"E and 252 m above sea level. It falls under central plain zone of agro climatic.

**Experimental detail**

A. Plot treatments:

**V1**

T1 = control

T2 = 100% Recommended dose of fertilizers

T3 = 75%Recommended dose of fertilizers + 25%Sewage sludge+ Azotobacter

T4 = 75%Recommended dose of fertilizers + 25%Sewage sludge +Azospirillum

T5 = 75%Recommended dose of fertilizers+ 25%Vermicompost+ Azotobacter

T6 = 75%Recommended dose of fertilizers+ 25%vermicompost+Azospirillum

**V2**

T7=control

T8=100%Recommended dose of fertilizers

T9=75%Recommended dose of fertilizers + 25%Sewage sludge+Azotobacter

T10=75%Recommended dose of fertilizers + 25%sewagesludge+Azospirillum

T11=75%Recommended dose of fertilizers + 25%Vermicompost +Azotobacter

T12=75%Recommended doze of fertilizers + 25%Vermicompost+Azospirillum

| R1 | R2 | R3 |
|---|---|---|
| $V_1 T_1$ | $V_2 T_{12}$ | $V_1 T_6$ |
| $V_1 T_2$ | $V_2 T_{11}$ | $V_1 T_5$ |
| $V_1 T_3$ | $V_2 T_{10}$ | $V_1 T_4$ |
| $V_1 T_4$ | $V_2 T_9$ | $V_1 T_3$ |
| $V_1 T_5$ | $V_2 T_8$ | $V_1 T_2$ |
| $V_1 T_6$ | $V_2 T_7$ | $V_1 T_1$ |
| ---------- Water channel---------- | | |
| $V_2 T_7$ | $V_1 T_6$ | $V_2 T_{12}$ |
| $V_2 T_8$ | $V_1 T_5$ | $V_2 T_{11}$ |
| $V_2 T_9$ | $V_1 T_4$ | $V_2 T_{10}$ |
| $V_2 T_{10}$ | $V_1 T_3$ | $V_2 T_9$ |
| $V_2 T_{11}$ | $V_1 T_2$ | $V_2 T_8$ |
| $V_2 T_{12}$ | $V_1 T_1$ | $V_2 T_7$ |

## Details of Layout:

1. Design = RBD (Randomized Block Design)
2. Treatments = 12
3. Replications = 3
4. Total number of plots = 36
5. Plot size = 5x4=20$m^2$
6. Total area = 20x36=720$m^2$ + 10% irrigation channel = 792$m^2$
7. Main irrigation channel = 1
8. Sub irrigation channel =1
9. Seed rate = 20kg/acre
10. Spacing = 60x20
11. Varieties = Variety 1 = Pioneer P3396  Variety 2 = Dekalab DKC9125
12. Date of sowing= 17$^{th}$ July 2017, Date of harvesting= 1$^{st}$ November 2017

## OBSERVATION TO BE RECORDED

**Meteorological observations:**

i.Weekly rainfall (mm)=

ii. Number of rainy days. = 3

iii.Temperature (°C) =

iv. Relative humidity (%)=

v. bright sun-shine (hrs/day)=

**Growth attributes:**

i. Plant height (cm) at30, 60, 90 DAS and at harvest stage=

ii. Stem Girth (cm)=

iii. No. of leaves per plant=

iv. No. of cobs per plant=

V. Cob length (cm)=

**Yield attributes:**

i. Grain yield (kg/ha) =

ii. Straw yield=

iii. Harvest index=

iv. Thousand- grain weight=

## Soil Analysis

Collection of samples

Soil samples will be taken for analysis to check soil status (pH, N, P, K, EC and organic carbon) of experimental field before crop season.

Analytical methods to be followed during investigation are as under

| s.no | Test parameter (soil ) | Method | References |
|---|---|---|---|
| 1. | Ph | Glass electrode | Sparks (1996) |
| 2. | Ec | Conductivity meter | Sparks(1996 |
| 3. | Available N | Alkaline potassium permeate method | Subbiah and asijal (1956) |
| 4. | Available P | Olsen's method | Olsen et al., (1954) |
| 5. | Available K | Flame photometer | Jackson(1973) |

**Economics:**

i. Cost of cultivation (₹/ha) =

ii. Gross return (₹/ha) =

iii. Net return (₹/ha) =

iv.Benefit cost ratio (B:C) =

**Statistical analysis:**

Data generated in the experiment will be analyzed as per standard statistical procedure.

**EXPECTED OUTCOMES**:

The experiment will be conducted at the Lovely Professional University, School of Agriculture, near experimental farm of Phagwara, Punjab. By the use of judicious use of organic as well as inorganic fertilizers that leads in maintaining soil health as well as increasing maize yield.

**PROPOSED WORK WITH TIMELINE**:

1. Time of sowing: Mid-June

2. Spacing: R * R = 60 cm, P * P = 20 cm

3. First Hoeing: 15 Days after sowing

4. Irrigation: 4-6 irrigations or as per the soil conditions.

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