Effect of organic and chemical fertilizers on growth of wheat and soil properties (*Triticum aestivum*)

THESIS

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BY

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CERTIFICATE

This is to certify that the thesis entitled" **Effect of organic and chemical fertilizers on growth of wheat and soil properties (*Triticum aestivum* L.)**" submitted by **Manpreet Singh** to the Lovely Professional University, Phagwara in partial fulfillment of the requirements for the degree of **Master of Agriculture/Agronomy** in the discipline of School of Agriculture has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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External Examiner

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Dean, School of Agriculture

CERTIFICATION

This is to certify that the thesis entitled "Effect of organic and chemical fertilizers on growth of wheat and soil properties (*Triticum aestivum*)**"** submitted in partial fulfilment of the requirements for the degree of Master of Science with major in Agronomy of the Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara, is a record of bonafide research carried out by **Manpreet Singh**, Registration No.11302121 under my supervision and no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

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DECLARATION

I hereby declare that this thesis is a presentation of my own work and has been generated by me as the result of my own research work and efforts. This thesis is submitted by me in partial fulfillment of the requirement for the award of degree M.Sc. in Agronomy from Lovely Professional University, Phagwara, Punjab comprises only my original work and due acknowledgement has been made in the text to all other material used.

This thesis work was done under the guidance of my advisor.

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Manpreet Singh

TABLE CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

N	Nitrogen
P	Phosphorus
K	Potassium
S	Sulphur
K	Thousand
%	percent
DAP	Di-ammonium phosphate
MOP	Muriate of potash
cm	Centimeter
m	Meter
ha	hectare
@	At the rate of
CAGR	Compound annual growth rate
T	Ton
MN	Million
MMT	Million metric tons
CIMMYT	International maize and wheat improvement
kg	Kilogram
g	gram
RCBD	Randomized complete block design
CGR	Crop growth rate
RGR	Relative growth rate

DAE	Day after emergence
AE	Agronomic efficiency
LAP	Leaf area profile
MLA	Mean leaf area
DMA	Dry matter accumulation
HI	Harvest index
PP	Plant population
TDM	Total dry matter
LAI	Leaf area index
BCR	Benefit cost ratio
DAE	Day after emergence
ASN	Ammonium sulphate nitrate
ET_c	Evapotranspiration
MIL	Monsanto India limited
V	Variety
S	Spacing
F	Fertilizer
R	Replication
X	Fertilizer combination dosages
^oC	Degree Celsius
hr	Hours
i.e	Id est (that is)
CD	Critical Difference

ABSTRACT

The present investigation entitled, "Effect of organic and chemical fertilizers on growth of wheat and soil properties (*Triticum aestivum L.)*" was conducted in the field of Agronomy at Lovely Professional University, Phagwara, Dist. Kapurthala for carrying out the study. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. There were seven treatments *viz.*, T1 (Cattle Slurry @ 10% foliar application), T2 (Poultry Manure 5tonne/ha), T3 (Vermicompost 5q/ha), T4 (Vermiwash 5q/ha), T5 (Poultry Manure + Vermiwash), T6 (Sattle Slurry + Vermiwash), T7 (RDF 50+25+12 NPk kg/ha). The results of experiment revealed that T7 (RDF 50+25+12 NPk kg/ha) proved quite effective in enhancing the growth of wheat crop, whereas, T2 (Poultry Manure 5tonne/ha) also showed better growth of wheat as compare to another Organic Manures. Similarly, T2 (Poultry Manure 5tonne/ha) was also maintain the pH, EC and increases Organic carbon and reduce the bulk density as compare to the NPK.

Keywords: Wheat, Vermiwash, Cattle Slurry, Poultry Manure, vermiccompost, Nitrogen, Phosphorus, Pottassium

CHAPTER-1

Introduction

In India, one third of the total food which is the use in human life wheat is the main crop for the chapattis. India is the second place wheat growing in terms of area and production. In India this crop is grown for the flour since long time. Wheat is most common crop in India. In the world food crops 80% are cereals. Among these cereals wheat is maximum consume. 27 countries in the world grow wheat which is food source for the two billion peoples (more the one third of world's population). 55% carbohydrates and 20% calories are given by wheat in the worldwide (Breiman and Graur, 1995) and also in production it wheat is main crop in the world. Wheat is grown at very wide range of climacteric conditions. Wheat also has great importance in molecular market due to genetics and plant breeding.

On the earth wheat produces as 2nd most crop which supply the extremely dietary products and grow through all most whole world. In the wheat crop farm yard manure combined with chemical fertilizer increase the crop growth. In this wheat experiment, i check the effect of chemical and organic fertilizer on the wheat yield and growth of the wheat.

The purpose of this study that farm yard manure improve the soil condition, crop quality, yield and soil organic matter improving soil fertility. The proper combination of both organic and inorganic fertilizers has better effects on crop growth and development and yield component of wheat. Organic farming is a production system which provides or largely excludes the use of synthetic inorganic fertilizers, pesticides and growth regulators. Organic manures in combination with each other render greater beneficial effects (Channabasanagowda, 2008) on plant growth and yield. The soils of Pakistan are generally low in organic matter firstly because of arid climate resulting in rapid decomposition of organic matter and secondly because very little organic matter is added to soils during cultivation. Soil fertility can be increased through the utilization of minerals as well as organic matter (Azad and Yousaf, 1982).

In the use of chemical fertilizers these are effect on the soil health and imbalanced the soil. Mainly farm yard manure, vermicompost, poultry manure and green leaf manures are improve the soil health due to nutrient content besides helping in the improvement of soil

structure and water holding capacity of the soil (Kale and Bano, 1986 and Srivastava, 1998) excessive use of inorganic fertilizers damage the environment and situation can be manage by the poultry manure, vermicompost, vermiwash and cattle slurry (Saadatnia and Riahi, 2009)

Vermicompost is rich in microbial populations and diversity, particularly fungi, bacteria, and actinomycetes (Edwards, 1998, Tomati, 1987) and also best result is obtained by the vermicompost at the growth of plants. The continuously use of chemical fertilizers effect on the human health and such as ground water, surface water polluted by the nitrate leaching (Pimentel, 1996).

Andhikari and Mishra (2002) showed that the mixed application of vermicompost and urea can be reduce by 50% amount of urea in the field conditions. And, also the yield was 12 % higher than by the use of vermicompost and urea. The demand of wheat crop in present day 72m tonnes and at the time of 2020 has been projected to be between 105 to 109m toones. Wheat is important cereal crop and require a good supply of nutrients especially nitrogen for its growth (Mandal *et al..*, 1992) and yield (Krylov and Pavlov, 1989) and also the best combination of organic and inorganic fertilizer for the growth and yield of wheat. Mainly application of organic and chemical fertilizers to improve the soil fertility, soil physical and chemical properties and increase yield (Ezekiel, 2010).

Approximately 351800 tonnes of wheat harvested from 815000 ha in 2012. Nitrogen mainly increases the leaf area and its chlorophyll concentration, inducing crude protein content and growth of wheat (Blandino and Rezneri, 2009). Nitrogen also influences the root biomass formation and creates optimal conditions for successful growth (Rieger *et al..*, 2008) and for for high protein content (Kindred *et al..*, 2008). On the other hand, nitrogen negatively affects the grains starch content and also negative effect on protein and starch content (Kindred *et al..*, 2008). Application of organic fertilizers increase the grain and straw yield (Coventry *et al..*, 2011).

CHAPTER-2

REVIEW OF LITERATURE

2.1 Growth

2.1.1 Effect of farm yard manure and Nitrogen on growth

Sazzad khan *et al.* (2014) in this treatment three organic fertilizers levels of poultry manure (2, 4, and 6 ton/ha) and three farm yard manure (2, 4, and 6 tonne/ha) and two Nitrogen levels (60 and 90 kg/ha) along with control applied in wheat. After harvest the crop cultivate the mung bean without use of fertilizer to investigate the effect of these fertilizers on growth and yield of mung bean. Higher spikes m^2yield is obtained then the use of 6 ton/ha poultry manure, 6 ton/ha FYM and 90kg/ha Nitrogen while higher harvest index compare the control. In mung bean more crop growth rate, pods/plant, and biological yield is higher. It is conclude that a ratio of 6 ton/ha poultry manure, 6 tons/ha farm yard manure and 90 kg/ha nitrogen is the best.

Muhammad Ibrahim *et al.* (2008) in this experiment investigate the Organic manures are used for the improving of the soil conditions. The effect of organic manure and composts are effect on the inherent capacity of wheat in sandy clay loam soil. The amounts of various organic manures as the inorganic fertilizers used to maximum the yield. Organic manures are changes on the growth and yield of wheat .organic manures are maximum the wheat yield by 11.13(105%) to 13.53 % (128%) gm poT1 compare to the control. The wheat plant height, number of tillers, spike length, straw yield, grain yield and 1000 grain weight will be different from the control. The result should be obtained that organic manures are used long time then the effect on the crop productivity and the quality of wheat grains hence, using inorganic fertilizers will be more effective and precision for environment and agriculture.

Khalid Nawab *et al.* (2011) in this treatment used the variety of Ghaznavi-98 was sown in November. In main plots used five cropping patterns and in subplots eight combination of FYM, k and Zn. same field is used the next year sowing. And check the cropping patterns (rice-wheat, maize-wheat, sunflower-wheat, sorghum-wheat & piegonpea-wheat). FYM, potassium and zinc produced the higher yield from the control. he find out that after leguminous crops give the best result wheat and also FYm is the sustainable agriculture

Ihsanullah Daur (2013) in this experiment used the FYM and Humic acid (HA) with the different level of nitrogen (0, 50, 75, 100, and 150 kg/ha) FYM 18mg/ha and humic acid 18mg/ha. In main plots he used the N and in subplots FYM and Humic acid. The result found out that the better performance in plant height, leaf area index, chlorophyll content, biological yield, grain yield and N content of grains by the FYM and HA. Our present result shown that the 18 mg/ha FYM with 100 kg/ha N recommended as a good source of wheat fertilization. HA is the also effectiveness with FYM

Rehman *et al.* (2008) a experiment is conduct to check the interaction between inorganic and organic fertilizers on wheat yield, NPK apply as inorganic fertilizer and FYM apply as the organic fertilizer. Different levels of NPK and FYM had significant effect on emergence per m2, spikes per m2, grains per spike, biological yield (kg per ha) and thousand grain weight. Maximum emergence per m (83.5), grains per spike (55.8) thousand grain weight (35.16) were recorded 80-60-60 NPK per ha. Maximum spikes per m2 (201.6) were recorded with 80-60-30 kg N/ha. When FYM at 45 t/ha produce the maximum spikes per m2 (191.2), grains per spike (54.4), while no significance difference was recorded when 30 and 45 t FYM per ha used. The significant result comes at 80-60-60 NPK with 30 tonnes FYM have produced higher wheat yield and biomass under rain fed condition

Amanullah Jan *et al.* (2007) in this experiment laid out in CRD with four replications. Wheat is sown on 14th of October. Plant height, productive tillers, grains spike, straw yield and harvest index are significantly higher in plots treated with 30 mg/ha FYM. N give in the amount of 90kg/ha best observation compare the levels (0, 30 and 60kg/ha). The present study is shown that 30mg/ha FYM and 90kg/ha N is the best for the growth

Vinay *et al.* (2011) to investigate the effect of Farm Yard manure (FYM) and nitrogen levels on performance of wheat at Bichpuri, Agra. Higher mean grain yield of 4.443 tons/ha was recorded with 10 tons FYM/ha, which was 9.1 and 26.3% more than 5 tons FYM/ha and control. Application of 120 kg N/ha maximum the growth, yield attributes and yield of wheat. The mean grain yield increased by 8.1 and 22.4% with the application of 120 kg N/ha compare with 90, 60 kg N/ha, respectively. The uptake of N, P and K by wheat grain and straw showed increasing tendency due to the treatments. Addition of these inputs showed positive changes in available N content of the soil. Available P and K content also increased due to FYM and nitrogen application.

Kowsar *et al.* (2014) to investigate the effect of bioferilizer alone or in combination with organic fertilizers i.e. farmyard manure and jinong on morphology and growth characters of bread wheat keept in mind the long term sustainability and concerns on environmental pollution. The effect was seen on the morphology and growth parameters. A comparison of biofertilizer with organic fertilizers and Farmyard manure showed that Jinong, a new product containing 48% humic acid and N, P, K, Cu, Fe, Zn, Mo, Mn induced better growth than biofertilizer and Farm Yard Manure.

2.1.2 Effect of vermicompost on growth

Rakesh joshi *et al.* (2013) in this experiment investigate the five treatments are take T1 control, T_2 vermicompost @5 ton/ha, T_3 VC @ 10tonn/ha, T_4 VC @20ton/ha, T_5 NPK (RDF by PAU Ludhiana). Result showed that all growth, yield and quality parameters are found maximum on NPK. All the growth, yield and quality parameters in vermicompost treatments varied significant from control through differences with in various vermicompost treatments are not to be significant.

Channabasanagowda *et al.* (2008) this experiment will be conducted during rabi season of 2006-07 on red loamy soil. The effect of organic manures on growth, seed yield, and quality of wheat in this treatment application of vermicompost 3.8 tons /ha + poultry manure 2.45 tons/ha and then result showed that higher plant height ,number of leaves and higher number of tillers at90 days after sowing. and also recorded higher number of ear heads /m2, 1000 seed weight (42.73g) and seed yield (3043 kg/ha), seedling dry weight (311.27)and protein content (13.41%) differ from other treatments

M.Lenin *et al.* (2013) to investigate the interaction of AMF and vermicompost on the nutrient content of groundnut the treatment details of research work, different rates of Vermicompost (VC) and Arbuscular mycorrizha fungi (AMF) species (Gloumus intraradices) application of treatment.,T1 - Control, T2 - AMF only, T3 - 1 ton/ha vermicompost, T4 - 1 tonne/ha VC + AMF inoculation T5 - 2 tons/ha VC, T6 - 2 tons/ha VC + AMF, T7 - 3 tonnes/ha VC, T8 - 3 tons/ha VC + AMF, T9 - 4 tons/ha VC, T10 - 4 tons/ha VC + AMF, T11 - 5 tons/ha VC, T12 - 5 tons/ha VC + AMF. The vermicompost is incorporate in to the top 15 cm of soil supplement with 500 g of AM fungi culture mixed with sand in all plots. All treatments are replicated with three times in a split plots methods. The uninoculate plot is maintained as control. In the present study the nutrient composition such as Nitrogen,

Phosphorous, Potassium, Calcium, Magnesium, Zinc, Iron and Manganese is estimate in the shoot portions of all sampling (30, 60, 90 and 120 DAS) of groundnut plants. Result indicates that, T12 - 5 tonnes/ha VC + AMF application increase all the nutrient content of groundnut plants. The vermicompost are termed rich in nitrogen, phosphorous, potassium and micronutrients

2.1.3 Effect of Vermicompost and NPK on growth

Abdol amir Yousefi *et al*. (2014) in this experiment use the effect of different doses of vermicompost on urea. In this experiment uses the split plot design and CRBD with three replications. The treatment takes three level of vermicompost (5, 10, 15 tons/ha) and five level of urea (0, 25, 50, 75 and 100% after the soil test). At time physiological maturity, grain spike grain, spike length, plant height, grain yield, spike length, and harvest index measured. The result found that the maximum yield obtained from the 100% urea and 10 to 15 tons/ha vermicompost but the no significant difference then the urea added 75% and vermicompost 10 to 15 tons/ha it means vermicompost reduce the 25 % urea.

K.N.Devi *et al.* (2011) In this treatment use the 11 treatments T1 100% recommended dose of fertilizer (RDF) i.e. 120: 26.4: 50 N:P:K kg/ha and the second treatment T_2 100% RDF +1 tons/ha vermicompost, T_3 100% RDF +1tonn/ha vermicompost + Phosphorus solubilising bacteria (PSB), T_4 100% RDF + PSB ,T_5 75% RDF +1ton/ha vermicompost, T_6 75% RDF +1ton/ha vermicompost + PSB , T_7 50% RDF + 1tonn/ha vermicompost , T_8 50% RDF + 1 ton/ha vermicompost + PSB , T_9 1ton/ha vermicompost + PSB , $T1_0$ Vermicompost 1 ton /ha , $T1_1$ absolutely control. All the treatments gave the result but 100% RDF + 1ton/ha vermicompost+ PSB and 75% RDF + 1tonn/ha vermicompost + PSB gave the higher yield but in twos the 75% RDF + 1tonn/ vermicompost +PSB is the best because the no significant difference highest yield obtained by this treatment and it is also reduce the chemical fertilizers vale.

Rupendra khandw *et al*. (2006) in this treatment uses the two varieties with recommended dose of fertilizer and vermicompost. Two varieties are Malwa shree and Malwa Shakti in agrisilviculture system with control. 100% of RDF gave the par result. But the vermicompost used 3tonn/ha give the best result over the control. 50% of RDF and 3tonn/ha vermicompost gave the best result from the 100% RDF because this is the sustained agriculture. And also agrisilvicuture gave the best result 0.55 lakh/ha income by the khamer.

In this experiment result found out the 50% RDF +3 tons/ha vermicompost with khamer tree give the best outputs.

Yousefi *et al.* (2014) to find the response of vermicompost on urea reduce and its impact on yield components. Three treatment include levels of vermicompost (5, 10 and 15 Ton per ha) and five levels of urea (0, 25, 50, 75 and 100% the recommended rate based on soil test).The physiological maturity, grain spike, number of grains per spikelet, fertile spikelet per spike, spike length, plant height were measured. The results indicated that the combined application of urea, vermicompost had significant effects on grain and grain weight. The maximum yield of the treatments 100% of the recommended urea with 10 and 15 Ton per ha vermicompost and treatments recommended by 75% urea and 15 Ton per ha vermicompost, respectively, there was no significant difference between the three groups (4977.3, 4890.7 and 4953.0 kg per ha, respectively). Thus use the vermicompost then reduce the urea upto25%.

Joshi *et al.* (2013) studied the vermicompost made from cattle dung as raw material in five treatments soil, 5, 10, 20 t/ha of vermicompost and NPK(recommended by PAU) in RBD. On the selected plants some test are taken yield and growth parameter are found significant in NPK treatment. All the yield and growth parameters are significant over the control treatment, but not significant to NPK treatments. There is no significant result to lower dose and higher dose of vermicompost in all treatment.

2.1.4 Effect of poultry manure and NPK on growth

Abbas *et al.* (2012) to investigate the application of different organic and inorganic fertilizer to wheat crop. The research is carried out with RCBD with three replication for the best combination of organic and inorganic for wheat production. The treatments were: control (T1, no manure), departmental recommendation 128+114+62 NPK Kg per ha (T2), farmyard manure @ 10 tons /ha at time of seed bed preparation (T3), poultry manure @ 6 tons per ha +128-114-62 Kg per ha NPK (T4). At the maturity level no of spikelet per plant, height of plant (cm) and yield from 1m2 area of randomly selected plants was recorded. Best results in T4 treatment with combination of 6 t/ha poultry manure and 128-114-62 kg ha NPK.

2.1.5 Effect of poultry manure on growth.

Enjueke (2013) in this study conducted that the use of poultry manure at the different level of 0 tonne/ ha, 10 tonne/ha, 20 tonne/ ha and 30 tonne/ha in the randomized block design with three replication. Data collected at the stage of 4^{th} to 8^{th} week after sowing after sowing then result were observed that higher the plant height, number of leaves, leaf area, leaf area index all the growth parameters were best on the 30 tonne/ ha of poultry manure.

Channabasanagowda *et al*. (2008) In this treatment shown that the combination of poultry manure and vermiwash at the level of 2.45 tonne/ hac and 3.8 tonne/ha significantly result obtained that the combination of these treatment recorded the higher plant height, number of leaves, and high number of tillers at 90 DAS. RDF also gave the at par result on the growth and yield.

S. Agyenim Boateng *et al.* (2006) The application of poultrymanure on maize growth and yields was studied in the semi-deciduous rain forest zone of Ghana. Eight treatments of 0, 2, 4, 6 and 8 tons of poultry manure/ha, 60-40-40 kg/ha NPK, 2x2 ton poultry manure and 2 tonne poultry manure + 30-20-20 kg/ha NPK were used in randomized block design with five replication. The study shown that poultry manure maximum produced fertilizer and can serve as a suitable alternative of the chemical fertilizer. Poultry manure produced higher values for height and leaf area index. Poultry manure 4 tonne/ha given the not significant result but the 6 tonne poultry manure higher amount of yield was obtained. And the 4 tonne/ha poultry manure maintain the exchangeable cations increased with manure application.

2.1.5 Effect of nitrogen, phosphorus and potassium on growth

TayebehAbedi *et al.* (2010) a experiment is conduct to check the interaction between inorganic nitrogen with organic fertilizer at the differ level of both inorganic nitrogen and organic fertilizer on grain yield, protein content and gluten at the different growth stages of wheat. Application of 0, 80, 160 and 240 kg/ha nitrogen and organic waste compost 0, 30, 60, 90 Mg/ha. In the treatment in which 160 Kg N with 30 Mg compost per ha with the increase the level of nitrogen then spikes per plant and 1000 kernels weight also increased. There is no significant result is observed except 60 Mg compost have highest protein content at all levels of nitrogen.

Meena *et al.* (2013) in another experiment worked on the effect of concentrate organic manure and in organic fertilizer on yield of wheat and growth of wheat under different levels of fertility. The improvement in terms of growth parameters like, dry matter production, tillers, productive tillers and plant height with application of 100% NPK + 300 kg well grow grain/ha and at par with application of 100% NPK + 200 kg well grow grain/ha, 100% NPK + 300 kg well grow soil/ha, Treatment receiving 100% NPK + 300 kg well grow grain/ha resulted maximum effective tillers/hill (350 m^2), grain yield (41.2 q/ha). Treatment 100% NPK + 300 kg well grow soil/ha maintained test weight (42.20 g) and higher straw yield (53.53 q/ha) due to application of 100 % NPK along with 300 kg well grow soil/ha.

M. Baves *et al*. (2007) to investigate the changes of leaf area index (LAI) by agricultural treatments – 4 sowing rates and 9 nitrogen treatments based on fertilising rates, target values based on soil mineral nitrogen and plant sap tests target values including different varieties. Increasing sowing rates from 350 to 800 viable seeds m^2 increased LAI at EC 75 stage from 2.9 to 5.5, where LAI 4.1 at 500 seeds m-2 did not vary between lower and higher rates also at EC 85 stage LAIs did not differ significantly. At EC 75 stage LAI differed among control and nitrogen treatments from 1.0 to 6.5 and at EC 85 stage from 0.1 to 2.4, with differences in interaction among varieties. Higher nitrogen rates for first and second top dressing increased LAI in both stages compared without dressing treatments. Due to significant differences among LAI as consequence of production system, we suggest to take this into account in every prediction and modelling of growth in winter wheat.

Ghulam *et al*. (2010) in this experiment used the nine treatment of NPK and three varieties. Three wheat varieties (TD-1, T.J-83 and Mehran-89) the level of NPK (0-0-0,60-60-60,60-60-30,120-60-0,120-60-60,180-60-0,180-60-90,240-60-00 and 240-60-120 kg/ha) mainly selected in randomly block design. Inorganic fertilizer mainly increased the growth of wheat growth, yield and nutrients significantly. Best result obtained at the level of 120-60-60 NPK kg/ha from the variety of TD-1 number of tillers, spike length, grains/spike, dry matter, leaf area index, crop growth rate and NPK uptake.

M. Niamatullah *et al.* (2011) in this experiment take the one variety at the different levels of NPK T1 0-0-0, T2 20-0-0, T3 40-20-0, T4 40-20-10, T5 60-30-20, T6 80-40-30 and T7 100-50-40 kg/ha in randomized block design with three replications. The result was obtained that treatment T6 (NPK @ 80-40-30 kg/ha) increased the growth and yield of wheat.

Abdul *et al.* (2011) in the conducted study effect of NPK on growth and yield on the cultivar (Sahar 2006) of wheat. The main motive of this was to check the optimum range of NPK for the better growth, yield and to maintain the soil condition. Three replication were tested in randomized block design with treatments T1 control, T275-50-25, T3 100-75-50, T4 125-100-75, T5 150-125-100, T6 175-150-125 and T7 200-150-125 NPK kg/ha. The result was obtained that T6 (175-150-125 NPK kg/ha) best for the proper growth and yield of wheat.

2.1.6 Effect of farm yard manure on growth

Abbas *et al.* (2013) in this experiment used the farmyard manure (0, 5, 10 and 20tonn/ha) and the method of sowing flat and ridge. Results of this study indicate no significant difference for planting methods on yield although the ridge sowing give higher grain yield as compare to the flat sowing. The use of different levels of the FYM significantly increased biomass, grain yield, thousand seed weight, number of head per m2 and a plant height. The interactions of the planting methods and the manures showed significant differences for the grain yield. The highest grain yield (4.3 t/ ha) is obtained from the combination of 20 t/ ha. FYM with ridge planting method and the lowest grain yield (3.8 t/ ha) from the combination of 20 tons/ha FYM with flat planting method.

A.M. El-Ghamry *et al.* (2009) to study the effect on yield and other parameter the adding the FYM dose of 0 to 20mg/kg per ha along with foliar application of some micro nutrients. Result comes significant in all parameters by Appling the FYM dose over then control treatment. Foliar application of mixed B, Mo and Zn treatment gives the highest yield characteristics. The application of balanced micro and macro nutrients gives higher yield and also dry matter which is influence by the FYM. The result is significant interaction with FYM and foliar application of mixed micro nutrients.

Zahoor *et al.* (2009-10) to investigate the effect of integrated use of urea and Farm Yard Manure for better yield of wheat. Nutrient is very essential for plant growth and production. Two kinds of nutrients are used chemical and other is organic fertilizer in this experiment. The use of application of organic and inorganic fertilizer boosts up crop production very rapidly. The result of this experiment showed that application of 10 tons FYM per ha before sowing increased the number spike per m2 , grain yield, grain per spike,

1000 grain yield compared with control. It is proved from the experimental results that the uses of FYM with urea before sowing have the potential to enhance the yield of wheat.

Yadav *et al.* (2014) in an experiment on winter season crop of 2005-06 and 2006-07 to study the impact of FYM on growth, yield attributes of wheat and nutrient uptake by wheat in Uttar Pradesh. The design of experiment was split plot design with three replications. Wheat crop recorded significantly higher value of growth, yield attributes (effective tillers/m^2, spike length, grains/spike and 1000 grain weight), yields, benefit: cost ratio and nutrient accumulation under integrated source of nutrients than inorganic fertilizer alone. There was significant improvement in yields, yield attributes, and nutrient uptake due to foliar treatment of micronutrients (Fe and Mn).

Bodruzzaman *et al*. (2010) conducted an experiment of 11 years study the effects of 9 treatments of organic manures with the chemical fertilizers on soil fertility and productivity of crop in a rice experiment. Soil pH increased in plots with poultry manure and unchanged in inorganic fertilizers and farmyard manure. Percentage of organic matter was reduced from 13 to 19% and percentage of inorganic fertilizers increased from 7 to39% with organic manures. Percentage of total Nitrogen was not changed in organic manure fields, but reduced in others. Available Phosphorus increased in poultry manure plots. After 9 years, organic manure, total Nitrogen (N) and exchangeable Potassium (K) was decrease in inorganic treatment and maximum in organic manure treatments. The soil pH increased in poultry manure treatments.

2.2 Soil

2.2.1 Effect of vermicompost and vermiwash on soil

Abdullah Adil Ansari *et al.* (2008) In this treatment used the vermicompost @ 6 tonnes and vermiwash, there has been significant improvement in soil qualities in plots treated with vermicompost and vermiwash (1; 10 in water) and next one is (1; 5 in water). The yield of spinach is significantly higher in plots treated with vermiwash (1; 5 in water). The yield of onion was significantly higher than treated with vermicompost and vermiwash (1; 5 in water).

Khalid Nawab *et al.* (2013) In this experiment investigate three nitrogen treatments tested were 100% N through chemical fertilizer, 75% N through chemical fertilizer + 25% through bio-compost, 75% N through chemical fertilizer + 25% through vermicompost, 50% N

through chemical fertilizer + 25% through biocompost + 25% through vermicompost along with two vermicompost treatments no sprays of vermiwash and three sprays of vermiwash. Combined analysis of variance for them depicted significant results for all the yield contributing characters. The highest grain yield (5261 kg/ ha) and stover yield (7405 kg/ha) were obtained from the 50% nitrogen through chemical fertilizer + 25% through biocompost + 25% through vermi-compost. The use of vermiwash imparted a rise of 11.21%.

2.2.2 Effect of NPK on soil

M. Niamatullah *et al*. (2011) To investigate the result of impact factor of NPK Kg ha-1 T1 0-0-0, T2 20-0-0, T3 40-20-0, T4 40- 20-10, T5 60-30-20, T6 80-40-30 and T7 100-50-40 in terms of number of productive tillers m^2 of fertilizer applications on wheat. In this treatment were used Randomized Block Design with three replications. The results showed that treatment T6 (NPK @ 80-40-30 kg/ha) proved most economical NPK dose yielding Rs. 7358.54/ha for wheat under hill irrigated area.

2.2.3 Effect of Farm yard manure on soil

Izhar-ul-haq *et al*. (2007) In this experiment used the treatment combinations T1 control, T_2 FYM 20 tons/hac,T_3gypsum @ 50% GR T_4 gypsum @50% GR + 10 tons FYM/ha, T_5 gypsum @100% GR and T_6 gypsum @ 100% GR +10 tons FYM/ha. Result shown thati in this experiment T_6 is the best for the growth of wheat crop and also maintain the soil quality and organic matter and also these are the eco-friendly.

CHAPTER-3

MATERIAL AND METHODS

This study was laid out at experimental farm on the Department of agronomy, school of Agriculture, Lovely Professional University, Jalandhar, Punjab (India) at the session of 2014-2015 with the title of "Effect of organic and chemical fertilizers on growth of wheat and soil properties.

3.1 Description of experimental site

The present study was carried out at the field Experimental of the Departent of Agronomy, School of Agriculture of Agriculture, Lovely Professional University, Jalandhar, Punjab (India) during 2014- 2015.

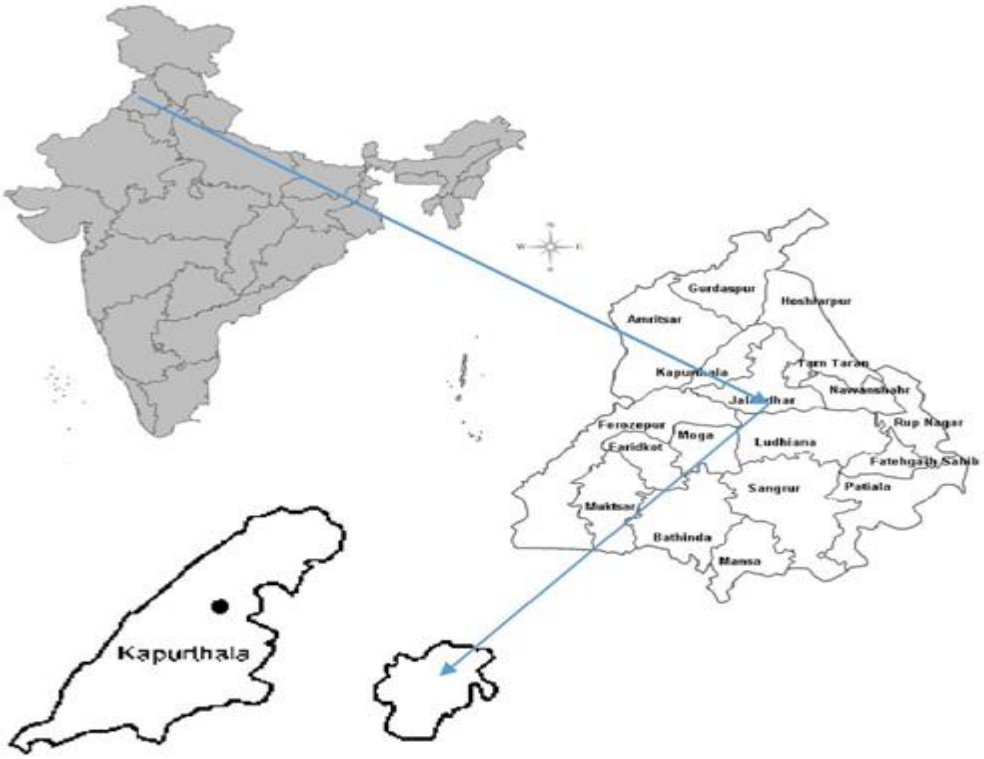


Figure 3.1 Picture showing the location of study area

The experimental site is localized in "*Central Plain Zone (PB-3)"* of Punjab. The rainfall in the region varies from 500-800 mm and about 80 per cent of which is received in a short period 3 months *(mid June to mid September)*. Major constraints of the region are declining water table and soil salinity. The soil predominantly belongs to Central Alluvial Plain or sandy loam. The major crops grown in the region are mainly wheat, rice, maize, groundnut, cotton, gram, barley, pear and guava. The experimental site is located at 31º 15' N latitude and 75^0 41' E longitudes at an elevation of 245 m above mean sea level. The climate of the experimental area is characterized as hot and dry summer and wet and humid monsoons, distinctly experiences all the four seasons. The soil of experimental field was Sandy loam. The table below contains details on experimental soil status before sowing.

3.2 Climatic and weather

The climate of the experimental site is located in Punjab State which experienced by the extreme hot and extreme cold conditions. The annual temperature in Punjab State range from 1 to 45^{o}C and can reach 49.5^{o}C during summer and 0^{o}C in winter. Its annually average rainfall ranges from 960 mm in the sub mountain region and 460 mm in the plains. It is also characterized by heavy rain in the northeast area near the foothills of Himalayas, whereas it receives less rainfall and high temperatures in the area lying in south and west. It experiences also three seasons as follows: Summer season (April and June) and it is characterized by the increase in temperatures up to 40^{o}C, Monsoon season (July to September) and it is during this period when the majority of rain occurs and in last, Winter season (December to February) with typical fall of temperatures up to 0^{o}C.

3.3 Meteorological data during growing season

Weather and climate are important factors that determining the success or failure of agriculture. Weather influences agricultural operations from sowing to the harvest, the reason why it is important to present the variations of climate during growing season. The mean of weekly meteorological observations were recorded during entire growing season and are represented in Table 3.1 Crops were sown on 26/11/2014. Pea was harvest on 25/3/2015. Maximum and minimum temperatures during growing season were 33.49^{o}C and 6.90^{o}C

Respectively, relative humidity varied between 63 and 85 per cent. There was a total rain of 190 mm during growing period.

Table: 3.2 Monthly air temperature, relative humidity and total precipitation from November 2014 to April 2015

Month		Temperature		RH%	Rainfall (mm)
	Maximum	Minimum	Average		
November	26.9	10.9	18.9	63	22.11
December	17.6	6.9	12.25	80	42
January	15.6	6.5	19.6	85	24.5
February	22.2	10.5	16.35	79	38.6
March	25.5	13.3	19.4	76	84.6
April	33.49	19.17	26.33	62	5.1
Total					216.91

(Source: Department of Meteorology, PAU)

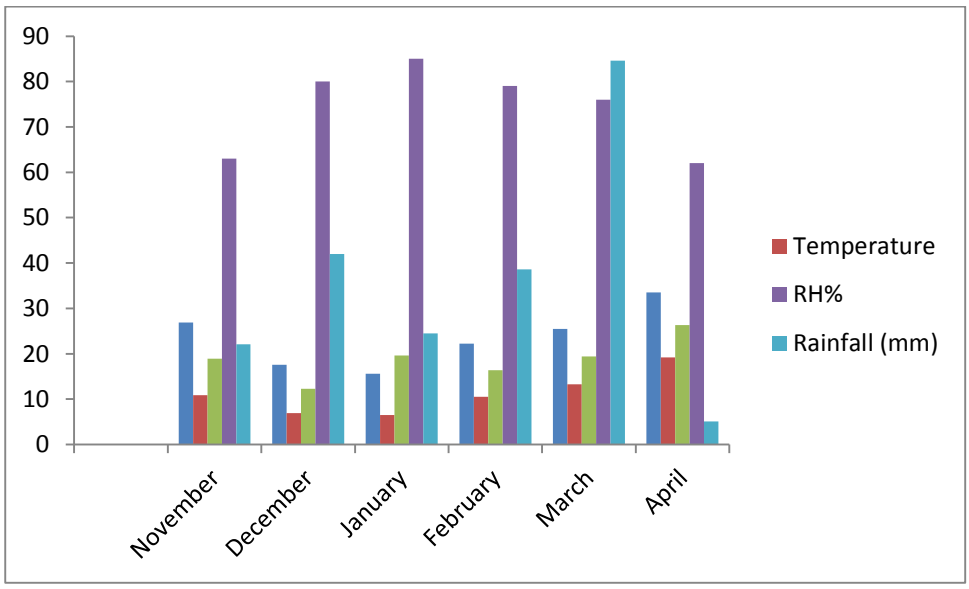


Figure: 3.2 Monthly air temperature, relative humidity and total precipitation from November 2014 to April 2015

3.4 Soil Analysis

To find out physical and chemical characteristics of the experimental soil, top soil samples from 0-15 cm depth were collected from each replicates before sowing then after harvesting all crops soil samples were collected from each plot and they were air dried and sieved then a composite sample was obtained by mixing them together for further analysis of both physical and chemical properties. The results of soil analysis before sowing presented in table 3.4 showed that the soil was silt loam, slightly alkaline in reaction, non-saline, low in organic carbon, low in available nitrogen and potassium and medium in available phosphorus status.

Table: 3.4. Soil physical and chemical properties of the experimental field

Sr. No	**Particulars**	**Values (0- 30 cm depth)**	**Method employed**
Physical properties			
1	Coarse sand (%)	61%	International pipette method (Piper, 1955)
2	Silt (%)	7%	
3	Clay (%)	32%	
Chemical properties			
1	pH	7.7	Buckmoric Hmeter (Piper,1955)
2	Electrical conductivity (dS/m)	0.33	Jackson (1973)
3	Organic carbon (%)	0.56	Wet oxidation method (Jackson, 1957)
4	Bulk density	1.29	Core method
	Available nutrient status		
A	Available N (kg/ha)	163	Alkaline per magnate method (Subbaiah and Asija,1955)
B	Available P (Kg/ha)	24.4	Olsen’s method (Jackson,1957)
C	Available K (kg/ha)	325	Flame photometer method (Tandon, 1993)

3.5 Procedures of soil analysis

3.5.1 Triangle Method for soil textural class

Soil textural class was determined by using U.S. soil texture triangle method (Soil Survey Staff, 1998).

3.5.2 Particles distribution (%): International pipette method (Piper, 1950)

For determination of soil texture, 50 g of dried soil were sieved with the help of 2 mm sieve and placed into 500 ml bottle. After that 100 ml of dispersion solution was added into 50 g soil in 500 ml plastic bottle. Sample bottles were shacked at regular interval for half an hour on shaking machine for preparing homogeneous solution. The obtained solution was transferred in 1000 ml glass measuring cylinder then after water was added to make solution of 1000 ml. As per International approved system, the sample solution was shaken for 30 seconds. Depending on the solution temperature and sedimentation chart, first pipetting was done with 50 ml pipette at 10 cm depth. In first pipetting, 50 ml solution were sucked and transferred into 60 ml petri dish. The formed sample solution contained mixture of clay and silt particles. Depending on the solution temperature and sedimentation chart, second pipetting was done with 50 ml pipette at 10 cm depth. In second pipetting 50 ml solution were sucked and transferred in 60 ml china dish. This solution contained clay particles in soil sample. Remaining soil solution was transferred in 1 litre. Measuring cylinders and 0.02 mm sieves were washed using jet of water. Sand particles on sieve were collected in china dish. Pipetted solution was transferred in 3 dishes and kept overnight in an oven at temperature of 105^{o}C. Solutions were cooled in desiccators and weight was taken quickly. The weight of fine was determined by deducting the weight of clay, silt and coarse sand particle from 100.

3.5.3 Electrical Conductivity: Water suspension (Jackson, 1967)

To find out the electrical conductivity of soil, 25 g of dried soil were taken then transferred into 100 ml beaker then after 50 ml of distilled water was added. The suspension was mixed intermittently for half an hour and left it for 30 minutes without any disturbances. Conductivity cell was inserted in solution and EC value was recorded.

3.5.4 Organic carbon: Rapid titration method (Walkley and Black 1934)

To determine organic carbon of soil, 2 g of dried soil samples were weighed and taken

into 250 ml conical flask, to which 10 ml of 1 N $K_2Cr_2O_7$ solution and 20 ml of concentrated H_2SO_4 were added. The content was shaken for a minute and was left for a half an hour to make reaction complete. Then after 200 ml of distilled water, 10 ml of orthophosphoric acid and 4 drops of drops of diphenylamine indicator were added and the violate color was appeared in the suspension. The obtained solution was titrated with ammonium ferrous sulphate and the point of the titration was marked with the change of colour from violate to bright green. The blank titration was performed in the similar way.

3.5.5 Available Nitrogen: Alkaline Permanganate Method (Subbiah and Asija, 1956)

To determine available nitrogen in the soil, 5 g of dried soil were taken and transferred into the distillation flask of micro-Kjeldhal distillation assembly. About 52 ml of 0.32% $KMnO_4$ solution was added to the distillation unit. From 150 ml conical flask, 10 ml of N/50 H_2SO_4 were pipetted out and mixed with two drops of methyl-red indicator. The conical flask and the delivery tube of the distillation unit were placed in such a way that the delivery tube was well placed into the content of the conical flask. The quantity of 25 ml of 2.5% NaOH solution was added into the distillation flask containing soil and $KMnO_4$ through the set provided in the distillation tube and the inlet was immediately closed with stop-cock. Then after, distillation was started and 30 ml of the distillate was collected. The content of the conical flask was titrated with N/50 NaOH and the end point was indicated with change of colour from pink to yellow.

3.5.6 Available Phosphorus: 0.5 M $NaHCO_3$, pH=8.5 (Olsen *et al.*. 1954)

A soil of 1 g of was weighed and transferred into 150 ml conical flask. A pinch of Darco-G 60 and 20 ml of 0.5 $NaHCO_3$ were added into the conical flask, then after the flask was shaken for half an hour on an electrical shaker and the suspension was filtered through Whatman No.1 filter paper. Similarly a blank solution was prepared. About 5 ml of the extract was transferred into a 25 ml volumetric flask and then after 0.5 ml 5N H_2SO_4 were added and the solution was shaken for a while till CO_2 evolution disappeared. A quantity of 4 ml of ascorbic acid (solution B) was added to it and the volume was made by addition of distilled water then after the flask content was mixed. The intensity of the blue colour developed within a calorimeter was measured at 760 µm wavelength using red filter.

3.5.7 Available Potassium: 1 N Neutral ammonium acetate (Black, 1965)

A quantity of 5 g of dried soil was weighed and was taken into in 150 ml conical flask, then after 52 ml of neutral ammonium acetate solution were added to the flask. The content was shaken for five minutes on mechanical shaker and filtered through Whatman No.1 filter paper. The extract was collected into beaker then after 5 ml of the extract was diluted with distilled water. The diluted extract was atomized flame photometer to note K reading.

3.6 Experiment design and layout

The experiment carried out in RCBD (randomized complete block design) and consisted of the seven treatments with three, in each replication put the treatments randomly. Thereby the 21 plots and each plot size was 1.70m x 2.46m total area of one plot was 4.18 m^2. The field prepare by the tractor primary and secondary tillage should be done through the use of mould board plough, harrow and rotavator respectively. And then the field was well levelled.

Table: 3.3 Details of treatments used in the experiment

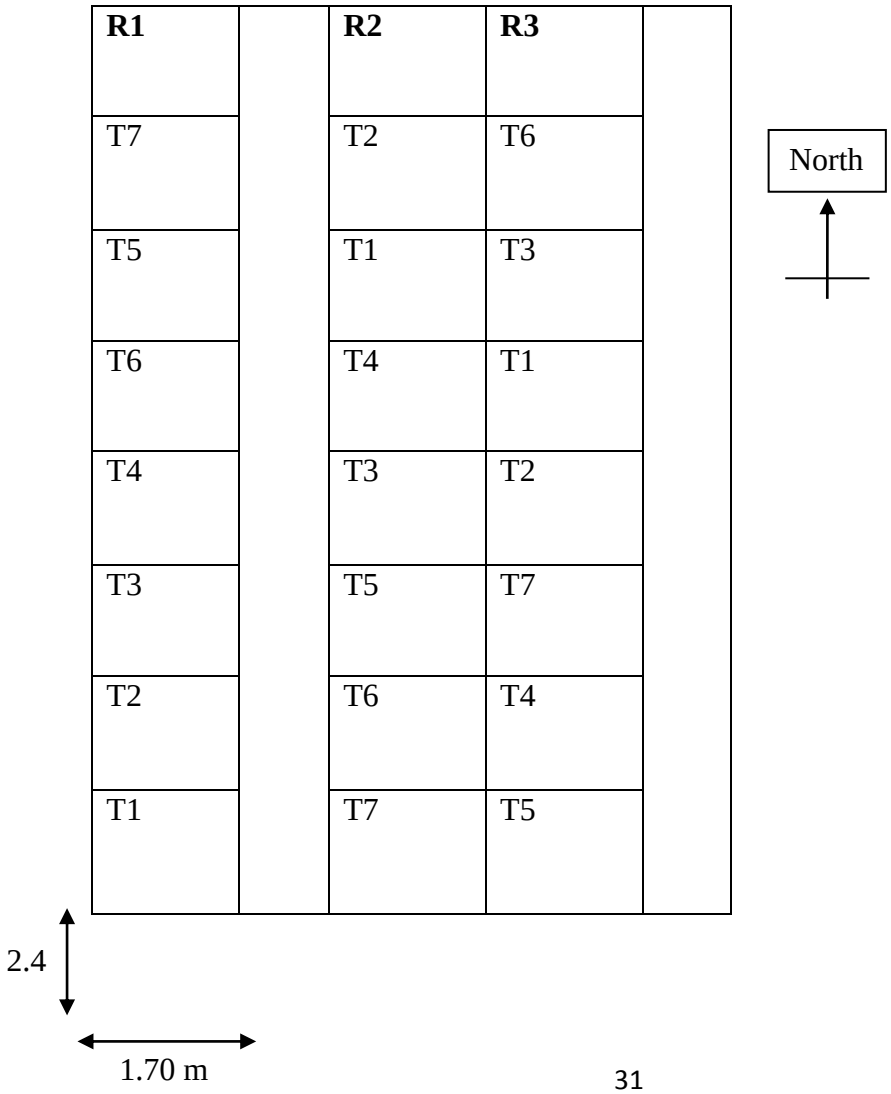
Treatments	Doses
T1	Cattle slurry@10% foliar application
T2	Poultry manure 5tonn/ha
T3	Vermicompost 5q/ha
T4	Vermiwash 5q/ha
T5	Poultry manure+vermiwash
T6	Cattle slurry+vermiwash
T7	RDF NPK 50-25-12 kg/ha

3.8 Experimental details

T: Treatment

R: Replication

1. Treatments 7
2. Replications 3
3. Total number of plots 21
4. Design RCBD
5. Plot size 4.18 m^2
6. Variety Wh-1105
7. Seed rate 100kg/ha
8. Spacing 18cm R x R



3.10 Variety description

3.10.1 Source of Seed

Seed used in this research was obtained from Punjab Agriculture University,

3.10.2 Variety detail

This variety is a double dwarf variety with an average plant height of 90 cm. Its ears are medium dense and parallel in shape with white smooth glumes. Its grains are amber, hard, medium bold and lustrous. It is resistant to yellow rust and brown rust but susceptible to karnal bunt and loose smut diseases. It's mainly mature in 157 days and its average grain yield is 23q/ha, which is 3-6 percent higher than the other varieties.

3.11 Organic and Inorganic Manures provide by

The manures used in this research were cattle slurry, poultry manure, vermicompost, vermiwash and NPK on the wheat field and manage by the agriculture department of Lovely professional university Jalandhar.

3.12 Field preparation and subsequent operations

November 15th 2014 the first ploughing was done and this was followed by harrowing and levelling the soil to provide a good seedbed before sowing. All crop residues and weeds were removed as necessary to control weeds during the growing period. The cattle slurry two spray should be done at sowing time and next after 40 days after sowing and the poultry manure, vermicompost given at the time of sowing and vermiwash also given at the sowing time. And the half dose of urea, DAP and potash were basally applied in plots according to the treatment assigned in each plot before sowing, and next dose of urea, DAP and potash given at the first irrigation. In each plot 18 cm was maintained as planting distance between two successive rows and plant to plant 2 cm. The other normal agricultural practices required including irrigation water canal cleaning were done. Details in table below

Table: 3.12 The schedule of various agronomic operations done in this experiment

Sr. /No.	Operation	Date
1.	Ploughing and planking of the field	15th November 2014
2.	Pre sowing irrigation	20thnovember, 2014
3.	Lay out of field experiment	25thnovember, 2014
4.	Fertilizer and manures application	25thnovember, 2014
5.	Sowing	25thnovember, 2014
6.	1st weeding	30thdecember 2015
7.	Thinning	13thdecember 2015
8.	First irrigation	1stJanuary, 2015
9.	Second irrigation	3rdfebruary,2015
10.	Third irrigation	5thmarch 2015

3.13 Data collection

Firstly tagged the plant in one meter square area in the plot then take the data.

First data collect- 10th December 2014
Second data collect- 25th December 2014
Third data collect- 9th January 2015
Fourth data collect- 24th January 2015
Fifth data collect- 8th February 2015

3.14 Measurements

In this thesis various plant parameters such as plant height, number of leaves, stem diameter, leaf area/plant, leaf area index, dry matter, net assimilation rate, crop growth rate, accumulation growth rate, chlorophyll content at the time of 15,30, 45, 75, 90 days after sowing and germination% and No. of day's emergence.

3.14.1 Germination percentage

Germination percentage has been depends on the how many seeds sown and then count the how many seeds are grown in one plot.

3.14.2 No. of days emergence

It is the depend on the after sowing of the seeds 80 percent germination

3.14.3 Plant height, number of leaves

Plant height of 4 tagged plants in each plot was recorded five times during crop growth at 15, 30, 45, 75, 90 days using a meter scale from ground level to the upper youngest leaf of the plant. Numbers of green leaves were counted without considering the yellowish old ones five times.

3.14.4 Stem diameter

Stem diameter of 4 tagged plants in each plot was recorded five times at the interval of 15, 30, 45, 75, 90 days after sowing by the inch tape.

3.14.5 Determination of Dry matter

The dry matter of single plant was estimated at flowering stage field pea. The randomly selected plants were removed from each plot. Above plant samples were dried in an oven at 75^{o}C for 24 hour until weight become constant. After 24 hour was weighting the dry matter the help of electrical weighing machine than reading was noted down.

3.14.6 Determination of leaf area index

Leaf area index is the ratio of leaf area over ground area.

LAI = leaf area /ground area

3.14.7 Determination of net assimilation rate

Using given formula to calculating

$$NAR= (W_2-W_1) (\log_e L_2 -\log_e L_1) / (t_2 - T1) (L_2 - L_1)$$

Where L_1 and W_1 are leaf area and dry weight of plants at the time T1, and L_2 and W_2 are leaf area and dry weight of plants at time t_2.

3.14.8 Determination of crop growth rate

It is the rate of crop per unit area and expressed as g/m^2 /day

$$CGR= 1/P \text{ X } (W_2-W_1)/ t_2 - T1$$

Where P is land area

3.14.9 Chlorophyll estimation in leaf

Randomly selected plants leaf was removed from all the field plots, and gram fresh leaf was taken for the estimation of chlorophyll content. The weighed leaves were grinded with the help of grinder and 10 ml acetone was added to it. After that extract was continuously shacked for 5 minutes and then centrifugation done at 10000 rpm/sec in centrifuged machine. Finally 2ml of upper surface liquid was used for recording the readings from spectrophotometer at (mention the wavelength) 1 gram fresh leaf grand with hand grander than put 10 ml acetone and mix for 5 minutes than centrifuged at 10000run/sec in centrifuged machine and take 2 ml upper liquid than taking readings from specto-photometer at two wave length.

3.15 Statistical analysis and interpretation of data

The data collected from the experiment at different growth yield and soil analysis were subjected to statistical analysis as described by Gomez and Gomez (1984). Statistical analysis was carried out by taking the averages of the five plants from each net plot. The level of significance used in 'F' and't' test was P=0.05. Critical difference valves were calculated wherever; the "F" test was significant

CHAPTER 4

RESULTS AND DISCUSSION

The experiment was conducted at Agriculture Farm, Lovely Professional University, Punjab during the Rabi season 2014 to investigate the **"Effect of organic and chemical fertilizers on growth of wheat and soil properties (*Triticum aestivum* L.)"**. The experiment was laid out in Randomized completely block design with three replications having a plot size was 1.70 X 2.46 m^2 with total gross area of 87.82 m^2. The crop was sown as per recommendations (package of practices for the crop of Punjab, published by PAU, Ludhiana) except the following seven different treatments of T1-Cattle Slurry, T2-vermicompost, T3-vermiwash, T4-Poultry Manure, T5-Poultry Manure + vermiwash, T6-Cattle Slurry + vermiwash and T7-NPK (RDF by PAU Ludhiana). The data was recorded at 15, 30, 45, 75, 90 DAS for important morphological and agronomic characters namely-plant height, number of leaves, dry matter, chlorophyll content, accumulation growth rate, net accumulation rate, crop growth rate, leaf area index, leaf area per plant, germination percentage, number of day's emergence and soil quality parameters namely-soil texture, pH/EC, organic carbon, bulk density/particle density, NPK concentration. The detailed character wise analysis has been discussed below:

4.1 Growth parameters

4.1.1 Plant height cm

In present studies, the data represented in Table 4.1.1 there was significant difference between the treatments of plant height at 15, 30, 45, 75, 90 DAS. Wheat plants shows significantly taller with the application of recommended dose of NPK at 15 DAS (7.308 cm), 30 DAS (15.417 cm), 45 DAS (33.933 cm), 75 DAS (70.467 cm) and 90 DAS (81.2 cm) as compared to other treatments. On the plant growth the result was founded at par in all the stages by the use of T2 (Poultry Manure) at 7.13, 15.15, 33.43, 68.90 and 78.66 respectively. On the other hand the minimum plant height was recorded in T3 (vermiwash). Similarly results were obtained by Rakesh joshi *et.al* (2013) ,who reported that the plant growth, yield, and quality parameters are found maximum in T_5-NPK (RDF by PAU Ludhiana) treatment as compared to T1-control, T_2 -vermicompost @5 tons/ha, T_3-VC @ 10tonn/ha and T_4-VC @20tonn/ha. Singh and Jain (2000) reported that in plant height with the application of NPK in wheat crop. Gawal and Jain (1999), who observed that plant height increased due to the

nitrogen fertilization. Nitrogen is the mainly effect on the vegetative growth and the other hand organic manures are gave the best result but they enhance the growth slowly as compare to the chemical fertilizers. Kostchi *et al.* (1989) reported that Poultry Manure gave the best result because of the maximum concentration of nutrients or minerals and easily absorb by the plants then they easily grow up. Fagimi and Odebode (2007) who reported that increased the plant height by the use of Poultry Manure in cereal crops.

Table 4.1.1 Plant height (cm) of wheat as influenced by crop geometry

Treatment	**Plant height (cm)**				
	15 DAS	**30 DAS**	**45 DAS**	**75 DAS**	**90 DAS**
T_1	6.93±0.08	15.16±0.11	31.46±0.68	68.33±0.54	78.36±0.50
T_2	7.13±0.67	15.15±0.08	33.43±0.76	68.90±0.58	78.66±0.08
T_3	6.93±0.08	15.26±0.08	31.80±0.20	67.66±0.28	77.66±0.70
T_4	7.10±0.05	15.05±0.06	33.13±0.12	67.63±0.82	76.4±0.70
T_5	6.86±0.08	15.07±0.05	33.26±0.12	67.73±0.69	78.17±0.30
T_6	7.06±0.08	15.01±0.15	30.40±0.15	67.50±0.46	77.43±0.50
T_7	7.30±0.09	15.41±0.03	33.93±0.38	70.46±0.56	81.2±0.40
CD	0.27	0.216	1.43	1.846	1.787
SE (m)	0.123	0.098	0.649	0.838	0.811

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/hac, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash . Value for each growth of stages significant difference $p<0.05\%$ by the opstat

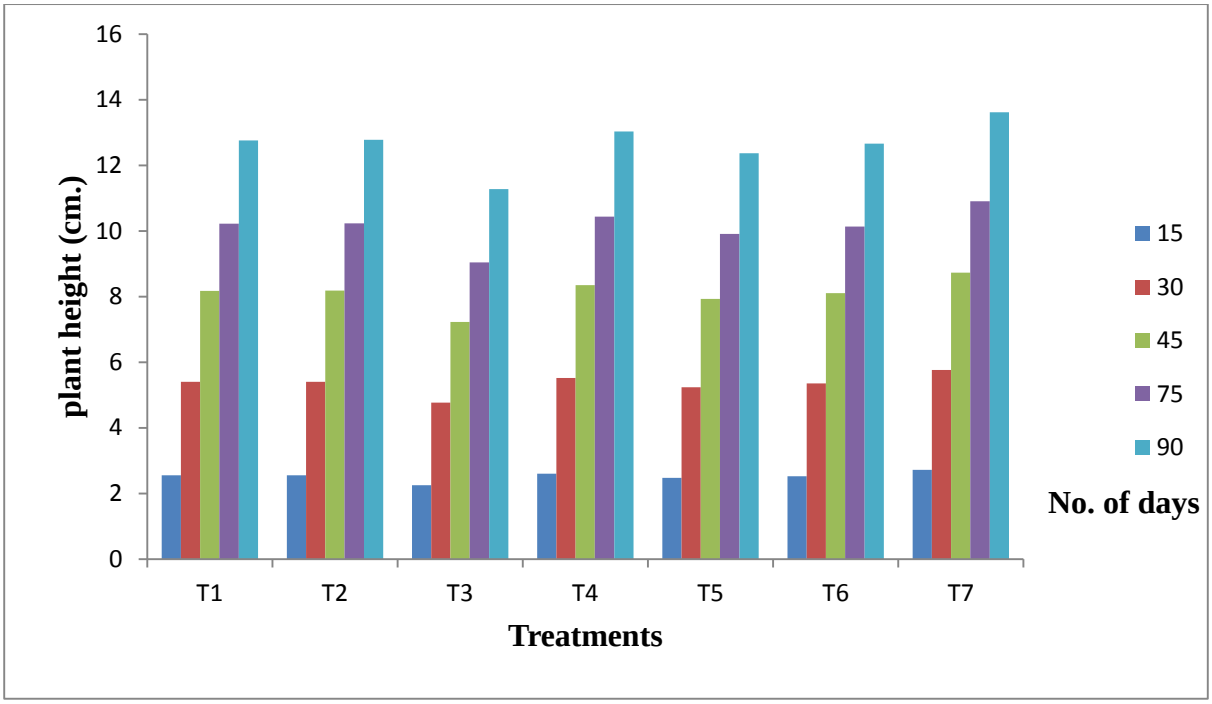


Figure: 4.1.1 Plant height (cm) of wheat as influenced by crop geometry.

4.1.2Number of leaves

In the present studies, (Table 4.1.2) showed that the number of leaf on single plant was effected by application of organic and inorganic fertilizer. The different fertilizer had significant difference on the number of leaf per plant except the stage of 45 DAS. The highest number of leaf was found in T7 (RDF) with 9.53, 12.83, 13.83, 14.16 and 14.75 from the 15, 30, 45, 75 and 90 DAS respectively. On the plant growth the result was founded at par in all the stages by the use of T2 (Poultry Manure) with 7.63, 11.71, 12.70, 13.14 and 13.59 at 15, 30, 45, 75 and 90 DAS. On the other hand lowest number of leaves were recorded in T4 (vermiwash) with 5.98, 09.58, 11.55, 10.90 and 11.05 with respective days. This is on agreement with M. Niamatullaha *et al.* (2011) who reported that the NPK level of 160-60-30 kg/ha gave the higher number of leaves. Lombin *et al.* (1992), kotschi *et al.* (1989), Fabiye and Oguunfowora (1992) found that Poultry Manure gave the best result after the NPK because the bulk density, organic carbon, microbial content was increased by the use of Poultry Manure then effect on the number of leaves it was depend on the condition of soil.

Table: 4.1.2 Number of green leaves per plant as influenced of crop geometry.

Treatments	Number of green leaves/ plant				
	15 DAS	30 DAS	45 DAS	75 DAS	90 DAS
T_1	5.90±1.05	10.04±0.60	11.50±0.77	11.62±0.66	12.23±0.40
T_2	7.63±0.30	11.71±0.39	12.70±0.76	13.14±0.48	13.59±0.40
T_3	7.65±0.10	10.68±0.36	11.13±0.64	12.11±0.35	12.15±0.30
T_4	5.98±0.77	9.58±0.18	11.55±0.66	10.90±0.63	11.05±0.30
T_5	6.39±1.40	10.6±0.87	11.03±0.60	11.96±0.49	13.74±0.70
T_6	7.63±0.30	11.71±0.39	12.70±0.76	13.14±0.48	13.59±0.40
T_7	9.53±0.46	12.83±0.32	13.38±0.74	14.16±	14.75±0.40
CD	2.27	1.209	N/A	1.513	1.423
SE (m)	1.034	0.549	0.867	0.687	0.646

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference p<0.05% by the op-stat.

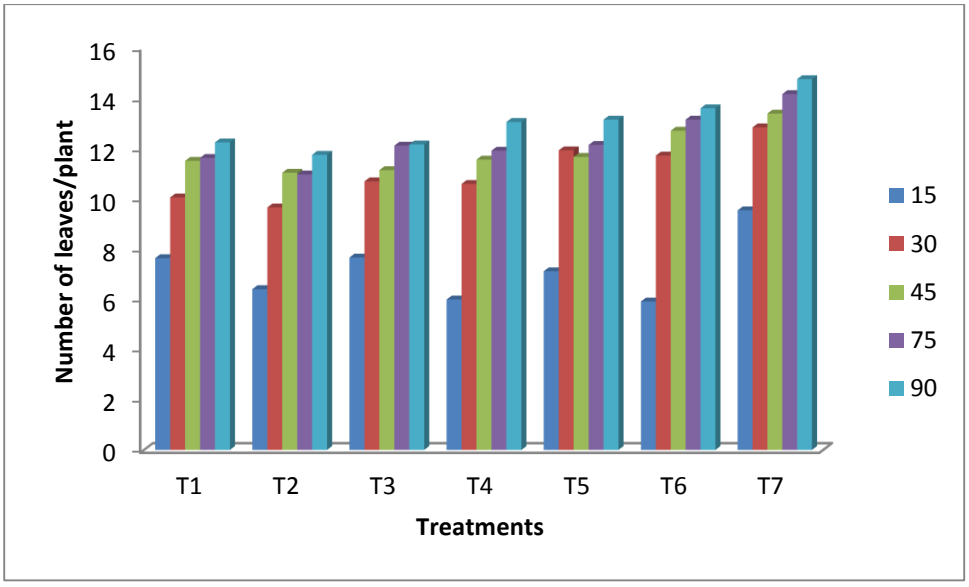


Figure: 4.1.2 Number of green leaves per plant as influenced of crop geometry.

4.1.3 Stem diameter

In the present study showed in (Table: 4.1.3) that the 15th day, 30th day and 75th DAS gave the significant result of the stem diameter on the treatments, where as the 45th day and 90th day after sowing show non-significant difference between the treatments. The result obtained T7 is the best at the 15(0.398), 30(o.78), 45(0.89), 75(1.22) and 90(1.947) DAS. Khalid Mahmud *et.al* (2003) showed that 100kg/ha. N and 50 kg/ha P and 25kg/ha K significantly gave the best result of the stem diameter. Similar result was recorded by Sadur rehman *et al.* (2010), who found that maximum stem diameter because this is also the part of growth as influenced by the use of NPK levels 80-60-30 kg/ha. And also Muchow and Davis, (1988), who reported that the Nitrogen, phosphorus and Pottassium influence the stem diameter in cereal crops as compare to other treatments. Amujoyegbe *et al.* (2007) and Egerszegi (1990) who reported that increased stem diameter because the growth is dependent on the Nitrogen, Phosphorus in the Poultry Manure and micro nutrients also in this. The application of Poultry Manure because the carbon content, water holding capacity, soil aggregation and decrease the bulk density. Poultry Manure also improves the pore space, nitrogen, phosphorus and micro nutrients and microbial content in the soil. Nitrogen is mainly increased the growth of the plant then the leaf area index automatically increased.

Table: 4.1.3 Stem diameter (mm) of wheat as influenced crop geometry.

Treatments	**Stem diameter (mm)**				
	15 DAS	**30 DAS**	**45 DAS**	**75 DAS**	**90 DAS**
T_1	0.38±0.01	0.76±0.01	0.83±0.03	0.90±0.02	1.43±0.11
T_2	0.33±0.09	0.74±0.00	0.87±0.01	0.95±0.01	1.03±0.01
T_3	0.38±0.01	0.74±0.02	0.81±0.03	0.91±0.03	1.49±0.23
T_4	0.33±0.09	0.76±0.01	0.86±0.02	0.90±0.03	1.40±0.17
T_5	0.35±0.07	0.68±0.02	0.81±0.01	0.91±0.02	1.67±0.29
T_6	0.37±0.01	0.66±0.01	0.83±0.00	0.86±0.01	1.55±0.17
T_7	0.39±0.01	0.78±0.01	0.89±0.01	1.2±0.11	1.94±0.04
CD	0.036	0.056	N/S	0.158	N/S
SE (m)	0.016	0.025	0.036	0.072	0.256

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the opstat.

4.1.4 Leaf Area Index

The present study pertaining to influenced organic and inorganic such as Poultry Manure, vermiwash, vermicompost, cattle sullary and NPK on leaf area index. The (Table 4.1.4) showed that leaf area index periodically at 15, 30, 45, 75 and 90 DAS highest with the application of T7 (RDF). It was significant difference from the other fertilizer. Among the fertilizer the maximum leaf area index was noticed in the treatment T_7 with 1.24, 2.49, 5.24, 5.66 and 6.38 at 15, 30, 45, 75 and 90 DAS. And it was also found at par result with the application of T_2 (Poultry Manure) with 1.23, 2.48, 5.22, 5.63 and 6.35 at different interval of days 15, 30, 45, 75 and 90 DAS. The proportional increases in leaf area index up to 90 days with the application of NPK. Similar result was recorded by Sadur rehman *et al.* (2010), who found that maximum leaf area index at the NPK levels 80-60-30 kg/ha. And also Muchow and Davis, (1988), who reported that the nitrogen influence the leaf area index in cereal crops as compare to other treatments. Amujoyegbe *et al.* (2007) who reported that increased leaf area/plant and leaf area index the application of Poultry Manure because the carbon content , water holding capacity, soil aggregation and decrease of bulk density. Poultry Manure also improves the pore space, nitrogen, phosphorus and microbial content in the soil. Nitrogen is mainly increased the growth of the plant then the leaf area index automatically increased.

Table: 4.1.4 Leaf area index per plant of wheat as influenced of crop geometry.

Treatments	**Leaf area index**				
	15 DAS	30 DAS	45 DAS	75 DAS	90 DAS
T_1	1.13±0.01	2.27±0.08	4.76±0.08	5.15±0.09	5.80±0.10
T_2	1.23±0.06	2.48±0.09	5.22±0.19	5.63±0.20	6.35±0.23
T_3	1.11±0.07	2.22±0.02	4.67±0.05	5.05±0.05	5.69±0.06
T_4	1.14±0.01	2.29±0.04	4.82±0.08	5.21±0.09	5.87±0.10
T_5	1.11±0.01	2.23±0.10	4.69±0.21	5.07±0.23	5.71±0.26
T_6	1.10±0.01	2.21±0.03	4.64±0.07	5.02±0.07	5.65±0.08
T_7	1.24±0.01	2.49±0.06	5.24±0.12	5.66±0.13	6.38±0.15
CD	0.092	0.182	0.383	0.416	0.467
SE (m)	0.042	0.083	0.174	0.189	0.212

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the opstat..

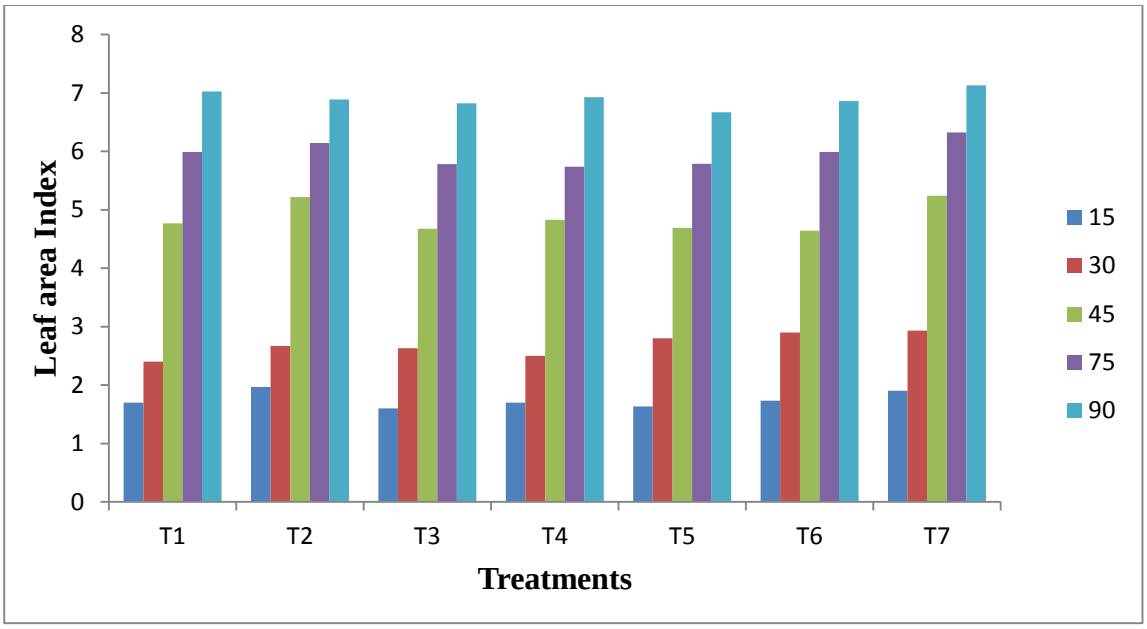


Figure: 4.1.4 Leaf area index per plant of wheat as influenced of crop geometry.

4.1.5 Leaf Area per Plant

In the present studies, (Table: 4.1.5) there was significant difference between treatments for leaf area per plant at 15, 30, 45, 75 and 90 DAS. The highest leaf area was obtained from the application of T7 (NPK) at respectively i.e. 44.69, 89.83, 188.64, 203.93 and 229.71 at the stage of 15, 30, 45, 75 and 90 DAS. The lowest leaf area was obtained in the treatment T6 (Cattle Slurry + vermiwash) with 39.61, 79.63, 168.22, 180.64 and 205.2 at the stage of 15, 30, 45, 75 and 90 DAS respectively. On the other hand with the application of T2 (Poultry Manure) registered leaf area at par where the leaf area was recorded 44.52, 89.48, 187.92, 203.01 and 228.83 after sowing 15, 30, 45, 75 and 90 DAS respectively. These result were line with the finding of Amanullah *et al.* (2009) who studied the effect of the NPK 160-60-40 kg/ha in the present investigation the leaf area increased up to 90 DAS and decrease there after due to senescence and aging of leaf. In general, the application of organic and inorganic fertilizer show a profound effect over these parameters and significant differences were noticed among the fertilizers at all stages. However NPK recorded significantly higher leaf area index as compare to other fertilizers. Egerszegi (1990), Sharply and smith (1991) and Amujoyegbe *et al.* (2007) who reported that increased leaf area/plant because the application of Poultry Manure increased the carbon content , water holding capacity, soil aggregation and decrease of bulk density.

Table 4.1.5 Leaf area per plant cm^2 of wheat as influenced of crop geometry.

Treatments	Leaf area/plant				
	15 DAS	30 DAS	45 DAS	75 DAS	90 DAS
T_1	13.55±0.25	33.88±0.62	60.98±1.12	134.15±2.48	146.35±2.70
T_2	14.84±0.54	37.10±1.35	66.78±2.43	146.91±5.35	160.27±5.83
T_3	13.29±0.14	33.23±0.37	59.82±0.67	131.62±1.47	143.59±1.60
T_4	13.72±0.25	34.30±0.62	61.74±1.13	135.82±2.50	148.17±2.72
T_5	13.34±0.62	33.34±1.55	60.03±2.80	132.06±6.17	144.07±6.73
T_6	13.20±0.20	33.01±0.50	59.42±0.90	130.73±1.98	142.61±2.16
T_7	44.08±0.21	37.24±0.90	67.03±1.63	147.48±3.58	160.88±3.91
CD	0.35	2.72	4.90	10.79	11.77
SE (m)	4.37	1.23	4.38	4.90	5.34

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference p<0.05% by the op-stat.

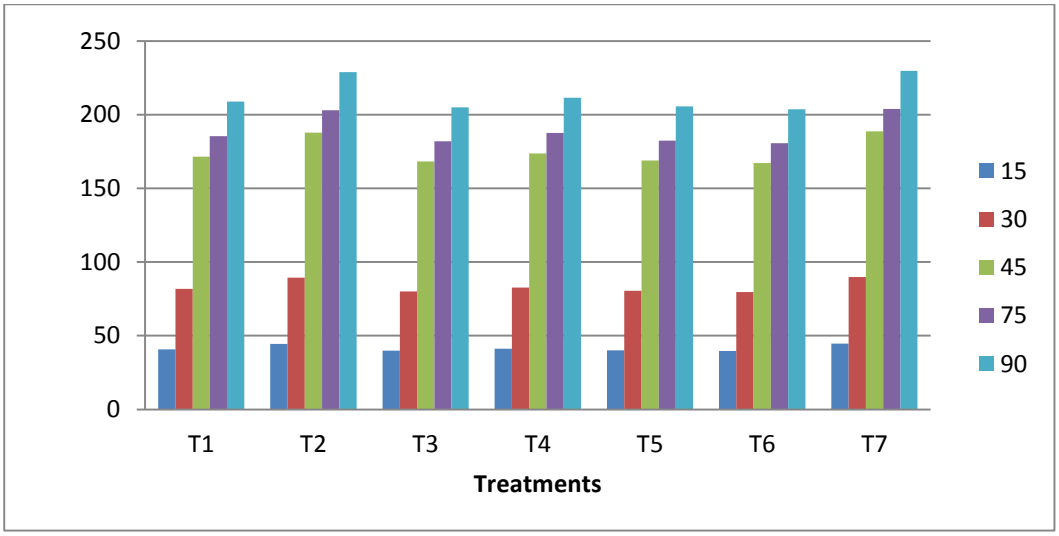


Figure: 4.1.5 Leaf area per plant cm^2 of wheat as influenced of crop geometry.

4.1.6 Accumulation growth rate

The data presenting in (Table: 4.1.6) revealed that there were significant difference between treatments for accumulation growth rate with the application of organic and inorganic fertilizers (Cattle Slurry, Poultry Manure, vermicompost, vermiwash and NPK). The maximum accumulation growth rate was recorded in the treatment T7 (NPK) with 0.20, 0.98, 0.73 and

0.181 at 30, 45, 75 and 90, followed by T2 (Poultry Manure) 0.19, 0.18, 0.068 and 0.17 at 30, 45, 75 and 90 DAS respectively. The least accumulation growth rate was recorded in T3 (vermicompost) with 0.168, 0.164, 0.06 and 0.15 at the stage of 30, 45, 75 and 90 DAS respectively among the fertilizer, NPK maintain significantly higher AGR but T4 also showed significantly higher AGR. The present finding on AGR are in accordance with the result of Fabiye and Oguunfowora (1992) found that Poultry Manure gave the best result after the NPK because the bulk density, organic carbon, microbial content was increased by the use of Poultry Manure then effect on the number of leaves it was depend on the condition of soil.

Table 4.1.6 Accumulation growth rate AGR (g/plant/day) of wheat as influenced of crop geometry.

Treatments	**Accumulation growth rate (g/plant/day)**			
	30 DAS	**45 DAS**	**75 DAS**	**90 DAS**
T_1	0.190±0.010	0.185±0.010	0.068±0.004	0.169±0.009
T_2	0.197±0.010	0.185±0.009	0.068±0.003	0.170±0.008
T_3	0.168±0.050	0.164±0.005	0.06±0.002	0.150±0.005
T_4	0.194±0.006	0.189±0.006	0.07±0.002	0.173±0.006
T_5	0.184±0.004	0.179±0.004	0.066±0.001	0.164±0.003
T_6	0.189±0.008	0.184±0.008	0.068±0.003	0.168±0.007
T_7	0.203±0.002	0.198±0.002	0.073±0.001	0.181±0.002
CD	0.018	0.018	0.007	0.016
SE (m)	0.008	0.008	0.003	0.007

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the op-stat.

4.1.7 Crop growth rate

The data presenting in (Figure 4.1.7) revealed that there were significant difference between treatments for crop growth rate with the application of organic and inorganic fertilizers (Cattle Slurry, Poultry Manure, vermicompost, vermiwash and NPK). Crop growth rate was also depend on dry matter production and spacing of the crop it was mainly increased by the use of NPK control The maximum crop growth rate was recorded in the treatment T7 (NPK) with 7.31, 7.11, 2.61 and 6.51 at 30, 45, 75 and 90 DAS and at par result in the T2 (Poultry Manure) 6.85, 6.67, 2.45 and 6.10 at 30, 45, 75 and 90 DAS respectively.

The minimum crop growth rate was obtained in T3 (vermicompost) with 6.055, 5.89, 2.16 and 5.39 at the stage of 30, 45, 75 and 90 DAS. Ghulam mustafa laghari *et al.* (2010) who reported that NPK was increased the crop growth rate at the rate of 120-60-60 kg/ha.

Table: 4.1.7 Crop growth rate CGR ($g/cm^2/day$) of wheat as influenced of crop geometry.

Treatments	**Crop growth rate CGR ($g/cm^2/day$)**			
	30 DAS	**45 DAS**	**75 DAS**	**90 DAS**
T_1	6.84±0.37	6.66±0.36	2.45±0.42	6.10±0.13
T_2	6.85±0.34	6.67±0.33	2.45±0.14	6.10±0.12
T_3	6.05±0.19	5.89±0.18	2.16±0.20	5.39±0.06
T_4	6.99±0.22	6.80±0.21	2.50±0.13	6.23±0.08
T_5	6.63±0.13	6.46±0.12	2.37±0.22	5.91±0.04
T_6	6.79±0.30	6.61±0.29	2.43±0.04	6.05±0.10
T_7	7.31±0.07	7.11±0.07	2.61±0.13	6.51±0.02
CD	0.655	0.637	0.234	0.583
SE (m)	0.297	0.289	0.106	0.265

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the op-stat.

4.1.8 Net Accumulation Rate

Result pertaining to net assimilation rate presented in (Table: 4.1.8) indicated net accumulation rate was non-significant difference in organic and inorganic fertilizers at 30, 45, 75 and 90 DAS respectively. Net Accumulation Rate, synonymously called as 'unit leaf rate' and express the rate of dry weight increases at any instant on a leaf area basis with leaf representing an estimate of the size of the assimilatory surface area. The present study on T7 (NPK) show better significant result with 1.44, 2.66, 0.35 and 0.75 at 30, 45, 75 and 90 DAS respectively. After that treatment followed by the T2 (Poultry Manure) 1.34, 2.49, 0.29 and 0.50 at 30, 45, 75 and 90 DAS. Where, as show least result as far as performance T1 (cattle slurry) and T4 (vermiwash) as compare to other treatments as far as. T7 perform significant for NAR. It can be easily concluded from present investigation that higher NAR can be obtain by using NPK in wheat crop. During different crop growth stages variation in absolute growth rate were observed because of plant population density, variation in dry matter production per plant and it was also depend on the leaf area of the plant. If dry matter

production and leaf area was increased then it increased the NAR also. Plant population increased per ha resulted to lower light interception, produce less dry matter production per plant and leaf area which was correlated with low net accumulation rate. In the increment Ghulam mustafa laghari *et al.* (2010) who reported that NPK was increase the Net accumulation rate of wheat at the rate of 120-60-60 kg/ha NPK gave the higher growth compare the organic fertilizer.

Table: 4.1.8 Net accumulation rate (g/cm^2/day) of wheat as influenced of crop geometry.

Treatments	**Net accumulation rate (g/cm^2/day)**			
	30 DAS	**45 DAS**	**75 DAS**	**90 DAS**
T_1	1.101±0.110	1.686±0.166	0.160±0.039	0.487±0.195
T_2	1.343±0.297	2.497±0.647	0.294±0.108	0.509±0.13
T_3	0.947±0.069	1.915±0.366	0.241±0.085	0.336±0.174
T_4	0.761±0.387	2.313±0.321	0.169±0.058	0.341±0.151
T_5	1.073±0.203	1.5±0.416	0.246±0.089	0.492±0.27
T_6	0.555±0.001	1.19±0.216	0.212±0.028	0.441±0.186
T	1.445±0.233	2.668±0.504	0.353±0.071	0.758±0.285
CD	N/S	N/S	N/S	N/S
SE (m)	0.302	0.612	0.095	0.229

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the op-stat.

4.1.9 Dry matter accumulation

In the present study, (Table: 4.1.9) there was significant difference between the treatments of dry matter accumulation at the 15, 30, 45, 75 and 90 DAS. The maximum result was obtained by the treatment of T7 NPK 2.72, 5.76, 8.73, 10.91 and 13.62 at 15, 30, 45, 75 and 90 DAS and followed by the T4 at 15,30 DAS with 2.6, 5.51 respectively at rest days T2 (Poultry Manure) with 8.35, 10.43 and 13.03 at 45, 75 and 90 DAS. And the minimum result was obtained in T3 (Vermicompost) 2.25, 4.77, 7.23, 9.04 and 11.28 at the stage of 15, 30, 45, 75 and 90 DAS. During all crop growth stages it was the mainly depend on the weight of the plant in this study higher weight of plant obtained by the use of NPK compare the organic manures but the Poultry Manure also give the significant result another treatments. Singh and

Jain (2000) founded that dry matter accumulation was increased with the help of NPK fertilizers 120-60-30 kg/ha and De doomy *et al.* (1978) also revealed that NPK gave the beat result for dry matter accumulation.

Table: 4.1.9 Dry matter accumulation g/plant of wheat as influenced of crop geometry.

Treatments	Dry matter accumulation g/plant				
	15 DAS	30 DAS	45 DAS	75 DAS	90 DAS
T_1	2.55±0.13	5.403±0.29	8.177±0.44	10.22±0.55	12.763±0.60
T_2	2.55±0.08	5.407±0.17	8.35±0.40	10.437±0.51	13.037±0.60
T_3	2.253±0.07	4.773±0.15	7.23±0.23	9.04±0.28	11.283±0.30
T_4	2.6±0.12	5.517±0.27	8.187±0.26	10.23±0.33	12.777±0.40
T_5	2.47±0.04	5.237±0.10	7.93±0.15	9.91±0.19	12.373±0.20
T_6	2.527±0.11	5.357±0.23	8.11±0.36	10.137±0.44	12.66±0.50
T_7	2.723±0.02	5.767±0.05	8.733±0.08	10.91±0.11	13.623±0.10
CD @5%	0.243	0.516	0.781	0.974	1.219
SE (m)	0.11	0.234	0.355	0.442	0.553

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the opstat method.

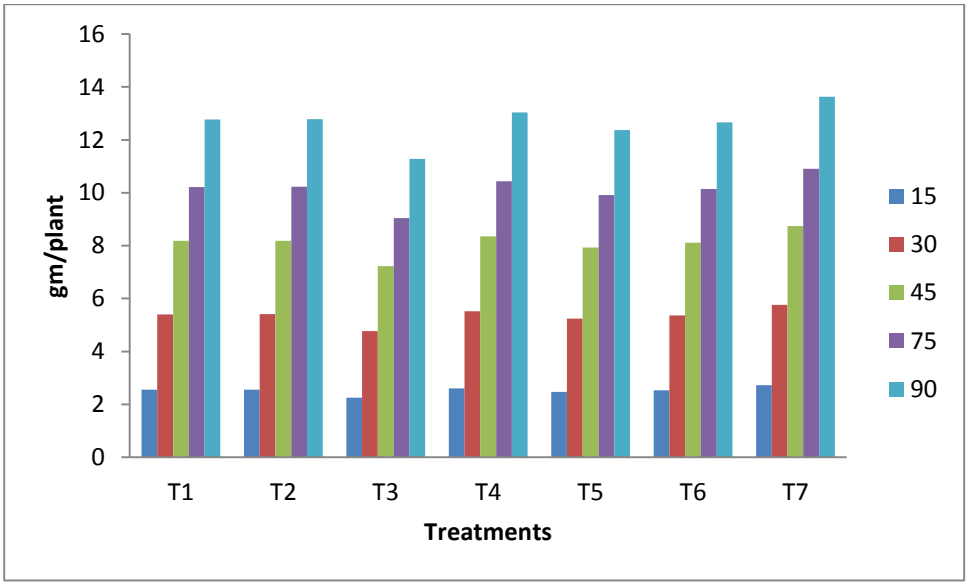


Figure: 4.1.9 Dry matter accumulation g/plant of wheat as influenced of crop geometry.

4.1.10 Chlorophyll content

The result pertaining to chlorophyll content in leaf as presenting in (Table 4.1.10) the table showed that significant result at the stage of 15, 30, 45 and 90 DAS, whereas the non-significant result was observed in the stage of 75 DAS. The maximum chlorophyll was observe in T7 (NPK) 1.91, 2.51, 4.86, 5.14 and 5.57 at 15, 30, 45, 75 and 90 DAS respectively, which was statistically followed by T2 with 1.86, 2.091, 4.60 and 5.21 respectively. The minimum chlorophyll content was found in T1 (Cattle Slurry) with 1.76, 2.009, 4.23, 4.71 and 4.67 $\mu g/cm^{-2}$ respectively. Biljana Bojovic *et.al* (2009) showed that the NPK gave the higher amount of the chlorophyll content in the leaves because the photosynthesis is higher in green leaves. Egerszegi, (1990), Sharply and Smith, (1991) and Amujoyegbe *et al.* (2007) who reported that Poultry Manure also give the significant result for the chlorophyll content because the growth of the crop was significantly improve by the use of this, the growth of the plant was also increase the chlorophyll content it is mainly maximum in green leaves plant.

Table: 4.1.10 Chlorophyll content (mg/g/leaf) of wheat as influenced crop geometry.

Treatments	**Chlorophyll content (ug/cm^2/ leaf)**				
	15 DAS	**30 DAS**	**45 DAS**	**75 DAS**	**90 DAS**
T_1	1.765±0.02	2.009±0.01	4.239±0.15	4.718±0.27	4.679±0.04
T_2	1.86±0.01	2.091±0.04	4.606±0.08	4.761±0.35	5.21±0.04
T_3	1.795±0.01	2.058±0.09	4.263±0.06	4.669±0.04	4.468±0.12
T_4	1.80±0.02	2.273±0.05	4.197±0.13	4.455±0.12	5.179±0.04
T_5	1.808±0.03	2.047±0.07	4.217±0.25	4.562±0.04	4.953±0.07
T_6	1.793±0.01	2.164±0.11	4.252±0.14	4.218±0.09	5.048±0.09
T_7	1.91±0.01	2.515±0.08	4.865±0.11	5.142±0.39	5.57±0.02
CD	0.059	0.174	0.418	N/S	0.242
SE (m)	0.027	0.079	0.19	0.263	0.11

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the op-stat.

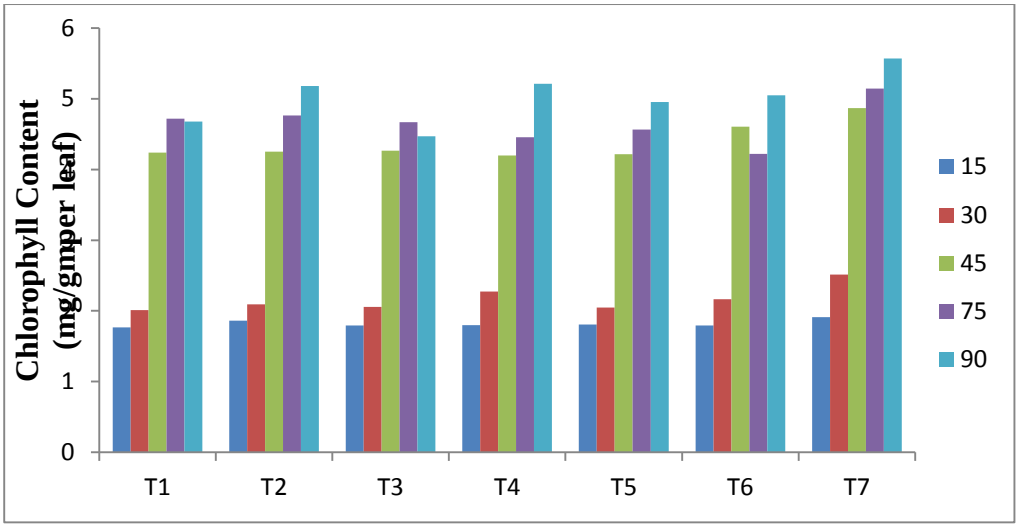


Figure: 4.1.10 chlorophyll content (mg/gm/leaf) of wheat as influenced crop geometry.

4.2 Soil parameters

4.2.1 pH

The table 4.13.1 result showed that pH increase at the level of different level of organic and inorganic fertilizer. Result obtained significantly of the all treatment but the T7 treatment increased with the value of pH 8.06 % at the harvest of the crop. And other hand T2 (Poultry Manure) maintain the value of the pH value. Because the Poultry Manure maintain the soil health, water holding capacity and bulk density decreased compare to the NPK then maintain the pH value.

4.2.2 Electrical conductivity

Electrical conductivity reflects soil salinity. Saline soil increases the osmotic pressure and affects considerably of the particular crops to extract water and nutrients. The use of ground water founded the saline soils. Table: 4.2.1 showed that the treatment T7 (NPK) increase the value of EC. And the other hand organic manures gave the significant result of the EC value.

4.2.3 Organic carbon

The organic matter (Table 4.2.1) consists of plant and animal residues at vigorous stages of decomposition. In the NPK organic matter in lower amount because these are the chemical fertilizer compare to the other treatments. In present study maximum amount of organic found in T2 (Poultry Manure) with 0.52 and followed by all treatments but except the

T7 (NPK). Mainly highly decomposition in the organic manures because they not effect on the bacteria and fungi they are mainly helpful in decomposition of residues.

Table: 4.2.1 Effect of treatments on pH, EC and organic carbon

Treatment	pH	EC ds/m	OC %
T_1	7.46±0.08	0.29±0.009	0.340±0.006
T_2	7.26±0.12	0.25±0.003	0.521±0.009
T_3	7.73±0.08	0.30±0.009	0.401±0.006
T_4	7.50±0.05	0.32±0.006	0.421±0.006
T_5	7.73±0.12	0.30±0.012	0.432±0.019
T_6	7.74±0.08	0.28±0.009	0.431±0.015
T_7	8.06±0.033	0.40±0.009	0.373±0.012
CD	0.291	0.036	0.036
SE(m)	0.093	0.012	0.012

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the opstat

4.2.4 Nitrogen, Phosphorus and Pottassium

In the present study result founded that at the harvest of the crop N value will be increased by the use of organic and chemical fertilizer. Maximum result was recorded by the use of T2 (Poultry manure) with 250.8 and the followed result given by T4 with 239.8 at the harvest.

In the Phosphorus present study shown that the P value increased by the Organic manure because Inorganic Manures are leach down in this study maximum result was founded with the use of T2 (Poultry Manure) with 28.65 and followed by the T6 (Cattle slurry + Vermiwash)

Pottassium value was depend on the Organic and chemical fertilizers but in that present study result founded that at harvest maximum K given by the T4 with 309.6 and followed by T7 258.2 because in vermiwash founded the maximum amount of Pottassium.

Table: 4.2.4 Effect of different treatments on Nitrogen, Phosphorus and Pottassium.

Treatments	Nitrogen (N) kg/ha	Phosphorus (P) kg/ha	Pottassium (K) kg/ha
T_1	197.0±6.30	21.35±0.85	201.23±9.06
T_2	250.8±5.50	28.65±0.45	237.45±8.15
T_3	231.55±1.55	27.35±0.05	258.2±6.9
T_4	239.8±0.50	25.55±0.55	209.6±0.5
T_5	215.2±2.89	25.1±1.10	233.02±0.08
T_6	219.70±0.39	28.2±0.90	232.6±0.5
T_7	232.20.89	25.8±0.5	233.95±1.64
CD	12.84	2.51	19.80
SE(m)	3.64	0.713	5.61

T1-Cattle Slurry@ 10%, T2-Poultry Manure 5t/ha, T3- Vermicompost 5q/ha, T4- Vermiwash @10 foliar application, T5-Poultry Manure + vermiwash, T6- Cattle Slurry + vermiwash Value for each growth of stages significant difference $p<0.05\%$ by the op-stat

CHAPTER-5

CONCLUSION AND SUMMARY

A field experiment was conducted at main Agriculture research field, Lovely Pofessional university, Phagwara Punjab is situated in the (PB-3) Central Zone of the state Punjab on clayey loam soil to study "Effect of organic and chemical fertilizers on growth of wheat and soil properties (Triticum aestivum L.) 2014. The experiment was laid out in Randomized Complete Block Design (RCBD) there were 7 organic and inorganic treatments viz., T1 Cattle Slurry(10), T2 Poultry Manure (5tonne/ha),T3 vermicompost (5q/ha), T4 vermiwash (10% foliar application), T5 Poultry manure + vermiwash, T6 Cattle slurry + vermiwash, T7 NPK (50+25+12 kg/ha) as a control used this treatment.

5.1 Effect of Organic and inorganic fertilizer on growth of Wheat

At all the growth stage crop geometry, high plant population T7 recorded significantly taller plant at the all stages per plant followed by T2 with 7.30 cm, 15.41 cm, 33.93 cm, 70.46 cm, 81.2 cm and 7.13 cm, 15.15 cm, 33.43 cm, 68.90 cm and 78.66 cm at 15, 30, 45, 75 and 90 DAS. Higher leaf area/plant recorded at T7 with 15.20 cm^2, 37.24 cm^2, 67.03 cm^2, 147.48 cm^2 and 160.88 cm^2 followed by the treatment T2 with 14.84 cm^2, 37.10 cm^2, 66.78 cm^2, 146.91 cm^2 and 160.27 cm^2 respectively. And the higher number of leaves founded at all growth stages by the T7 with 9.53, 12.83, 13.38, 14.16 and 14.75 and followed by the T2 7.64, 11.72, 12.76, 13.19 and 13.64 significantly result given by these treatments.

Stem diameter was the main in plant growth because whole part is dependent on the stem. Significantly increased the stem diameter at 15, 30, 45, 75 and 90 DAS T7 given best result with 0.39 mm, 0.78 mm, 0.89 mm, 1.2 mm and 1.94 mm and followed by the T2 0.38 mm, 0.77 mm, 0.87 mm, 0.95 mm and 1.55 mm respectively.

Leaf area index was also depend on the growth of the crop it was also given the significant result by T7 with 1.24 cm^2, 2.49 cm^2, 5.24 cm^2, 5.66 cm^2 and 6.38 cm^2 and followed by the T2 1.23 cm^2, 2.48 cm^2, 5.22 cm^2, 5.63 cm^2 and 6.35 cm^2 higher plant growth recorded at control T7 but compare the other manures T2 (poultry manure) given the best result.

In this recorded significantly higher Absolute Growth Rate at 30 45, 75 and 90 DAS by the T7 with 0.20 g/plant/day, 0.19 g/plant/day, 0.073 g/plant/day and 0.181 g/plant/day and followed by T2 0.191 g/plant/day, 0.186 g/plant/day, 0.069 g/plant/day and 0.174 g/plant/day respectively. And the crop growth rate was observed maximum in T7 with 7.31 g/cm^2/plant, 7.11 g/cm^2/plant, 2.61 g/cm^2/plant and 6.51 g/cm^2/plant and the followed result founded in T2 with 6.85 g/cm^2/plant, 6.67 g/cm^2/plant, 2.45 g/cm^2/plant, 6.10 g/cm^2/plant at 30, 45, 75 and 90 DAS respectively. Net accumulation growth rate was founded maximum in T7 1.44 g/cm^2/day, 2.66 g/cm^2/day, 0.35 g/cm^2/day and 0.75 g/cm^2/day on the other hand followed result were found in T2 1.34 g/cm^2/day, 2.49 g/cm^2/day, 0.29 g/cm^2/day and 0.50 g/cm^2/day at 30, 45, 75 and 90 DAS.

Dry matter accumulation rate was found in maximum T7 with 2.72 g/plant, 5.76 g/plant, 8.73 g/plant, 10.91 g/plant and 13.62 g/plant and the followed result were obtained in T4 2.6 g/plant, 5.51 g/plant at 15 and 30 DAS, T2 given at 45, 75, 90 DAS in T2 8.35 g/plant, 10.43 g/plant and 13.03 respectively. And the chlorophyll content was also founded maximum inT7 1.91ug/cm^2/leaf, 2.51 ug/cm^2/leaf, 4.86 ug/cm^2/leaf, 5.14 ug/cm^2/leaf and 5.57 ug/cm^2/leaf and the followed result were found in T2 1.86 ug/cm^2/leaf, 2.01 ug/cm^2/leaf, 4.60 ug/cm^2/leaf and 5.21 ug/cm^2/leaf at 15, 30, 45, 75 and 90 DAS respectively.

5.2 Effect of organic and inorganic fertilizer on soil

pH level is maintained by the use of organic manure compare the NPK because the NPK increased the EC, bulk density and the reduce the level of organic carbon. Mainly pH maintained by T2 at harvest 7.2 pH and increased by the T7 at harvest 8.06. EC value is also depend on the NPK with 0.40 because increased by the NPK and maintain by the organic manures mainly by the T2 0.25. Organic carbon mainly increased by the use of Organic Manure T2 gave the best result with 0.52 and reduced with the use of 0.37 respectively. Mainly this experiment concluded that poultry manure was best for soil health.

In Nitrogen maximum result were obtained by the use of T2 because the chemical manure earlier leach down. And the maximum value was recorded in T2 with 250.8 kg/ha and the other hand T4 given after the T2 best result for the Nitrogen 239.8 kg/ ha And the amount of Phosphorus will be also recorded in T2 with 28.65 kg/ha and followed by the T6 28.2 kg/ha respectively. Pottassium also recorde in T3 with 258.2 kg/ha and followed by T2

CHAPTER-6

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