Effect of organic and chemical fertilizer on yield and seed quality of wheat

Thesis

Submitted to the Lovely Professional University in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

IN

AGRONOMY

BY

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Under the supervision of

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CERTIFICATE

This is to certify that **Gagandeep Singh** bearing Registration no. **11302119** is doing Project titled, **"Effect of organic and chemical fertilizer on yield and seed quality of Wheat"** under my guidance and supervision. To the best of my knowledge, the present work is the result of his original investigation and study. No part of the project has ever been submitted for any other degree at any University. The project is fit for submission and the partial fulfilment of the conditions for the award of degree of M.Sc. in Agronomy.

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Declaration

I hereby declare that the project work entitled "**Effect of organic and chemical fertilizer on yield and seed quality of Wheat**" is an authentic record of my work carried out at Lovely Professional University as requirements of Project work for the award of degree of Master of Science in Agronomy, under the guidance of Dr. Amit Kesarwani, Designation: Assistant Professor, School of Agriculture, Lovely Professional University, Jalandhar, Punjab, India.

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Gagandeep Singh

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Terminology

NPK	- Nitrogen, Phosphorus, Potassium
cm	- centimeter
kg/ha	- kilogram per hectare
q/ha	- quintals per hectare
g	- gram
@	- at the rate
CD at 5%	- critical difference at 5% probability
SE (m) ±	- Standard error of mean
et al.	- et alia (and his associates)
%	- percent
ha^{-1}	-per hectare
viz	- namely
LPU	- Lovely Professional University
RCBD	- Randomized Complete Block Design
FYM	- Farmyard manure
Zn	- Zinc
Mn	- Manganese
Fe	- Iron
Cu	- Copper
RH	- Relative humidity

ABSTRACT

In sustainable agriculture, the major constraint seems to be the unbalanced application of nutrients which harmfully affects soil characteristics. The present investigation was carried out at lovely professional University, India during *Rabi* season 2014-15 to examine the Effect of organic and inorganic fertilizers on yield and seed quality of wheat *(Triticum aestivum).* The experiment was done in Randomized Complete Block design (RCBD), with three replications comparing seven treatments were given *viz.* T1 (Cattle slurry); T2 (Poultry manure); T3 (Vermicompost); T4 (Vermiwash); T5 (Poultry manure + Vermiwash); T6 (Cattle slurry + Vermiwash) and T7 (Recommended dose of NPK). In this experiment the Different types of organic and inorganic fertilizer were used in the wheat crop. To study the various yield parameters and quality parameter to analysis the outcome from the experiment. The study revealed that treatment T7 (Recommended dose of NPK) lead to significant result in yield and yield parameters as compare with other treatments. Thus the use of recommended dose of nitrogen, phosphorus and potassium lead to enhancing the yield of wheat crop. Whereas in treatment T3 (Vermicompost) leads to better result in quality parameter as compare to other treatments. Thereby it will be recommended to increase the yield parameters (NPK) and quality (Vermicompost) than other based on our studies.

Keywords: Sustainable, LPU, Organic fertilizers, Inorganic fertilizers, Yield, Quality, Wheat *(Triticum aestivum)*, RCBD, Cattle slurry, Poultry manure, Vermicompost, Vermiwash, NPK.

Chapter I

INTRODUCTION

Wheat considered as the highest cultivated crop all around the world. It is a good source of protein and provides a large fraction of the total food supply. Wheat is mainly grown in Punjab and some other states of India, but now cultivated worldwide. Total production of wheat all around world in 2013 year was 713 million tons, after maize (1016 million tons), and rice was third (745 million tons). The wheat considered grown under larger area than any other commercial food. Wheat has higher protein content than other major cereals crops, corn or rice. Wheat is a *Rabi* season crop of Central Zone and North Western Plain zone of India. Wheat grains are comparatively better source of protein consumed in India. Wheat fulfills the 10-20% requirement of protein in India. The productivity of the wheat crop and the protein content could be increased by the use of different fertilizers. The imbalanced and heavy use of chemical fertilizer are two most important factors has led to think about the use of vermicompost, poultry manure etc. in growing areas for sustainable production system. To achieve the potential of production and sustainability of crop, higher uses of vermicompost, poultry manure and their scientific management is very important. It must be stressed that the value of FYM, poultry manure, cattle slurry and vermicompost in soil improve the nutrient content, while helping in the improvement of water holding capacity and soil structure of soil (Kale and Bano, 1986 and Srivastava, 1998). The seed produced under organic system has to be used for organic crop production. For the sake of continuing world energy crisis and spiraling price of chemical fertilizer, the use of organic manure as a renewable source of plant nutrients is assuming importance. In this endeavor proper blend of organic manure and inorganic fertilizer is important not only for increasing yield but also for sustaining soil health (Kumar *et al.*, 2013).

Organic manure increases the accumulation of the soil organic carbon (SOC), quality and quantity of various classes of organic compounds. Research on SOC following crop residue has been mainly focused on changes of bulk organic carbon (Sebastia *et al.*, 2007). It is seen that the integrated use of concentrate organic materials and inorganic fertilizers has received considerable attention in the past with a hope of meeting the farmer’s economic need.

Regular use of a reasonable dose of organic manure, along with crop residue recycling, is known to cater the nutrient requirements of a low to medium intensity rice-wheat cropping system. However, most of the long term integrated nutrient management field research in South Asia pertains to rice-wheat system. The integrated nutrient management helps to restore sustain fertility and crop productivity. It may also help to check the emerging deficiency of nutrients other than N, P and K that brings economy and efficiency in fertilizers. The necessary nutrient management favorably affects the physical, chemical and biological environment of soil. Keeping this in mind, the present investigation was carried out to study the influence of yield of wheat and growth of wheat by organic and inorganic sources of nutrients with residual effect under different fertility levels. Increment in production to meet the demands of increasing population is possible only by increasing the average yield. This can be achieved through efficient resource utilization, better management and precise farming. Moreover, continuous depletion of the ground water-table, deterioration, soil health, stagnated yield levels and green revolution fatigue makes imperative to search for new strategies.

Nitrogen is the major nutritional element required by the plants in large amount, being an important constituent of amino acids and thus proteins. Nitrogen plays an important role in growth and development processes. Hence, growth, development and yield are directly related to availability of nitrogen through the rate, timing and methods of application.

Vermicompost is rich in microbial populations and diversity, particularly fungi, bacteria, and actinomycetes (Edwards, 1988, Tomati, 1995) 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).

The application of farmyard manure to soil have increased crop yield, improved soil fertility, increased soil organic matter, improved soil structure. The proper combination of both organic and inorganic fertilizers has better effects on crop growth and development and yield component of wheat. In the intensive cropping system which is the present day slogan, the soil gets depleted in respect of plant nutrients. Moreover this cropping system delays the sowing of wheat. It is roughly estimated that about 1/3 of the area under wheat in Punjab is grown under late sown conditions. There are two possibilities about fertilization of the late sown crop. According to one school of thought the doses of fertilizer for late sown wheat should be increased in order to boost of growth of crop and to compensate the loss in length of growing period caused by delays in sowing. According to second way of thinking the fertilizer dose has to be reduced because the crop cannot be expected to absorb and utilize higher doses for production of grains in comparatively shorter period. Information is, however, lacking on this aspect.

Among the major nutrients needed by wheat crop, nitrogen and phosphorous are of low to medium status in Punjab soils. The application of these nutrients, therefore, plays a major role for successful rising of wheat crop. It has been reported that nitrogen and phosphorous are very much related to each other and these nitrogen supplement the uptake of each other by the plant. Nitrogen increases he vegetative growth of wheat and phosphorous strengthens the root system in the soil, strengthens the stem resulting into reduced lodging and induces earliness in maturity. In order to study the combined effect of nitrogen and phosphorous on the production of wheat and also to know how far the belief of higher doses for late sown wheat is true and if so, what part is played by these two nutrients (Nitrogen and phosphorous) individually or in combination with each other for increasing yield under late sown condition (Stat. Abst. 1972)

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SCOPE OF THE STUDY

It is very necessary to produce agricultural products free from any harmful chemicals. Organic farming is best source of attaining the goals of sustainable agriculture organic farming mainly leads to the use of organic manures such as Farm Yard Manure (FYM), poultry manure, vermicompost etc. growing of wheat crop which are very beneficial for increasing the nutrient levels in the soil for availability to plants absorption, these all are eco-friendly and not harmful for the environment and by using them fertility of soil can be improved and now there are many biological controls are available for controlling the insect pests. By which we are not going to harm to organisms such as pollinators (birds, honey bee, bats etc.). Vermicompost technology has promising potential to meet the organic manure requirement in both irrigated and rain fed areas. Thus various economic uses can be obtained from organic wastes, garbage and prevent pollution. Organic manure increases the fertility and productivity of the soil and less damage to the environment.

OBJECTIVES OF THE STUDY

1. To study the effect of organic and chemical fertilizers on yield attributes of wheat.
2. To study the effect of organic and chemical fertilizers on seed quality of wheat.

Chapter II
REVIEW OF LITERATURE

The relevant research work carried out so far on some aspects of present investigation entitled, “Effect of organic and chemical fertilizer on seed quality and yield of wheat *(Triticum aestivum)*” has been reviewed.

2.1 EFFECT OF ORGANIC AND INORGANIC FERTILIZER

a) Yield Attributes

b) Seed Quality

a) Yield Attributes

Zahoor (2014) in an experiment conducted at Peshawar, in Farm Agricultural University during December 2009 to May 2010 to study the effect of efficient use of FYM on nitrogen uptake and increase the yield of wheat. The result of this experiment was show that the application of 9.5 tons FYM/ha before sowing, it increase the grain per spike, number spike/m^2, grain yield, 1000 grain yield compared with control. It was proved from the experimental results that the uses of FYM with urea before sowing have the potential to enhance the yield of wheat.

Abbas *et al.* (2012) conducted an experiment, where the farmers and researcher are interested in organic farming which is increasing yield of crop. Application of the different organic manures (poultry manure, farmyard manure, vermiwash etc) in combination with inorganic fertilizer to wheat crop provided a substitute under field condition. A field trial was perform for two years (2007-09) with the objective to find out the best combination and type of organic and inorganic fertilizers for the production wheat. The RBCD design of this experiment with three replications was taken for research. At maturity - number of spikelets/spike, plant height (cm), spike length (cm) and grain yield from 1m^2 area of randomly selected plants were recorded.

Bodruzzaman *et al.* (2010) conducted an experiment of 11 years study the effects of 9 treatments of organic manures with the combination of 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 plot, but compact in others. Available P improved in poultry manure plot. After 9 years, organic manure (%), total Nitrogen (%) and transferable Potassium (K) was decrease in inorganic fertilizers treatment and increased in organic manure treatments. The soil pH increased in poultry manure receiving treatments.

Meena *et al.* (2013) in another experiment worked on the effect of concentrate organic manure and levels of different nutrients on yield attributes of wheat and growth of wheat under different levels of fertility. The improvement in terms of growth parameters like, dry matter production, number of tillers, number of 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.

Vinay *et al.* (2013) in a field trial was conducted during the *rabi* season in 2006–07 and 2007–08 to study the influence 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 improved the yield attributes and growth of wheat. The mean grain yield increased by 8.1 and 22.4% with the use of 120 kg N/ha compared with 90 and 60 kg N/ha, respectively. The uptake of N, P and K by wheat straw and grain show rising tendency due to the treatments. Additions of these inputs show positive changes in available N content of the soil. Available P and K content also increased by FYM and nitrogen application.

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).

Essential nutrients are required by plants for their proper growth and yield. Nitrogen is a major macronutrient which is taken up by large amount. Plant growth and yield are limited more often by its availability. For obtaining maximum yield it is necessary to know optimum requirement of nitrogen. Use of chemical fertilizers for crop production started in 1950's in the developing countries and among these nitrogenous fertilizers are the main Jain *et al (1959)*. Panse and Khanna (1964) and Singh (1963) observed a significant increase in wheat yield as a result of nitrogen application. While, Gautam (1961) reported that grain yield and straw yield were affect differentially by nitrogen application, the ratio of grain to straw decrease with an increase in level of nitrogen fertilization. So, there is a need to work out optimum nitrogen rates go optimum growth and yield.

Singh (1964) observed a significant increase in plant height, effective tillers per palnt, number of total and fertile spikelets, grain per shoot ear, 1000 grain weight and grain yield with 40 lb N per acre compared with control. White *et al* (1965) and kansal (1967) reported that use of nitrogen improved the cation exchange capacity of roots resulting in higher nitrogen content, thus leading to increase in yield.

Ghosh and Mukhopadhly (1984) observed increased, number of ears, number of grains per/ear, plant height and test weight of wheat with an application of 40 kg N/ha, Prasad *et al* (1991) observed that use of nitrogen at lower rates (75 % of recommended i.e. 120 kg ha^{-1}) showed heavier weed growth resulting in lesser number of effective tillers/sq. m, grains/spike and thus significantly lower grain and straw yields. Lal (1984) Reported a significant increase in grain yield upto 80 kg N/ha, whereas Lal and Bhargava (1982) obtained highest grain and straw yield at 90 kg N/ha. And the difference between 90 and 120 kg N/ha was non-significant. Therefore, optimum dose needs to be worked out.

Misra *et al.* (1987) observed optimum N rate ranging from 115 to 167 kg N/ha. Mehta and Shekhawat (1972) from four levels of nitrogen (0, 33.6, 67.2, 100.8 kg N/ha) on a sandy loam soil reported significant increase is grain yield with application of 100.8 ka N/ha gave the highest yield (41.7 q/ha). Further increase in N dose above 120 kg ha^{-1} though increased the grain yield but not significantly (Malik 1981). Similarly, Sharma *et al* (1970), Agarwal *et* *al* (1972) and Kapur *et al* (1985) also recommended 120 kg N/ha as optimum dose for wheat for obtaining economic yield.

Singh *et al* (1992b) reported that all the growth and yield contributory characters including grain and straw yield were significantly higher at 120 kg N/ha as compared to lower rates of 80 and 100 kg N/ha. Also the protein content in grain significantly higher with increase in nitrogen level and was 7 percent more than lower rate of 100 kg N/ha raise in dry matter accumulation with increase in N rates has been observed by Chandra *et al* (1992). This led to increase in grain and straw yield upto 120 kg N/ha and further enhance in nitrogen rates decreased the growth and yield parameters.

The increasing levels of nitrogen significantly increased the number of plants/meter row length, spike length, grains/spike and test weight and grain yield upto 120 kg N/ha, but nitrogen content and its uptake by grain and straw was enhanced even upto 160 kg N ha^{-1}whereas significant increase in protein content was observed upto only 120 kg N/ha (Singh and Singh 1993). The decrease in yield could be due to decrease in nitrogen utilization efficiency with enhanced rate of N (Srivastava and Mehrotra 1982). Singh and Srivastava (1996) reported that every unit of nitrogen added increased yield upto 120 kg N/ha and at higher rates response to added nitrogen decreased. Lathwal *et al* (1991) found significant increase in grain (54.83 q/ha) and straw (67.24 q/ha) yields upto 120 kg N/ha though increase was observed even upto 160 kg N/ha which gave 55.12 q/ha grain and 69.24 q/ha straw yield. Kumar and Sharma (2000) studied influence of N on growth, yield and yield attributes of wheat and reported that the plots which received 120 kg N/ha produced significantly higher values of growth and yield parameters over the lower doses and control.

Samra and Dhillon (1993) conducted an trial at Punjab Agricultural University, Ludhiana and concluded that significant response in both grain (39.9 q/ha) and straw (59.8 q/ha) yields was obtained upto 120 kg N/ha. This was due to increased plant height, effective tillers/meter row length, ear/meter row length and test weight. Similar results were reported by Garg and Saraswat (1974). Agarwal *et al* (1979). Vaisya and Singh (1981) and Dhiman *et al* (1982). Yadav *et al* (1995) also recommended 120 kg N/ha as optimal dose for wheat.

Sharma *et al* (1970) observed increase in ear bearing shoots, grains per ear, test weight, plant height, grain yield and straw yield with increase in application of N and recommended 120 to 160 kg N/ha for dwarf wheat varieties. Application of nitrogen at 100 and 150 kg N/ha improved all the yield attributes and increased grain yield and straw yield over lower rates (Borse and Mahajan 1980).

Chandramohan *et al* (1977) reported that grain yield improved with nitrogen application upto 180 kg N/ha and had a positive co-relation with the number of ear/m^2, ear length, number of grains/ear and test weight.

Reddy and Prasad (1980) observed that each successive dose of nitrogen upto 180 kg N/ha increased the total tillers. Similar results have been reported by Gill and Pannun (1968) and Misra and Ram (1968). Chandravanshi and Singh (1974) reported that nitrogen application to a limit of 208 kg N/ha afforded promising response in terms of monetary grains as it affected ear length, grains/ear, fertility (%), test weight, effective tillers and grain yield.

Rohde (1963) reported that nitrogen fertilization caused an increase in grain yield, increase in test weight, increase in plant height and increase in straw yield of winter wheat. Singh (1964) indicated that application of ammonia sulphate increased the number of ear bearing tillers, number of total and fertilizer spike-lets and number of grains/main shoot ear and test weight and the grain yield/acre. Singh (1965) found an increase in yield when 60 lbs N/acre was applied and it decreased when dose increased to 90 lbs N/acre.

Sekhon *et al* (1968) reported that plant height, effective tillers and grain and straw yield increased with N application. They also observed that maximum increase in grain yield was with first 40 kg N/ha i.e. 24.7 kg grain/kg of nitrogen and for the remaining doses of 80, 120, 160 and 200 kg N/ha, it was 10.0, 9.0, -1.7 and -3.5 kg of grains respectively.

Sharma *et al* (1966) reported that maximum response of 41.7 kg grain per kg of nitrogen was obtained from Sonora 64 at 40 kg N/ha. At this level the response in Lerma Rojo and NP 876 was 34.4 kg and 13.2 kg grains per kg of nitrogen. In most cases the rates of nitrogen and response at each level of N was more in case of Mexican wheat as compared to NP 876.

Singh and Dastana (1971) reported that 150 kg N/ha produced the maximum yield by increasing number of ear, number of grains but decreased 500 grains weight when the N status of the soil was 0.038% but no differential response was noted when the initial N content of the soil was 0.065% in case of dwarf wheat varieties.

Randhawa and Singh (1972) found that N at the rate of 120 kg /ha increased the grain yield by increasing the number of tillers, the plant height and ear weight and also the straw yield in case of dwarf wheat.

Knowles and Watkins (1931) observed that the amount of total nitrogen in entire plant of wheat increased until three weeks before harvest. This was confirmed by Miller (1939) who reported that total amount of nitrogen in wheat plant of Kanred variety reached its maximum the week before harvest in 1932-33 but during 1933-34 and 1934-35 the maximum was reached fifth week before harvest. Bartholomew and Hiltbold (1952) using N 15 found no significant difference in total uptake of nitrogen between two soils at 37 days after planting. Recovery of nitrogen at boot stage was 48 percent but at maturity it was 42 percent.

Boatwright and Haas (1961) reported that maturity was hastened and amount of nutrient uptake by the entire plant of wheat was increased by fertilization.. Maximum dry weight and nitrogen uptake from N and P fertilized, K fertilized and unfertilized plants, occurred at the stages of heading, soft dough and maturity respectively.

Bolaria and Mann (1964) reported that uptake of nutrients (NPK) and percentage composition of two wheat varieties – Pawnee and Travis was practically the same under same nutrient treatment. The difference in uptake of nutrient at different stages was quite marked and varied due to NPK and their combination. The uptake and percentage composition was lower at maturity than at three earlier stages. The uptake of nitrogen was higher at young stage and it steadily decreased as the plant advanced in age under treatments which did not include nitrogen. But with an addition of nitrogen alone or in combination with P and K the uptake was higher at boot stage.

Mehrotra *et al* (1967) started that during three years of experiment, nitrogen absorption was high in earlier stages of plant life and it went on decreasing with advancement in age. The uptake of nitrogen in plant increased with nitrogen treatment. The rate of uptake was maximum (45 percent) at tillering, 25 percent at jointing to ear initiation and 30 percent upto grain formation.

Malik *et al* (1965) reported a highly significant response to phosphorus application, both on grain and straw yield, with the application of 33 kg of P_2O_5/ha (with 44.8 kg N/ha), direct to the wheat crop, in addition to the 33.5 kg P_2O_5 in the first crop of Paddy in wheat-paddy rotation, under Sambalpur conditions. Similarly, Tiwari and Singh (1969) also reported a response of full P application to the wheat crop at Powerkheda (M.P) upto 33.6 kg P_2O_5/ha. This dose of 33.6 kg significantly affected the number of tillers/m, number of grains and 1000 grain weight.

Bathkal (1965) reported a highly significant response to P application at 10 lbs P_2P_5/acre in black cotton soils at Nagpur, although 20 lbs of P_2O_5/acre gave better yield, but the difference between the two doses were non significant. Pathak (1965) also reported an increased yield of wheat (NP-718 tall variety) upto 40 kg P_2O_5/ha, under Vidarbha condition (M.P).

Misra and Alexander (1973), in an experiment at Banaras, with Kalyan Sona, reported a response with 80 kg P_2O_5/ha and described this doses as an optimum. But the experiment conducted in Punjab at Gurdaspur showed that P application upto 60 kg P_2O_5/ha gave response with C273 and C306 (Tall wheat).

The response of wheat to the applied dose of phosphorus, varies on soil varying in available phosphorus. Experiment conducted in Punjab, under irrigated condition (Annonymous 1969, 1970) show that the yield of wheat control plots (no phosphorus) was generally higher at higher initial levels of available phosphorus on all types of soils, but the rate of increase in the initial levels of phosphorus in all the soils. However, under un irrigated conditions, applications of phosphorus was more effective in P deficient soils than in P rich soils (Kanwar and Bhumbla 1959) These results bear out that soils with low available P_2O_5 content responds to the application of phosphatic fertilizers more than the medium and high phosphorus soils.

b) Seed quality

Nasim Ranjkesh (2015), It is done to check the result of compost fertilizer granular sulphur and nitrogen on nutrient iron concentration in shoot of wheat with two cultivators. It is a factorial experiment on pot and with 4 replications in complete and randomized design. First factor consist of three levels of nitrogen from urea fertilizer (0, 25 & 50mg/kg of soil), 2nd of four level of compost granular sulphur fertilizer (0,5,10 & 15kg/soil) & 3rd of cultivator of N8019 and DARYA, respectively. The highest concentration was observed using 50mg/kg of nitrogen and in N8019 25.6% was accelerated in compare of control treatment. Maximum concentration was obtained in N8109 and the treatment of non-application of compost and then it reached at treatment with 10gm/kg its peak. Both maximum and minimum concentration of iron was found under triple effect of nitrogen, compost and cultivator was seen at cultivars N8019. So, co-consuming of 50mg/kg of nitrogen fertilizer and 10gm/kg of compost fertilizer highest intake was got. Depend upon these results, it was suggested that combined application of nitrogen fertilizer in the compost induce absorption and availability of iron in sample cultivars. The N8019 was also preferred to cultivar, Darya.

K. E. Petrofsky and R. C. Hoseneythe (1995) existence of starch gluten or starch gluten water interactions in dough was showed by the range in moduli for isolated starch & vital gluten doughs. Starches isolated from different wheat cultivars gave large rheological difference, which shows starch had active role in rheological characteristics. Soft wheat & non-wheat starch had higher moduli compared to hard wheat starch because of greater interaction of starch with gluten. As indicated by range of elastic (G') & loss (G") moduli for isolated wheat gluten & commercial starch doughs, the source of gluten also had a significant effect on dough rheology. Hard wheat gluten dough had low G' & G" values indicate a greater extensibility & less starch gluten interactions. Soft wheat gluten doughs had greater G' & G" values because of increase starch gluten interactions.

Mpofu *et al.* (2006) total grain wheat which is likely derived from phenolic compound & further antioxidants make wheat a potential source of functional food ingredient. The aim is to establish the effect of genotype & growing environment on phenolic content & antioxidant activities of alcohol-soluble extract from commercial cultivars. The measurement of Total Phenolic Content (TCP), antioxidants activities (AOAs) & concentration of 6 phenolic aids were made in 6 red & white grained heard spring wheat genotype grown at 4 diverse locations in Western Canada during 2003 year crop. Differences among genotype & environment for TCP, AOA & concentration of all phenolic acid were measured. The indicators of antioxidants potential were intercorelated. Because of these, Canada Western Red Spring wheat cultivars Neepawa & AC Elsa had the maximum levels, whereas an analogous CW hard white spring wheat cultivars, AC snowbird had lowest level. For TPC, AOA, vanillic acid, & other, environmental effects were considered larger than genotype effect. Genotype & environment interaction was significant only for TPC. This genotype variation indicates that it would be possible to select these quantitative traits in breeding program. Therefore, environment variations was observed would delay or complicate this process.

Zilic *et al.* (2013), the main aim was to determine phenolic compound & the total antioxidant capacity of grain of 10 bread & 10 durum w, heat genotype. Investigations of soluble free forms of total phenolics, flavonoids, PVPP (polyvinylpolypyruolidone) bound phenolic, proanthocyanidins & phenolic acid were made. Iett was found that significant different in content of acetone or water extractable total phenolics, PVPP bound phenolic & phenolic acid between and within 2 wheat species. On average, durum wheat sample had 1.19 fold higher total phenolic compound & 1.5 fold higher PVPP bound phenolic then bread sample. 3 acids i.e. ferulic, caffeic & chlorogenic were found in whole meal bread wheat. The capacity measure as DPPH radical scavenging activity was as same as in whole meal of bread & durum wheat. That is why, such differences were observed within species.

Vaher *et al.* (2010), the objective was to determine total phenolic content of brand layer, flour made from endosperm & total grain of wheat. Sample of 10 spring & 5 *Rabi* wheat varieties were analyzed. The spring varieties were grown-up in both conventional & organic condition. It was found that the total phenolic content of bran layer was highest (1258-3157 µg/g), followed by that of grain (168-459 µg/g) and the lowest of flour (44-140 µg/g). The phenolic acid was bound qualified by CE-DAD analysis after alkaline hydrolysis.

The objective was to determine total phenolic content & DPPH radical scavenging capability of brand layer, flour made from endosperm & total grain of wheat. Sample of 10 spring & 5 *Rabi* wheat varieties were analyzed. The spring varieties were grown in both conventional & organic condition. It was found that the total phenolic content of bran layer was highest (1258-3157 µg/g), followed by that of grain (168-459 µg/g) and the lowest of flour (44-140 µg/g). The phenolic acid which were bound were qualified by CT-DAB analysis after alkaline hydrolysis.

Chlopicka *et al.* (2012), it was done to investigate the effect of adding pseudo cereal flour on anti-oxidants properties and sensory value of breads. Buckwheat flour had highest phenolic content (7.25±0.23mg/gm). When compare to bread, the content of total fluoride in flour was about 2-4 fold higher. For enhancing anti-oxidants activity, the addition of buckwheat flour to wheat bread in higher dose was more effective as evaluated by FRAP & DPPH, which increase by 2.36 fold, and 3.64 fold respectively, in comparison with other pseudo cereal flours which caused changed of parameter within the ranges 1.20-1.79 fold, and 0.60-1.71 fold.. Analysis showed that addition of buckwheat flour to dough might improve subjective properties of bread and increase quality attribute. These observations suggest that, it can improve anti-oxidants as well as sensory properties of bread. It may be placed on market as functional food.

Konopka *et al.* (2012) an experiment was done to evaluate the result of mineral (NPK) and organic based fertilizer such as meat and bone meal, manure (FYM) and compost on appearance of spring wheat kernels and on total content in grain of main its physiochemical and phenolic acid composition. Total Phenolic compound were determined by Folin-Ciocalteu assay after alkaline hydrolysis of grain and carotenoids were analyzed spectrophotometrically. Composition of Tocochromanols and phenolic acid composition was determined by RP-HPLC technique. Greatest variations was observed in group of Polyphenol compound among analyzed phyto-chemical with stated increase of their total content of 6.7 and 11.2 % in grain fertilized with MBM and compost respiration. Similarly, the grain contained less phenolic acid and decrease in their content ranged from 10% for FYM to 24.8%.

Osman *et al.* (2010) an experiment was made for 2 consecutive season (2008-09) and (2009-10) in the demonstration of faculty of Agriculture, Sudan University of Science and Technology – Shambat to check the result of organic fertilization on yield and growth of wheat in compare with chemical fertilization. Organic fertilizer which were used in the study were cattle manure (9.58 – 9.63 t/ha), chicken manure (5.21 – 6.40 t/ha Elkhaseeb (9.58 – 9.63 t/ha) and Elkhairat (9.58 – 9.63 t/ha). Organic and inorganic fertilizers used were urea (190 kg/ha) and triple sugar phosphate 94 kg/ha) for comparison. The arrangement done for treatment in complete block design with 4 replication. Data were collected afterwards of seed yield, straw yield per unit area , percentage of nitrogen in seeds and straw, potassium, moisture, phosphorous, calcium, ash, protein, carbohydrates content in addition to Iron (Fe), Copper(Cu) and Zinc(Zn) in wheat seeds.

Van Hung *et al.* (2009). it is done to see the graded flour fractions which were milled from whole wheat grain without removal of germs and bran are rich in dietary fibers and minerals. In this, studied the whole waxy wheat was milled into 5 fractions and phenolic content and anti-oxidant capacity of these flours were seen/checked. There were increase in total phenolic content of free and bound phenolic from both fractions outer part of grain contain higher amount of phenolics then whole grain and also high anti-oxidant capacity. Similarly, inner fractions milled from endosperm part had higher amount of phenolic and higher anti-oxidant capacity then white flour. Whole waxy wheat should be encouraged to be used for processing whole grain to improve its qualities.

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. The use of 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.

Chapter III

Material and Research Methodology

The field experiment entitled **— 'Effect of organic and chemical fertilizer on yield and seed quality of Wheat'** was conducted during *Rabi* season year 2014-15. The experimental materials and the criteria used for treatment evaluation through the entire course of research are being presented in this chapter under the following heads.

3.1 Experimental site

The experiment was conducted at the Experimental Farm of the Department of Agriculture, Lovely Professional University, Jalandhar, Punjab (India) during 2014-15. The trial site is characterize as "Central Plain Zone (PB-3)" of Punjab and it is located at 31º 15' N latitude and 75 41' E longitudes at an elevation of 245 m above mean sea level. It comprise parts of eight districts of Punjab viz. Tarn Taran, Jalandhar, Amritsar, Ludhiana, Fatehgarh Sahib, Sangrur, Kapurthala, and Patiala. The main crops grown in the region are mainly maize, barley, rice, wheat, guava, cotton, gram, groundnut and pear. The soil type was sandy loam and pH 7.7.

3.2 Climatic and weather

The climate of the experimental site is located in Punjab State which experiences 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 25/11/2014. Wheat was harvest on 22/4/2015. 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 216.91 mm during growing period.

Table: 3.1 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)

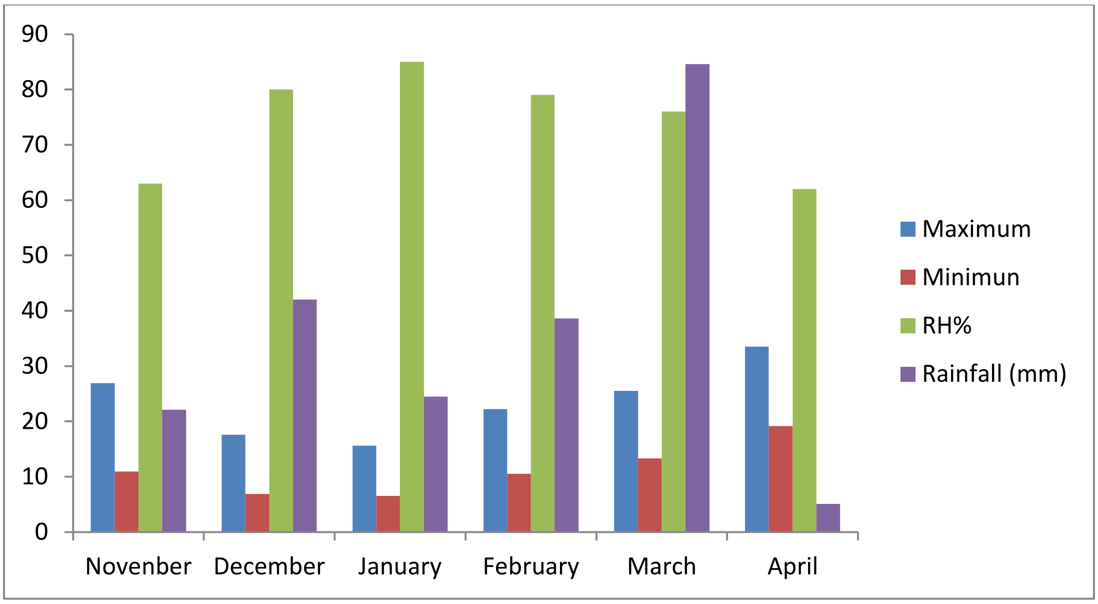

Figure: 3.1 Monthly meteorological reports

3.4 Soil of experimental field

The soils mainly belong to sandy loam or Central Alluvial Plain. The trial soil was subjected to various estimations before the commencement of experiment. In table no. 3.2.

Table 3.2: Soil physical and chemical properties of the experimental field soil.

Sr. No	Particulars	Values (0- 30 cm depth)	Method employed
Physical properties			
1	Coarse sand (%)	61%	International pipette method (Piper, 1966)
2	Silt (%)	7%	
	Clay (%)	32%	
Chemical properties			
1	pH	7.7	BuckmoricHmeter (Piper,1966)
2	Electrical conductivity (dS/m)	0.33	Jackson (1973)
3	Organic carbon (%)	0.56	Wet oxidation method (Jackson, 1957)
Available nutrient status			
A	Available N (kg/ha)	163	Alkaline per magnate method (Subbaiah and Asija,1976)

B	Available P (Kg/ha)	24.4	Olsen's method (Jackson,1958)
C	Available K (kg/ha)	325	Flame photometer method (Jackson,1958)

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, 1966)

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, 1973)

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, 1976)

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.*. 1958)

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 EXPERIMENTAL DETAILS

1. Variety**:** WH 1105

2**.** Seed rate**:** 100 kg/ha.

3. Time of sowing**:** 25 November

4. Spacing**:** 18 cm R x R

3.7 Treatments

T1: Cattle slurry @ 10% (soil and foliar application).

T2: Poultry manure @ 5 t/ha.

T3: Vermicompost @ 5 q/ha.

T4: Vermiwash @ 10% (soil and foliar application).

T5: Poultry manure + vermiwash.

T6: cattle slurry + vermiwash.

T7: Recommended dose @ 50-25-12 kg/acre of NPK.

3.8 Layout Plan

North

Irrigation channel				
R1		**R2**	**R3**	
T7		T2	T6	
T5		T1	T3	
T6		T4	T1	
T4		T3	T2	
T3		T5	T7	
T2		T6	T4	
T1		T7	T5	

2.46m

1.70 m

Row side –North to South

3.9 Plot History

Previous cropping history of experimental field in this plot no fertilizer use for last 15 years but for my research this field is suitable for organic farming.

3.10 Field Preparation and Treatment Application

3.10.1 Field Preparation

The experimental field was prepared by ploughing with disc plough and cross harrowing and planking to bring the field to a good tilth condition. Each experimental unit was demarcated and layout was drawn as per plan.

3.10.2 Crop Raising Seed and Sowing

The variety WH 1105 of wheat was used as the test crop. The seeds were sown by pora method @ 100 kg/ha and the sowing was done on 25th November, 2014-2015.Details of the interculture, harvesting, threshing and winnowing operation for wheat including pre and post sowing operation are presented in Table 3.3.

Table 3.3 Schedule of operations carried out in the experimental field during the year 2014-15

S.no	Operations	2014-2015
1	**FIELD PREPARATION**	
A	Disc harrowing (cross)	11-11-14
B	Planking	15-11-14
C	Layout demarcation	25-11-14
2	**TREATMENT APPLICATION**	
A	Pre- sowing irrigation	20-11-14
B	Basal dose of N ,P and k treatment	25-11-14
C	Sowing	26-11-14
3	Ist Irrigation	01-01-2015
4	2nd Irrigation	03-02-2015
5	3rd Irrigation	05-03-2015
6	Thinning –Ist	13-12-14
7	Thinning-IInd	29-12-14
8	Hoeing, weeding Ist	30-12-14
9	Hoeing IInd	17-1-15
10	Hoeing and weeding IIIrd	7-2-15
11	Harvesting	22-4-2015
10	Threshing and winnowing	27-4-2015

3.11 Yield Parameters

3.11.1Test Weight

One thousand seeds were counted from each sample drawn from the finally. Winnowed and cleaned produce of each plot and their weight (g) was recorded.

3.11.2 Seed Yield

After threshing and winnowing, the clean seeds from each plot were weighed and the weight was recorded as seed yield in kg per plot and then converted in kg/ha.

3.11.3 Straw Yield

Stover yield was obtained by subtracting the seed yield from biological yield of the respective net plot and it was expressed as kg/ha.

3.11.4 Harvest Index

Harvest index is the ration between economical yield and biological yield. This was measured after harvesting where seeds as economical yield are the nominator of the ration and the whole crop biomass as the biological yield was the denominator of the ratio.

Harvest index = Economic yield/Biological yield *100

3.11.5 Length of Ear Head

With the help of scale, ear was measured to determine its size. Subsequently, size measurements of head of wheat crop was taken o calculate ear Head size. This ratio will help estimate the size of one seed compare to size of the whole head. These measurements were taken at maturity stage.

3.11.6 Number of Grains/Head

After harvesting, threshing of seeds was done treatment wise. After this threshing, by the used of hand, seeds per one head were counted and finally it was done to estimate yield per one plant.

3.11.7 Number of Spike/m^2

Plot wise, one square meter was determined and then the number of plants that belong in the same area. In context, the number spikes were counted.

3.11.8 Ear Head Weight

In each plot, three heads were cut at harvesting time. Those heads were curried into agronomy laboratory and by the use of weighing balance the weight of one ear head were measured.

3.11.9 Number of Days of Flowering

Number of days of flowering is the gap between seed sowing and first day of flowering of wheat.

3.12 Seed Quality Parameters

3.12.1 Protein Content

Calculate N% by Kjeldhal method

Protein content (%) = % N content in seed x 6.25.

Protein content is calculated by using the formula given by A.O.A.C.

3.12.2 Ash Content

1. A small sample of flour wheat (3-5 gram) is weighed and placed in an ash cup.
2. The sample is heated at 580º C in ash oven until its weight is stable (usually during the night).
3. The residue is cooled to room temperature and then weighed.

3.12.3 Carbohydrates (%)

The carbohydrate content of a food can be determined by calculating the percent remaining after all the other components have been measured: %carbohydrates = 100 – protein (%) - moisture (%) - mineral (%) - lipid (%).Nevertheless, this method can lead to erroneous results due to experimental errors in any of the other methods, and so it is usually better to directly measure the carbohydrate content for accurate measurements.

3.12.4 Zn, Cu, Mn and Fe

These micronutrients measured with the help of Atomic absorption spectroscopy instrument in labortory**.**

3.12.5 Moisture Content

1. A little sample of flour wheat (3-4 gram) is weighed and placed in a moisture dish.
2. The sample is heated at 120º C in air oven for 1 hour.
3. The sample is cooled to room temperature and the residue is weighed.

3.12.6 Total Phenolic Compound

This total phenolic compound is measure with the help of instrument Spectrophotometer. It was evaluated using a Folin-Ciocalteau method or modified colorimetric method.

CHAPTER IV

RESULT AND DISCUSSION

4.1 Yield Attributes

Table 4.1 Effects Of Organic And Inorganic Fertilizers On Yield Attributes.

Treatment	Number of days of flowering (days)	Length of ear head (g)	Number of grains/head	Thousand grains weight (g)	Number of spikes/m^2	Ear head weight (g)
T1	85.3b	9.1b	52.33a	41.30b	375.66ab	2.5
T2	87.3a	9.1b	54a	44.34a	380.33ab	2.7
T3	86.3abc	9.3b	48b	37.59c	372.66b	2.8
T4	86.6ab	9.5ab	51.66a	41.06b	381.66ab	2.7
T5	85.3bc	9.3b	51a	43.14a	374.33ab	2.7
T6	86abc	8.9b	52.33a	38.51c	371.33b	2.9
T7	85c	10.1a	53.66a	43.93a	392.33a	3.0
CV	0.835	4.414	2.859	0.860	2.656	11.164
SE	0.586	0.335	1.211	2.543	8.206	0.251

T1=Cattle slurry; T2=Poultry manure; T3=Vermicompost; T4=Vermiwash; T5=Poultry manure + Vermiwash; T6=Poultry manure + Vermiwash; T7= Recommended dose of NPK.

4.1.1: Number of Days of Flowering

Here we will discuss about the number of days to flowering effects on the yield of wheat seed in variety WH1105. Number of days to flowering was longer in T2 than other treatments of organic and inorganic fertilizers (Table 4.1). The highest number of days to flowering of wheat (87.33 days) was recorded under poultry manure (T2) and the lowest number of days to flowering was recorded (85 days) under recommended dose of NPK (T7). Similar, result found by Adeniyan and Ojeniyi (2009). Higher levels of poultry manure significantly delayed days to 50% flowering stage. It does appear that the increased vegetative growth in these treatments also caused a delay in flowering and NPK has fast process than organic fertilizers.

4.1.2: Length of Ear Head Size (cm)

Ear head size was more in T7 treatment than other treatment of organic manure (Table 4.1). The highest ear head size of wheat (10.10 cm) was recorded under recommended dose of

NPK (T7) and the lowest ear head size of wheat was recorded (8.88 cm) with the cattle slurry + vermiwash (T6). Ear head size is one of the most important yield parameters in wheat cultivation which directly influences seed yield. Increase in Ear head size of wheat with increase in NPK application was also reported by Sharshar, M.S. and A. Soad El-Said (2000). In this study, the main reason behind high no. of spike/m^2 can be attributed to highest NPK uptake in plant, which ultimately recorded maximum values of all morphological traits.

4.1.3: Number of Grains/head

Here we will discuss about the Number of grains/head effect on the yield of wheat seed in variety WH1105. Number of grains/head was more in T2 (Poultry manure) than other treatments of organic and inorganic fertilizers (Table 4.1). The highest number of grains/head of wheat (54) was recorded under T2 treatment (poultry manure) and the lower number of grains/ear head was recorded (48) under vermicompost (T3). This trend might be due to the role of nitrogen in crop maturation, flowering and fruiting, including seed formation. Number of grains/head is also very important yield parameters in wheat which directly influences seed yield. Similar, that the present findings by Alam, et al., (2007), and Ayub (2002) reported significant increase in number of grains/ear head in wheat with RDF of poultry manure They concluded that application of nitrogen fertilizers to wheat promote tillers production and survival and number of kernel per head. Maximum grain/head was recorded the level of 80-60-60 kg NPK/ha.

4.1.4: Test Weight (1000 grain weight g.)

There was consistent and significant increase in 1000 seed weight with application Recommended dose of NPK (Table 4.1). The highest 1000-grain weight (44.34 g) was observed from recommended dose of NPK application (T7) while the lowest was observed from the vermicompost application (T3) (37.39 g). Similar, that the present findings by Sharma, M. P. and J. P. Gupta (1998) reported significant increase in 1000-seed weight in wheat. They concluded that higher N rates with suitable amount of moisture extended the leaf area duration, duration of photosynthates production during grain fill and finely increased individual kernel weight. The increase in test weight by application of recommended dose of NPK could be due to balanced supply of food nutrients from NPK throughout development of plant.

4.1.5: No. of Spike/m^2

Number of spike/m^2 was more in T7 treatment than other organic or inorganic fertilizer (Table 4.1). The highest number was recorded 392 under T7 treatment (Recommended dose of NPK) and the lowest number was recorded 371 with the T3 treatment (vermicompost). Number of spike/m^2 is one the most important yield parameters in wheat which directly influences productivity. Increase in number of spike/m^2 with increase in NPK application was also reported by Iqtidar *et al.* (2006), Mossedaq and Smith (1994), Ayoub *et al.* (1994), Frederick and Camberato (1995) and Lloveras *et al.* (2001). Maximum spikes/m^2 (195.8) was recorded in 2004-05 while minimum spikes/m^2 (175.8) was recorded in 2003-04. Spike/m^2 was significantly increased with all levels of NPK than control plots however, there was no significant difference in spikes/m^2 between 80-60-60 kg NPK/ha and 80-60-30 kg NPK/ha. The improvement in spike number and plant height with increase in nitrogen use efficiency is attributed to the quick conversion of synthesized carbohydrates into protein and consequent to increase in the number and size of growing cells, resulting ultimately in increased number of spike/m$^{2.}$ They concluded that nitrogen fertilization increased spike density at harvest because of increased tillering. So, that the no. of spike/m^2 was more according to other organic fertilizers.

4.1.6: Ear Head Weight (g)

Ear head weight was more also in T7 treatment than other treatment of organic fertilizers (Table 4.1). The highest Ear head weight of wheat (2.95 g) was recorded under T7 treatment (RDF of NPK) and the lower Ear head weight was recorded (2.49 g) with the T1 treatment (cattle slurry). Increase in Ear head weight of wheat with increase in NPK application was also reported by Sharshar, M.S. and A. Soad El-Said (2000). In this study, the main reason behind high no. of spike/m^2 can be attributed to highest NPK uptake in plant, which ultimately recorded maximum values of all morphological traits. The beneficial effects of NPK in increasing grain, straw yield, grains per ear head and nutrient uptake can be explained on the basis that NPK improved the growth of the plant and enhanced the uptake of other nutrients which might have increased the photosynthesis and photosynthates translocated to different parts for promote meristematic development and thus increased the yield of crop

4.1.7: Grain Yield

Final seed yield per unit area of wheat is a cumulative effect of yield components like number of grains/head, number of plants/m^2, 1000-seed weight etc the data regarding variety WH1105. The highest seed yield was recorded under T7 (Recommended dose of NPK) followed by conventional with the amount of seed yield (5.89 t/ha) and lower amount of seed yield observed under T4 (Vermiwash) with the amount of seed yield (4.09 t/ha) in figure 4.1. It increases the photosynthesis and photosynthates translocated to different parts for promoting meristematic development and consequently increased the yield of crop. Similar result was found by Deshmukh and Tiwari (1996). The grains yield was increase with increase the dose of NPK. The promote effect of NPK on growth characters as mention before was reflected in the increase in the yield. Application of biofertilizer and organic fertilizer caused a vigorous growth, which was reflected in increased translocated photosynthates to the developing grains.

4.1.8: Straw yield

Straw yield was more also T7 treatment than other treatment of organic fertilizers (figure 4.1). The highest straw yield of wheat (3.47 t/ha) was recorded under T7 treatment (RDF of NPK) and the lower straw yield was recorded (3.09 t/ha) with the T4 treatment (Vermiwash). It is increase the photosynthesis and photosynthates translocated to different parts for promoting meristematic development and consequently increased the yield of crop. Similar result was also found by Deshmukh and Tiwari (1996). The straw yield was increase with increase the dose of NPK. The bigger uptake of the nutrients was due to added supply of nutrient and well developed root system resulting in better absorption of water and nutrient. The increase in yield owing to the application of N-fertilizer may be attributed to the fact that this nutrient being important constituents of nucleotides, proteins, chlorophyll and enzymes, involves in various metabolic processes which have direct impact on vegetative and reproductive phase of plants.

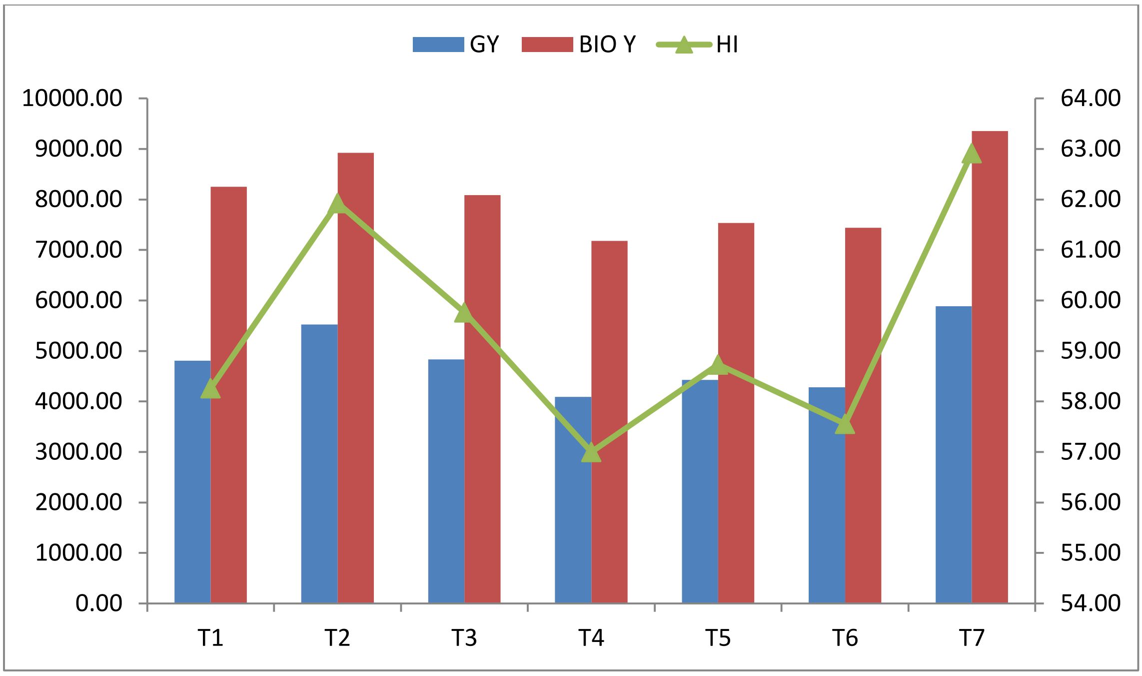

Figure 4.1 Effect of Organic and Inorganic Fertilizers on Grain Yield, Straw Yield and Harvest Index.

4.1.9: Harvest Index

The physiological efficiency and ability of a crop plant for converting the total biomass into seed yield is known by its Harvest Index. In figure 4.1, the higher the value of harvest index more will be the seed yield per unit of dry matter. It is evident from the data in variety WH1105. The highest harvest index was recorded under T7 (NPK) treatment followed by conventional with the amount of harvest index (62.92%) lower amount of harvest index observed under T4 (Vermiwash) treatment. Similar result was conducted by Iqtidar *et al.* (2006), Mossedaq and Smith (1994) and Badaruddin *et al.* (1999). If grain yield and biological yield is high in that case harvest index is also high because harvest index is totally depending on grain yield and biological yield. Harvest index is increase with increase the dose of NPK upto some level of fertilizer application.

4.2 Seed Quality Parameter

Table 4.2 Effect of Organic and Inorganic Fertilizers on Seed Quality.

Treatment	Carbohydrates (%)	Ash (%)	Moisture (%)
T1	75.42a	0.77c	14.13a
T2	71.46c	0.91b	13.66ab
T3	70.04d	1.06a	13.66ab
T4	71.95bc	0.85b	13.00c
T5	72.34b	0.87b	13.46bc
T6	71.74c	0.90b	13.53abc
T7	75.43a	0.75c	12.93c
CV	0.421	4.656	2.334
SE	0.250	0.033	0.257

T1=Cattle slurry, T2=Poultry manure, T3=Vermicompost, T4=Vermiwash, T5=Poultry manure + Vermiwash, T6=Poultry manure + Vermiwash, T7= Recommended dose of NPK.

4.2.1 Carbohydrates (%)

Amount of carbohydrates is depend on the quality of wheat seed WH 1105. The highest carbohydrates % was recorded under Recommended dose of NPK (T7) than other organic manure (Table 4.2) followed by conventional with the amount of carbohydrates (75.43 %). Vijaya and Seethalakshmi (2011) found the similar result of carbohydrates in wheat seed. Lower amount of carbohydrate content (70.04%) observed under vermicompost (T3). Parthenium weed help to prepared the vermicompost which increased total soluble carbohydrates (%) as compared to control or recommended dose of chemical fertilizers.

4.2.2 Ash Content

Ash content (%) is depending on the variety of wheat seed. The highest ash content (1.06 %) was recorded under vermicompost (T3) as compared to the all other compost (Table 4.2). Lower amount of ash content (0.75 %) observed under recommended dose of NPK (T7). However C:N ratio and total organic carbon values were lesser in the vermicompost than that of other organic compost. So that ash content is high with vermicompost. The difference in C:N ratio was because of higher nitrogen content of diverse chemically enriched and vermicompost. The results were in agreement to those reported by Sharma *et al.* (2004).

4.2.3 Zn, Cu, Mn and Fe Content

Application of vermicompost significantly increased the micronutrient content of Zn, Cu, Fe and Mn in wheat seed/grain over the other organic manure (Table 4.3). The application of wheat residue with vermicompost also resulted in a significant increase in nutrient uptake by wheat grain. Vermicompost was superior to other manure with respect to Zn, Cu, Fe, and Mn removal by wheat seed/grain. The highest Zn (1.04), Cu (1.07), Mn (8.83) and Fe (13.53) content was recorded under vermicompost (T3) as compared to other treatment. Similar, result observed by Kachroo *et al.* (2006), the incorporation of wheat residues in wheat not only increased nutrient uptake compared to no residue incorporation, but it also increased the productivity and yield components of wheat. The increase in nutrient uptake may be due to an increase in available N, P and K contents in the soil, and improved soil structure for higher uptake of nutrients.

Table 4.3: Effect of Organic and Inorganic Fertilizers on Micronutrients.

Treatment	Zn (ppm)	Cu (ppm)	Mn (ppm)	Fe (ppm)
T1	0.78ef	0.96bc	7.73bc	11.66d
T2	0.87cd	0.96bc	7.73bc	12.06c
T3	1.04a	1.07a	8.83a	13.53a
T4	0.93b	1.03a	8.16b	12.53b
T5	0.83de	0.93c	7.30c	11.30d
T6	0.90bc	0.92c	7.50c	10.86e
T7	0.75f	0.98b	7.6bc	10.86e
CV	3.318	1.793	3.246	2.031
SE	0.024	0.014	0.208	0.196

T1=Cattle slurry, T2=Poultry manure, T3=Vermicompost, T4=Vermiwash, T5=Poultry manure + Vermiwash, T6=Poultry manure + Vermiwash, T7= Recommended dose of NPK.

4.2.4 Moisture Content (%)

Moisture content effect on the quality of wheat seed in variety WH1105. The highest moisture content (%) was recorded under Cattle slurry (T1) organic followed by conventional with the amount of water content (14.13%) and lower amount of water content observed under recommended dose of NPK (T7). T1 is the best treatment from all other treatment (Table 4.2). It has highest moisture content (%) in wheat seed. Adeniyan, (2010) found the better result of water content in wheat seed. The high water content (%) in soil will cause less cohesion. This is because water content (%) separates the soil particles and cause softening of soil which leads to nutrient loss. So that less moisture content (%) present in NPK make it suitable for soil productivity and fertility.

4.2.5 Total Phenolic Compound

Total phenolic compounds also effect on the quality of wheat seed in variety WH1105. The application of vermicompost significantly increased the quantity of phenolic compound removed by wheat seed over the other organic manure (Table 4.4). The highest total phenolic compound was recorded under T3 treatment (6.78 mg/g) and lowest total phenolic compound was recorded under T1 treatment (6.64 mg/g). The high performance liquid chromatographic (HPLC) analysis exposed that the organically grown wheat had several times more phenolic compound particularly tannic, gallic, caffeic and ferulic acids than that of inorganically grown wheat crop. It is equally important to understanding of how vermicompost application should be manipulated to increase the metabolism of phenolic compounds sufficiently enough to improve the color and nutritional quality of the plants and the antioxidant activity of their medicinal or edible products for the benefits of the food industry. Similar, result was found by Haukioja *et al.,* 2002 and Vinken *et al.,* 2005.

Table 4.4: Effect of Organic and Inorganic Fertilizers on Total Phenolic compound.

Treatment	Total phenolic compound(mg/g)
T1	6.64c
T2	6.65c
T3	6.78a
T4	6.66bc
T5	6.76a
T6	6.70b
T7	6.65c
CV	0.365
SE	0.020

T1=Cattle slurry, T2=Poultry manure, T3=Vermicompost, T4=Vermiwash, T5=Poultry manure + Vermiwash, T6=Poultry manure + Vermiwash, T7= Recommended dose of NPK.

4.2.6 Protein

Application of organic manures not only influenced the growth and yield of wheat, but it also helped in enhancing the seed quality parameters on par with RDF. Highest protein content (%) was recorded under treatment T6. The increase in quality parameters might be due to the higher protein content and better sized seeds with these treatments. Kachot *et al*. (2001) also observed that vermiwash (50%) + poultry manure (50%) applications had effect on seed protein content of wheat. It was found that the treatment T9 was maximum % of protein content over other treatment and control. The higher seed quality is due to improved filled seeds with higher protein content in the seed obtained with these treatments. The increase in seed quality with application of organic manures may be due to better nutrient availability and its uptake by mother plant. This might have lead to accumulation of higher quantities of seed components like calcium carbonate and increased the lipid metabolism which helps in increasing the protein content in seed.

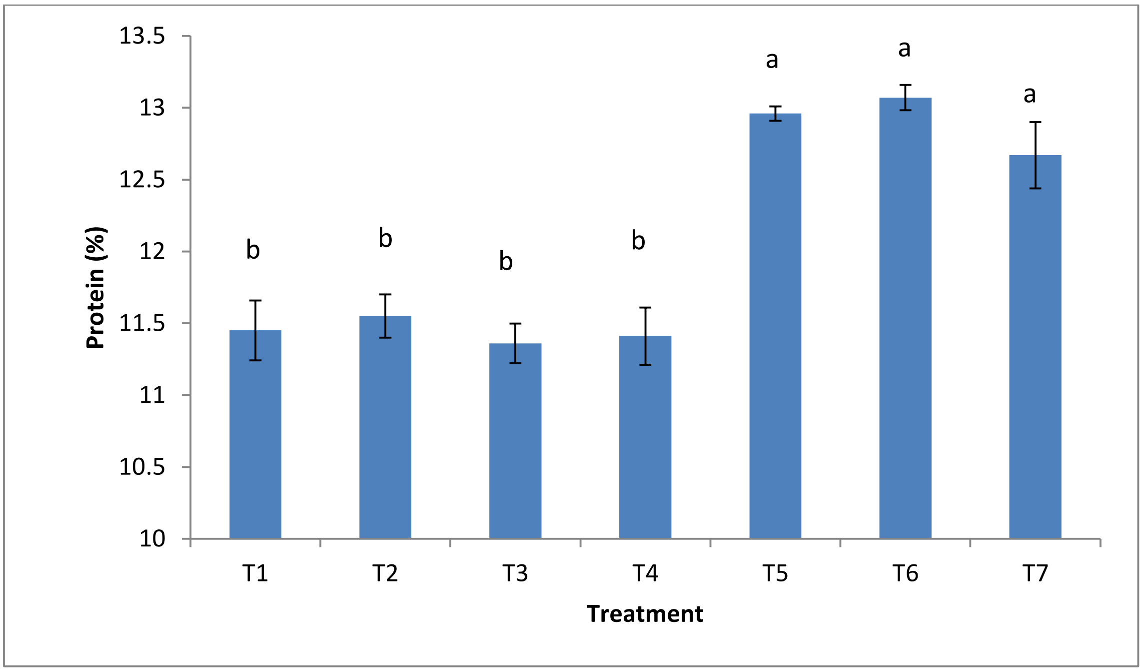

Figure 4.2 Effect of organic and inorganic fertilizers on Protein content.

4.3 Soil parameters

4.3.1 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.

4.3.2 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.

4.3.3 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: 4.5 Effect of treatments on pH, EC and organic carbon

Treatment	pH%	EC ds/m	OC %
T1	7.46±0.08	0.29±0.009	0.340±0.006
T2	7.26±0.12	0.25±0.003	0.521±0.009
T3	7.73±0.08	0.30±0.009	0.401±0.006
T4	7.50±0.05	0.32±0.006	0.421±0.006
T5	7.73±0.12	0.30±0.012	0.432±0.019
T6	7.74±0.08	0.28±0.009	0.431±0.015
T7	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: 4.6 Effect of different treatments on Nitrogen, Phosphorus and Pottassium.

Treatments	Nitrogen (N)	Phosphorus (P)	Pottassium (K)
T1	197.0±6.30	21.35±0.85	201.23±9.06
T2	250.8±5.50	28.65±0.45	233.95±1.64
T3	231.55±1.55	27.35±0.05	232.6±0.5
T4	239.8±0.50	25.55±0.55	309.6±0.5
T5	215.2±2.89	25.1±1.10	233.02±0.08
T6	219.70±0.39	28.2±0.90	237.45±8.15
T7	232.20.89	25.8±0.5	258.2±6.9
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 and T7- NPK.

CHAPTER V
CONCLUSION

In this study, it was observed that the organic and inorganic fertilizers are beneficial to wheat crop. The treatments show the significant impact on yield and seed quality of the wheat crop. The recommended dose of NPK shows the significant effect on yield parameter as compared to organic fertilizers. The highest biological and grain yield was obtained with the application of NPK followed by other organic fertilizers. Organic fertilizers are slow leaching and have to be applied in bulk because of their lower N, P and K content. It may take more than two years time for an organic farm to improve the soil health enough to make the yield equivalent to chemical fertilizers. Application of organic fertilizer (vermicompost @5q/ha) shows better result in seed quality of wheat.

CHAPTER VI
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