PRE-DISSERTATION

ON

"Biofortification in Wheat (*Triticum aestivum*)"

Submitted To

Department of Agronomy

School of Agriculture

Lovely Professional University

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Submitted By,

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UNDER GUIDANCE OF

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CERTIFICATE

This is to certify that this synopsis entitled **"Biofortification in Wheat(*Triticum aestivum*)"**submitted in partial fulfillment of requirement for degree – Master of Science in Agronomy by **Gursharnpreet Singh Brar, Registration no. 11719005** to Department of Agronomy, School of Agriculture**, Lovely Professional University,** has been formulated and finalized by the student herself on the subject.

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(Signature of Supervisor)

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Designation: Assistant Professor

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DECLARATION

I hereby declare that the project work entitled **— "Biofortification in wheat (*Triticum aestivum*)"** is an authentic record of my work carried at **Lovely Professional University** as requirements of Project work for the award of degree -Master of Science in Agronomy, under the guidance of **Mrs. Poonam Pandurang Shete**, Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

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INTRODUCTION

Wheat *(Triticum aestivum L.) is* one of the most important cereal crop grown in India. It belongs to family Poaceae. It is also known as the-King of Cereals because of its highest genetic yield potential. It is a rabi crop. It is a staple food for about 2 billion people. One sixth of the total aerable land in world is cultivated by wheat. India is second largest producer of wheat after China. Wheat can be grown over a wide range of climatic conditions. Ideal temperature for growth of wheat in winters is 10-15 degree Celsius and in summers is 21-26 degree Celsius. At sowing time temperature must be low while at harvesting time it must be higher for accurate ripening of wheat crop. There are over 30000 varieties of wheat worldwide. There are many species of wheat which together make up genus *Triticum*. It contains carbohydrates and proteins. Approximately on an average it contains 11-12%. Nearly it provides 55% of carbohydrates and 20% of food calories consumed globally (Breiman and Graur 1995). Normal area of wheat in India is 266.92 lakh ha. It originates from Euphrates valley but today it is found everywhere worldwide. The most widely grown is common wheat. Botanists consider wheat kernels as type of fruit which is also known as Caryopsis. In 1753 Linnaeus firstly classified wheat. In the year 1918 Sakamura reported chromosome number sets. On this basis wheat is categorized into 3 categories viz. Diploids (2n = 14), tetraploids (2n=28) and hexaploids (2n=42) chromosome. Major cultivated species of wheat are :

- Common or bread wheat *(Triticum aestivum)* – hexaploid and is most widely cultivated.
- Spelt wheat (*T. spelta*) - hexaploid but cultivated very less.
- Durum (*T. durum*) - tetraploid wheat , mostly used today and is 2nd most widely cultivated.
- Emmer (*T. dicoccum*) - tetraploid species cultivated during ancient time
- Einkorn (*T. monococcum*) -diploid species but is both wild and cultivated type.

Wheat is considered as a cash crop because gives very good yield. In India wheat is grown mainly in U P, Punjab, M.P and Haryana. Productivity in India is increasing at a faster rate and is around 2872 kg/ hectare and this data is given by Indian Department of Agriculture in

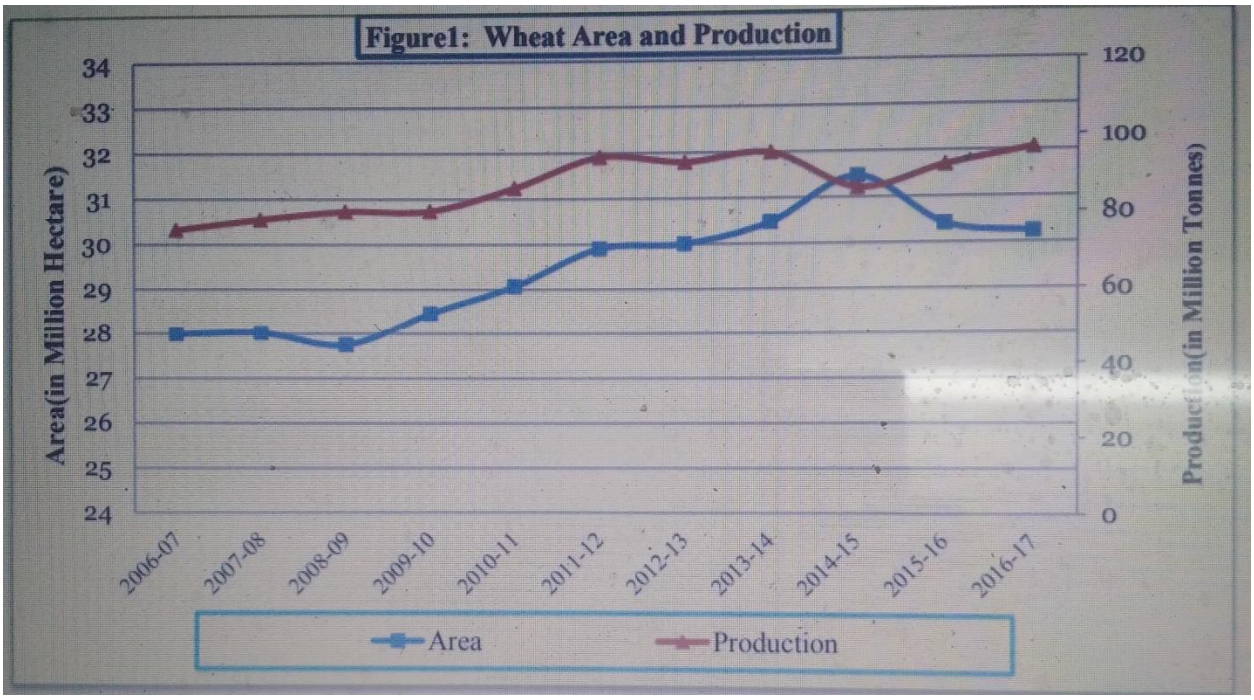
the year 2014- 2015. U P is top most contributor of wheat with total production of 25.22 million tonnes, Punjab has production of 15.78 million tonnes and Madhya Pradesh with 14.18 tonnes production. U.P has highest area under wheat and is also highest producer of wheat but its productivity is still less than national average (2561 kg/ha). On the another hand productivity of Punjab is much higher than U.P which is (4491 kg/ha) which beats every state in India.

Presently at global level it occupies 240 million ha area with production of 600 million tones. In India increase in wheat production during 60s lead to Green Revolution. It leads to self sufficiency of India to food grain. UP state of India gives highest production while Punjab gives highest average yield (4221 kg/ha). During the year 2011-12 production of wheat was 93.9 million tones.

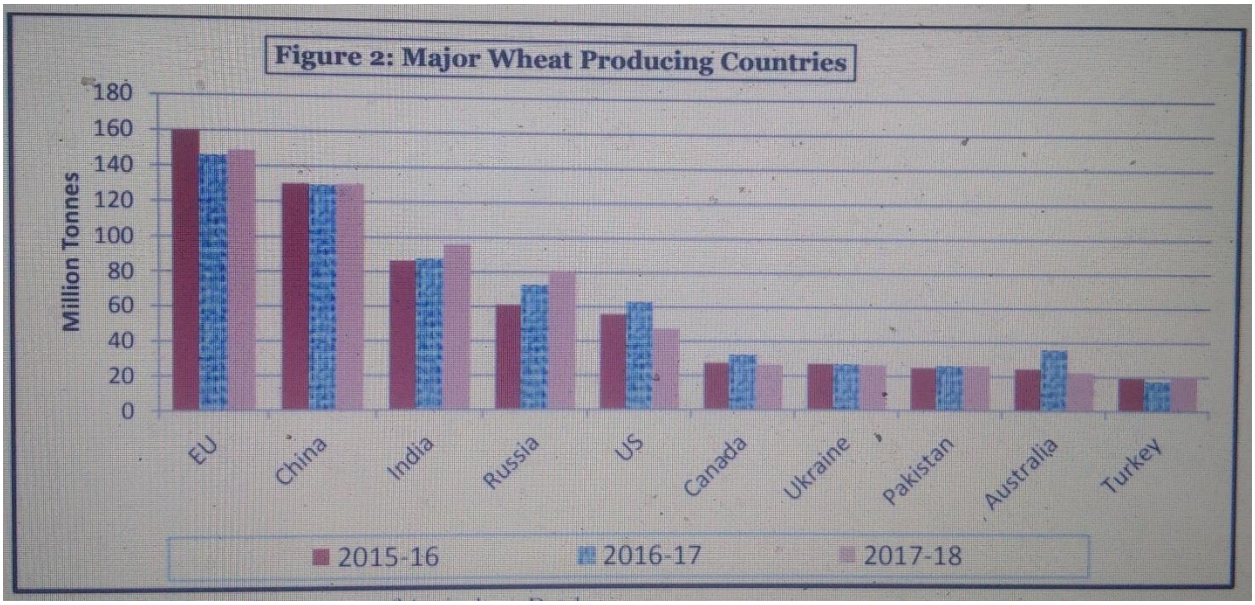
Wheat contains very low amount of iron and zinc like other staple cereals. About 2 billion people in world are suffering from deficiency of iron and zinc. Biofortification of wheat is done to increase the content of essential micronutrients in wheat. Wheat crop is supplied with extra nutrients so that in wheat grain level of micronutrients increase. Foliar application of Zn fertilizer can increase grain Zn level .

In this experiment, I had opted four treatments viz. organic, inorganic, mixed and controlled. Four varieties of wheat were taken viz. HD 2967, HD 3086, PBW 677 and PBW 725. Total no. of 48 pots were taken and for each variety above of four treatments are followed. Different treatments are just done to find out that which treatment gives good amount of micronutrients in wheat grain.

It’s not too expensive process. The main objective of this study is just to find out effectiveness of agronomic biofortification means the application of mineral micronutrient fertilizers to soil or plant leaves to increase micronutrient content in edible portion of crop. Biofortification method will increase yield as well as nutritional quality of wheat grains. Area under the wheat production of the India in year (2017-2018) is



Major wheat producing countries



Nutrition facts :- whole grain- 100 grams:-

Calories	**340**
Water	**11%**
Protein	**13.2g**
Sugar	**0.4g**
Fiber	**10.7g**
Fat	**2.5g**
Omega-3	**0.07g**
Omega-6	**1.09g**

Objectives of the study;

1. To study the influence of soil, FYM, urea on growth, yield and quality of grain.
2. To evaluate the concentration of zinc, Sulphur, Phosphorous in grains of wheat.

Scope of the study:

Studying and evaluating effect of inorganic treatment, organic treatment, combination of both on wheat plant and estimating increase in micronutrients content in grain of wheat. And comparing content of micronutrients of each treatment with non treated pot of wheat.

Review of literature

Maryam Varadipour (1997) Worked on effect of applied phosphorous, Sulphur, zinc on wheat and soybean crops and availability of these nutrients in an inceptisol

During (1999-2000) a study was conducted in western Himalayan for 2 years in a randomized block design replicated thrice with five sources of organic manure and three sources of inorganic fertilizers just to find out nutrient uptake of wheat plant and content of nutrients in wheat grain.

A. K. Ghosh (2000) Utilization of P and S and their forms in the soil as affected by N, P AND S Fertilizer applied to Wheat- Soybean cropping Sequence

Prabhakar Mahapatra (2000) Evaluation of Nitrogen and Sulphur Utilization in Wheat-Moong .. Soybean Cropping Sequence using 15N and 35S

Y. Vishwanath Shetty (2001) Studies on the Behavior of Zinc in Tobacco Growing Soils of Southern Transition Zone of Karnataka

Ashok Kumar Yadawa (2002) Integrated use of organic and fertilizer nitrogen in wheat *(Triticum aestivum* L.) with and without zinc

Howarth E. Bouis∗, Amy Saltzman (2003) Improving nutrition through biofortification: A review of evidence from HarvestPlus, 2003 through 2016

Raman Janeya Reddy (2003) Worked on effect of long-term FYM and Nitrogen application in bajra-wheat cropping system on fraction of S, Fe and Mn in soil

Ramavatar Jat (2006) Response of Pigeonpea + Groundnut Intercropping system to Sulphur in conjunction with organic manure

Anurag Sangwan (2009) Effect of Different Sources of Sulphur and Organic Manures on Sulphur Transformation and Wheat Crop

Moola Ram (2009) Effect of organic manures and biofertilizers in organic farming of rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) cropping system

Ruchi Bansal *et al.* (2009) worked on wheat biofortification challenges and progress.

Urmila (2010) Study on Long Term Use of Fertilizers, Manures and their Combination on Quality of Wheat and Soil Properties in Maize-Wheat Cropping System

Pardeep Kumar (2010) worked on biofortification and enhancement of productivity of bread wheat

Patel Rahul Kanubhai (2011) worked on effect of manganese application on growth, yield and biofortification on wheat

Rohit Singh Faujdar (2011) Effect of FYM, Biofertilizers and Zinc on Nutrient Transformations, Soil Properties and Yield of Maize (*Zea mays* L.) and their Residual Effect on Wheat (*Triticum aestivum* L.) on Typic Haplustept

Patel Girishkumar Gulabbhai (2011) worked on organic and inorganic fertilizers in comparison with humic acid on growth, yield and quality of wheat

C.Q.Zou *et al.* (2012) studied biofortification of wheat with zinc through zinc fertilization in seven countries. Zinc fertilization is an effective agronomic tool for zinc biofortification of wheat for overcoming human zinc deficiency.

Santosh Kumar Yadav (2014) Effect of real time Nitrogen Management on Wheat after differential Rice establishment method

Hari ram, Aildson Pereira Duarte, Abdul Rashid and co-authors (2015) worked on biofortification of wheat by applying foliar zinc fertilizer along with pesticides in seven countries.

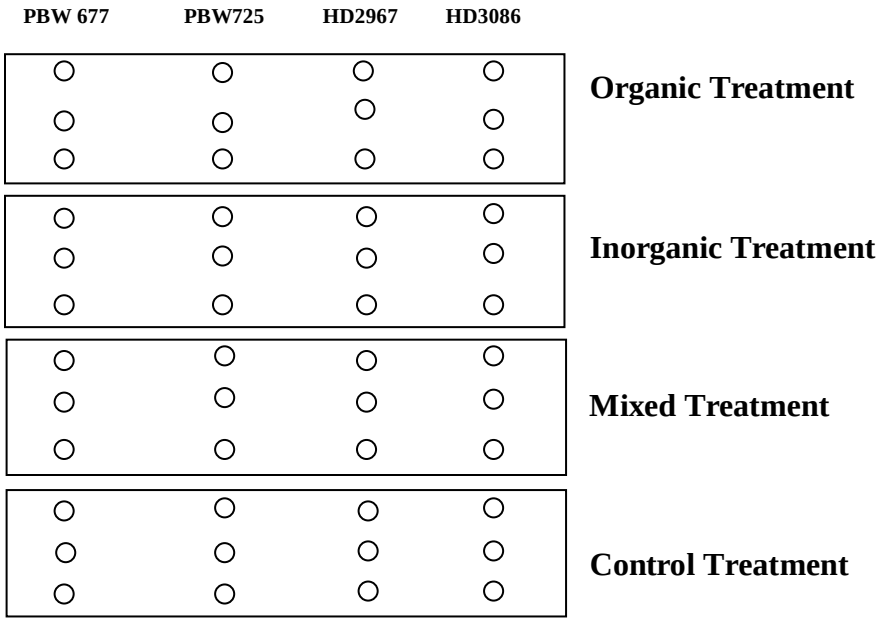
H. Ram & A. Rashid & W. Zhang & A. P. Duarte & N. Phattarakul & S. Simunji & M. Kalayci &R. Freitas & B. Rerkasem & R. S. Bal & K. Mahmood & E. Savasli & O Lungu & Z. H.Wang &V. L. N. P. de Barros & S. S. Malik & R. Z. Arisoy & J. X. Guo & V. S. Sohu & C. Q. Zou & I. Cakmak (2015) Biofortification of wheat, rice and common bean by applying foliar zinc fertilizer along with pesticides in seven countries

Sewa Ram Rundala (2016) Effect bio-organics and micronutrient fertilization on soil fertility and productivity of wheat crop

Priyanka Mathpal (2016) Biofortification on hexaploidy wheat with iron and zinc through classical and molecular approaches

Material and methods

Technical program of work
Location of the experiment
Experiment will be conducted at the field of Lovely Professional University, Phagwara situated geographically at 252 m above sea level. It falls under central plain zone of agro climatic zones of Punjab.



Where,
No of Pot = 48
No of Treatment = 4
No of Variety = 4

Brief introduction about work:

a. Crop = wheat
b. Period of work = 2017 – 18
c. Topic under discussion= Biofortification in wheat
d. Sowing method= Sowing will be done in pots

Treatments :

T1 = Control (no fertilizers)

T2 = Organic method

T3 = Inorganic method

T4 = Mixed (organic + inorganic)

Observations to be recorded:

a. **Yield parameters** :
   1. No. of grains per kernel
   2. Content of micronutrients and macronutrients in wheat grain
   3. Grain yield (kg)
   4. Harvest index (%)

b. **Soil parameters**:
   1. Soil EC
   2. Soil PH
   3. Soil N, P, K content
   4. Organic carbon (%)
   5. Organic matter (%)

c. Growth parameters:
   1. Plant height
   2. Dry matter production (g)

Expected outcomes:

Experiment will be conducted at Lovely Professional University, Phagwara, School of Agriculture, near experimental farm of Phagwara. By the use of inorganic, organic, and combination of both it is expected that they will enhance growth and yield of wheat plant and will also increase content of essential nutrients in wheat grain.

Proposed work with timeline:

- Time of sowing= November
- Organic fertilizer= FYM
- Inorganic fertilizer= urea
- Spacing= 2-3 plants in a single pot
- Irrigation= 4-5 light irrigations.

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