Dissertation-I

Submitted to the Lovely Professional University

in partial fulfillment of the requirements for the degree of

Master of Science

In

Agronomy

SUMITTED BY

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SYNOPSIS

Effect of foliar application of iron on nitrogen uptake and its combined impact on growth and yield of wheat *(T. aestivum*)

Name of Student : Vivek Chauhan

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Section : H1723

Major Subject : Agronomy

Major Advisor : Dr. Chandra Mohan Mehta

Certified that topic entitled " **Effect of foliar application of iron on nitrogen uptake and its combined impact on growth and yield of wheat *(T. aestivum*)**'' has been decided and formulated by the student himself and is appropriate for his programme.

(Signature of the student) **(Signature of the Major advisor)**

VivekChauhan **Dr. Chandra Mohan Mehta**

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CERTIFICATION

This is to certify that Vivek Chauhan registration No (11714561) is doing project titled "Effect of foliar application of iron on nitrogen uptake and its combined impact on growth and yield of wheat *(T. aestivum)*" 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 fulfillment of the condition for the award of degree of M.Sc. in Agronomy.

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(Signature of student)

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DECLARATION

I hereby declare that the project work entitiled " **Effect of foliar application of iron on nitrogen uptake and its combined impact on growth and yield of wheat *(T. aestivum*)**'' is an authentic record of my work carried out by Lovely Professional University as requirement of project work for the award of degree of Master of Science in Agronomy, under the guidance of Dr. Chandra Mohan Mehta, School of Agriculture, Lovely Professional University, Phagwara, Punjab.

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INTRODUCTION

Wheat is the one of most important cereal crops being grown across a wide range of environments around the world. Many species of wheat which together make up the genus Triticum the most widely grown is common wheat (*T. aestivum*).Wheat is known as the "King of cereals" for centuries and it retain the pride of place even today. Wheat is on the number one food grain consumed directly by human beings and is estimated that more than 35 per cent of the world population depends on wheat, as it supplies more nutrients particularly, essential amino acids than any other single crop. It has been a staple food with the level of consumption largely unaffected by changes in its prices and the price of other crops like rice, maize and millets (Titouan et al., 2015). Wheat is the second most important crop in India next to rice.

The total area under wheat crop has been estimated 1061602 acre (429602hectares) as compared to 1029268 acres (416522 hectares) of the year 2013 which is 3.14% higher than previous year. Average yield of wheat has been estimated 3.03 metric tons per hectare which is 0.66% of the higher than the last year (BBS, 2014). In India, wheat is the second important crop after rice occupying 29.40 million hectare, with a production of 88.31 million tones with an average productivity of 3000 kg per hectare (The Hindu, March 9, 2012). In Punjab region the area under wheat cultivation is 3497000 hectares in present time and the production of wheat in 2017is about 177 lakh metric tonne (Hindustan times, May29,2017). From the point of area and production of wheat Uttar Pradesh, Madhya Pradesh, Punjab and Haryana are on the top in India.

Wheat is a rabi season crop which is grown in tropics and sub tropics region and also need high temperature during its growth cycle. Heat stress is the main factor for growth stage like grain filling and if heat stress is more then it also reduce the yield. The fertilization of nitrogen increase the protein content significantly (Ames et al., 2003).

Wheat sown in late season is affected by heat stress in the anthesis period which results in the decreased productivity due to spikelet sterility. In last some years the foliar fertilization of nutrients is the most effective method to increase the yield and improve the quality crop product. In foliar fertilization the nutrients are utilized properly and reduce the environmental pollution due to the less amount of fertilizers added in soil. In 2016, world production of wheat was 749 million tonnes,

making it the second most produced cereal after maize. The demand of wheat is increasing globally due to presence of unique viscoelastic and gluten protein. Wheat is also good source of carbohydrate. It is leading source of vegetal protein in human food with 13% protein content.

Foliar feeding of nutrients promote root absorption of same nutrient and other nutrients through improving root growth and increasing nutrient uptake. Cereals are deficient in micronutrients specially in iron and zinc that decrease at the time of processing. So it is necessary to complete the amount of iron and zinc in the crops so there is no deficiency of these micronutrients. For completing their deficiency foliar application, food fortification and supplementation is done in some countries.

Crop rotation method are used for large cultivated area to increase pure yield of wheat per unit area. Foliar application of major and minor nutrients like NPK shall be more effective than soil application and also avoiding the depletion of these nutrients in leaves, thereby resulting in an increased photosynthetic rate, better translocation of these nutrients from the leaves to the developing grains.

Foliar application is quick and most efficiently use of nutrients and eliminate the losses through leaching and fixation and regulate the uptake of nutrients by plants. Foliar application of micronutrients in wheat is to increase the amount of nutrients like iron, zinc, which is essential for humans beings. If micronutrients are applied in soil then their effect is less as compared to foliar application and the their uptake is also more when applied in foliar spray. Iron also participates in the oxidation process that releases energy from sugars and starches and in responses that convert nitrate to ammonium in plant. It plays an essential role in nucleic acid metabolism (Romheld and Marschner, 1991; Miller et al., 1995; Eskandari, 2011; Havlin et al., 2014)The proposed work is planned to study the uptake of micronutrients and its effect on the yield under following objectives:-

1. To study the effect of foliar application of iron on wheat

2. To study the effect of foliar application on yield

REVIEW OF LITERATURE

The foliar application of macro and micronutrients in different stages of plant growth plays an important role, which enable rapid change in the plant to achieve desirable results.Iron deficiency is a growing health concern in the developing world, and responsible for diverse of health complications including anemia and impairments in immune system (Welch and Graham 2004).The foliar application of micro and macronutrients at peak stages of growth is most useful and give more effect at that time

The deficiency of iron also cause problems in human health so it is very necessary to full fill the amount of iron in human food and it can be done by adding iron in grains directly because we can not get iron easily in our daily food diet. To add iron in foods is through by agricultural practices (Pfeiffer and McClafferty 2007; Borg et al.2009; Cakmak et al.2010a). According to a recent report based on the WHO Database, anemia affects nearly 1.6 billion people, and preschool children and pregnant women are under greatest risk of Fe deficiency anemia (McLeon et al. 2009).

The micro and macro nutrients take part in the various processes in the plant, some nutrients act as catalyst they increase the growth and other activities by taking part in plants activities. This work is conducted to know about the suitable stage which gives better response to foliar application of fertilizers. There are some points on which the review is divided :-

Effect on the performance of wheat by the time of sowing

Effect of foliar application on the yield

Effect of heat stress on the growth and yield

Effect on the performance of wheat by the time of sowing

The number of fertile tillers in wheat is affected by the time of sowing and genotype. The number of tillers is maximum when wheat is sown between 10^{th} -20^{th} November, and the number of tillers in early and late variety are less. So it is necessary to sow the wheat at suitable time that there is no reduction in yield.

The temperature of 25^0C in double ridge to anthesis had 30 grains in main ear, while at 15^0C there are about 70 grains in the spike and the dry weight of spike is also reduced by high temperature (Warrington et al. 1977).

Javed Anwar et al. (2007) reported that higher grain yield, grain per spike and tillers per meter row were obtained when crop was seeded on November 10 compared to late sowing.

Muhammad Anjum Ali et al. (2010) reported that 3826 kg/ha grain yield is obtained from the variety AS 2002 when it was sown on November 10 and when the same variety was sown on November 20 the yield is 3731 kg/ha.

Effect of foliar application on the yield

The foliar spray of fertilizers increase the yield by increasing the uptake of other nutrients, because these quickly absorbed by the plants from leaf epidermis and easily accessible to other plant parts through xylem and phloem. The yield was increased by foliar spray of nitrogen and it also effect the yield components of wheat due to its involvement in the mineral status of the crop (Sud et al., 1990).

Nitrogen is an important constituent of plant proteins and is most frequently deficient element. Protein content of wheat flour is the principal factor in determining its baking properties (Bequette et al., 1963).

Iron foliar applications are generally based on Fechelates or Fe-salt solutions and is taken up via the cuticle or stomata (Fernandez et al., 2009).

Foliar application of micronutrients results in quick absorption by leaf epidermis of plant and accessible to other plant parts through xylem and phloem (Hasslett et al., 2001; Nasiri et al., 2010).

The foliar application of mineral nutrients using sprays, presents a method of providing nutrients to higher plants more competently than methods involving soil application when soil conditions are not suitable for Fe availability (Erdal et al., 2004; Kinaci and Gulmezoglu, 2007; Babaeian et al., 2011; Borowski and Michalek, 2011; Fernandez et al., 2013). PLAN OF WORK

The present experiment will be conduct in winter season 2017 at agricultural farm of Lovely Professional University, Jalandhar, Punjab. Materials and methods used during this experiment.

EXPERIMENT SITE

The experiment will be conduct atagriculture farm at Lovely Professional University which is located in Punjab state in India at about 252meters above from sea level and this region falls under Trans-Gangetic plain region of agro climatic zone on Punjab India.

DESIGN AND LAYOUT OF THE EXPERIMENT

TECHANICAL PROGRAMME :

EXPERIMENTAL DETAILS :

- Year of the experimentation : 2017
- No. of treatments :Eight(8)
- No. of replications : Three(3)
- Total no. of plots : Twenty four(24)
- Plot size : 3m x 3m($9m^2$)
- Irrigation channel : 0.5 m
- Total area :$245m^2$
- Row to row spacing : 20 cm
- Plant to plant spacing :10 cm
- Crop : Wheat

Recommended dose of fertilizers :kg/ha

N 120kg P_2O_5 60kg K_2O 40kg $FeSo_4$ 45kg

TREATMENT DETALS

Variety : HD 3086

Sowing time : 9th December 2017

Sowing depth :3-5 cm

Harvesting Date : 21st April 2018

NUTRIENT MANAGEMENT TREATMENTS

T1- Recommended dose
T2- no fertilizer

T3- Iron and nitrogen(milking)
T4- only iron no nitrogen (milking)
T5- iron and nitrogen(flowering)
T6- only iron no nitrogen(flowering)
T7- iron and nitrogen (maturity)
T8- only iron no nitrogen (maturity)

Collection of soil samples:

Soil samples will be taken before crop sowing to check the soil pH, organic carbon, electric conductivity, N, P, K and Fe ratio present in soil.

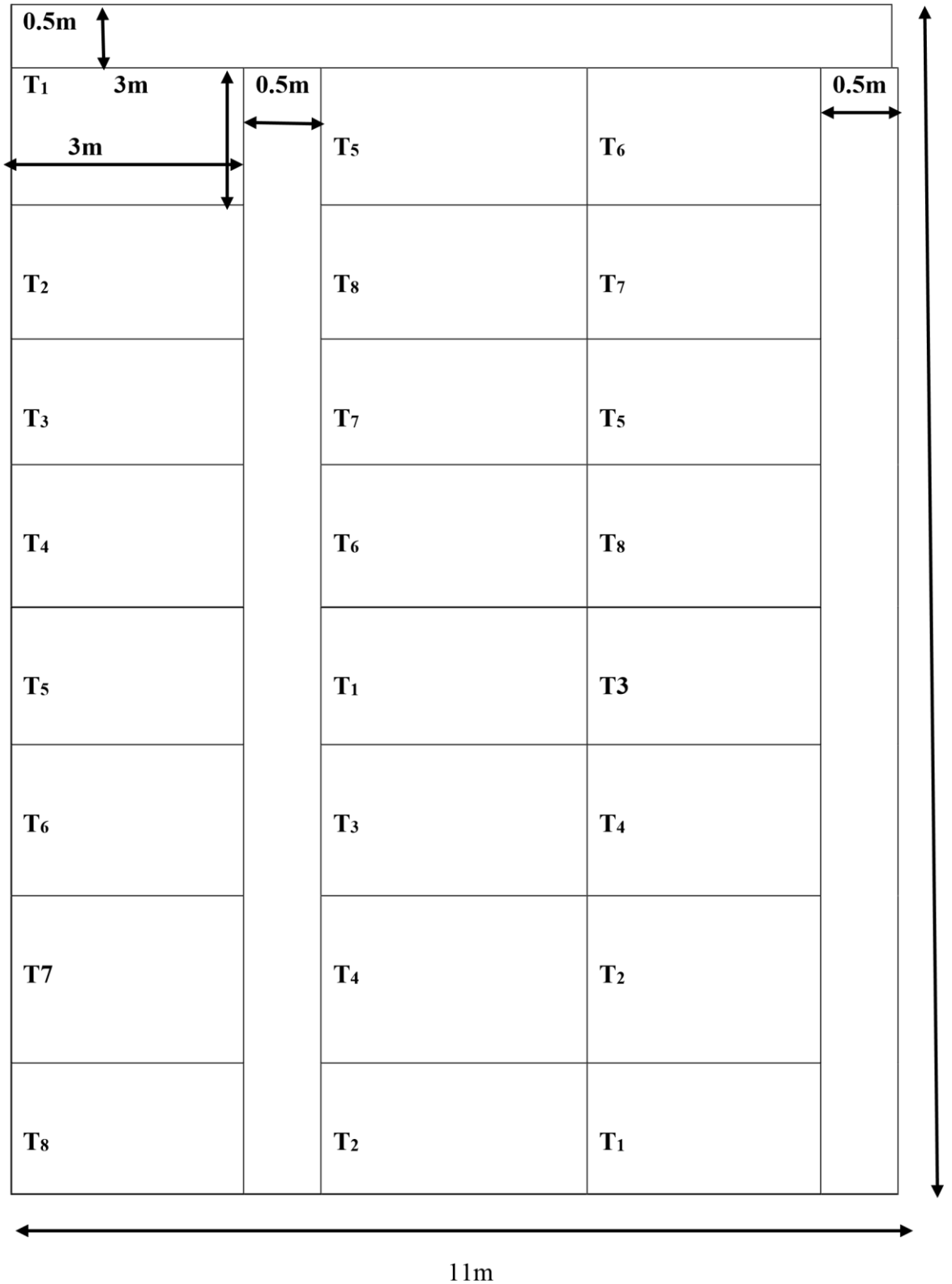
Analysis :soil analysis

Initial soil: initial soil samples will be analyzed for pH, EC, Organic C, available N,P and K and Fe amount present in soil.

Analytical methods to be followed during investigation are as under

S. N.	**Test parameter**	**Method**	**References**
1	pH (1:2.5)	Glass electrode	Sparks (1996)
2	EC (1:2.5)	Conductivity meter	Sparks (1996)
3	Organic C	Wet digestion	Walkley and Black (1934)
4	Available N	Alkaline potassium permanganate method	Subbiah&Asija (1956)
5	Available P	Olsen's Method	Olsen *et al*. (1954)
6	Available K	Flame photometer	Jackson (1973)
7	Zinc	*Atomic Absorption Spectroscopy*	Walsh (1955)

Field Layout

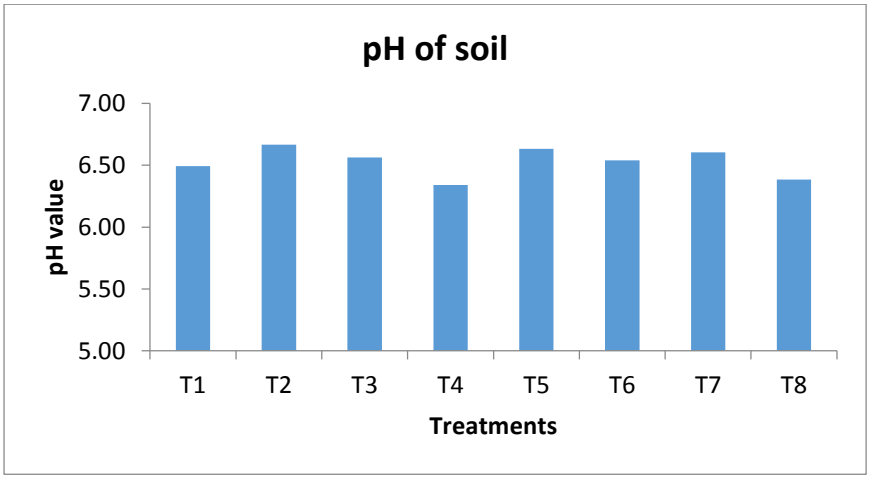


Preliminary Results:

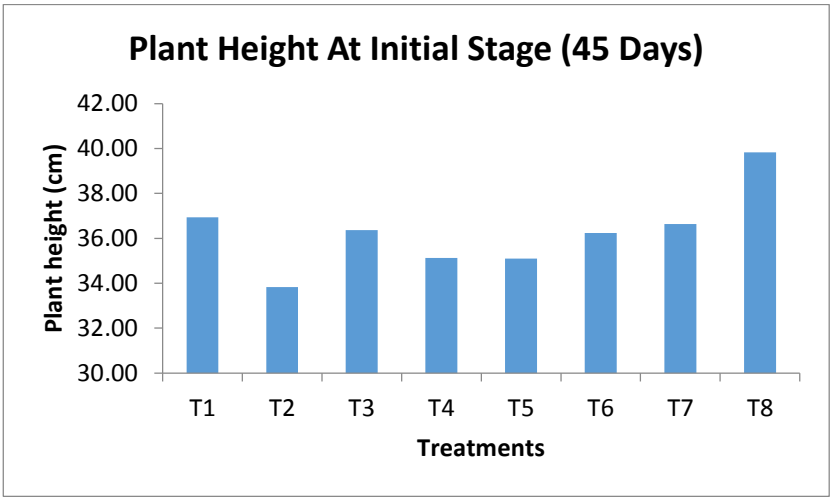
Soil parameters

Parameters	Observations
1. Soil pH and EC	pH- 6.5 and EC-0.53
2. Organic Carbon	0.375
3. Available Nitrogen	Less than 272kg/ha (low)
4. Available Phosphorus	19.8 kg/ha (medium)
5. Available Potassium	Less than 140 kg/ha (low)

pH: pH value of soil was observed between 6.34 to 6.63.



Plant Height at Initial Stage: Preliminary results on growth parameters reflected that T8 is having maximum growth while minimum was observed in T2. However statistical analysis is still need to be performed for significance.



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