“EFFECT OF IRRIGATION SCHEDULE, MULCHING AND HYDROGEL ON MAIZE (*Zea mays*)”

Pre Dissertation Report

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CERTIFICATE

This is to certify that, **Saptarshi Bhowmick** Reg. No.11719017 has personally completed M.Sc. pre-dissertation **"Effect of irrigation schedule, mulching and hydrogel on maize"** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of Dissertation has ever been submitted for any other purpose at any University.

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Date: **12th May, 2018**

Place: Phagwara

Dr. Yuvraj Gopinath Kasal
Ph.D., Farm Power and Machinery
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DECLARATION

I hereby declare that the work presented in the Thesis entitled **"Effect of irrigation schedule, mulching and hydrogel on maize"** is my own and original. The work will be carried out by me at School of Agriculture, Lovely Professional University, Phagwara, Punjab, India under the guidance of **Dr. Yuvraj Gopinath Kasal** Assistant Professor of School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

Date: 12th May, 2018 **Saptarshi Bhowmick**

Regn.No.:11719017

Place: Phagwara, Punjab (India)

I certified that the above statement made by the student is correct to the best of my knowledge and belief.

Date: **12th May, 2018** **Dr. Yuvraj Gopinath Kasal**

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Place: Phagwara

Date: 14/05/2018 (Saptarshi Bhowmick)

INTRODUCTION

Maize (Zea mays) is one of the most important cereal grains grown worldwide in a wider range of environments because of its greater adaptability (Kogbe and Adediran, 2003). It is mainly used as a food source and now has become the most important raw material for animal feed (Pimentel and Patzek, 2005). Maize (Zea mays L.) is one of the main source of cereals for food, forage and processed industrial products. Maize is a traditionally consumed staple food for household consumption. However, there has been increased demand for animal feeds and industrial utilization over the recent years. In India, the amount of maize being used for animal feed is nearly 50% (Singh et al., 2003).

Maize originated in central Mexico in around 5,000 BC. The crop was introduced to Europe in the sixteenth century, from where it spread to Africa and Asia. It is now one of the most widely-grown crops around the world in both temperate and tropical regions. World production of maize is around 370.96 million metric tonnes(Statista, 2017).

In India, maize is cultivated both in *kharif* and *rabi* seasons and share of *kharif* maize is 85 per cent of total maize in the country. In spite of highest share in area, the relative contribution of *kharif* maize is lower than that of *rabi* maize due to the vagaries of rainfall pattern. Severity and duration of drought during 2002 in India had caused about 42 per cent yield loss in *kharif* maize (DMR, 2003). The extent of yield reduction owing to moisture stress depends on the critical growth stages at which it occurs. Limited irrigation at critical moisture stages increases production levels and stability as well as profit. Ideal scheduling of available water should be based on meeting full crop water requirement at most sensitive stages and at less sensitive stages to deficit water. Scheduling can be adopted without meeting full water requirement of the crop.

The issue of water management has occupied the centre stage of politico-economic debates in world. India has already entered the shadow of the zone of physical and economic water scarcity. The sharp fall in groundwater levels owing to excessive removal for agricultural and other uses coupled with the high costs of fuel and electrical energy used in drawing groundwater, and poor water use efficiency due to wasteful practices are affecting the economics of water use in all spheres of human activity.

Irrigation scheduling is one of the important managerial activities and affects the effective and efficient utilization of water by crops. It determines the process to decide when to irrigate the crops and how much water to apply. It optimizes agricultural production with minimizing yield loss due to water shortage and improving performance and sustainability of any irrigation system through conserving water.

Objectives of the Study

1. To study the effect of irrigation scheduling on maize.
2. To study the effect of mulching and hydrogel on maize.
3. To understand and correlate different socio economic factors for maize cultivation.

Review of Literature

Water scarcity is a global concern in context of increasing population and competitive demands from agriculture, industry and urban inhabitants. The problem is further aggravated by the fast changing climate. It has been predicted that two-thirds of the world will experience water scarcity by the year 2025. India has already entered the shadow of the zone of physical and economic water scarcity. The sharp fall in groundwater level showing to excessive removal for agricultural and other uses coupled with the high costs of fuel and electrical energy used in drawing groundwater, and poor water use efficiency due to wasteful practices are affecting the economics of water use in all spheres of human activity.

The situation is forcing the planners to search for viable technology options to meet future water needs. Several agronomic practices have been developed and recommended for use. Thus, limited irrigation, mulching, application of super absorbent polymer provide a sustainable solutions. Keeping these facts into consideration the relevant research findings related to present investigation entitled **"Effect of irrigation schedule, mulching and hydrogel on Maize (*Zea mays*)** is presented in this chapter under following sub headings.

2.1 Effect of irrigation scheduling:-

2.1.1 Effect of irrigation schedules on growth:-

Singh et al. (1989) conducted experiment on sandy loam soil of Hissar during summer season observed significantly higher green fodder and dry matter yield at IW/CPE ratio of 0.5 and 0.75 over 0.25 ratio.

Tyagi et al. (1998) recorded higher number of cob plant-1 (1.53), length cob-1 (18.13 cm), grain cob-1 (393.30), test weight (188.27 g) and grain yield (50.72 q ha-1) with irrigation scheduling at 0.6 IW/CPE ratio over 0.2 and 0.4 ratio in spring maize. Stover yield was also higher in 0.6 ratio (139.09 q ha-1) during 1995 on sandy loam soil of Hissar.

Chigign et al. (2014) conducted experiment at Water Management Research Center (WMRC), Belvatagi, University of Agricultural Sciences, Dharwad. The main plots comprised of four irrigation levels (0.4. 0.6, and 0.8 IW/CPE ratio and irrigation at critical growth stages of maize) and subplots comprised of three maize hybrids. The result of the experiment revealed that the taller plant height (198.77 cm) and above ground dry matter accumulation (259.56 g plant-1) was recorded in irrigation scheduled at 0.8 IW/CPE ratio. The moisture stress due to 0.4 IW/CPE ratio resulted in more number of days to 50 % tasseling (61.40), day to reach 50% silking (69.30) and tasseling – silking interval (8.44). The main plots comprised of four irrigation levels (0.4. 0.6, and 0.8 IW/CPE ratio and irrigation at critical growth stages of maize) and subplots comprised of three maize hybrids. The result of the experiment revealed that higher grain yield (81.43 q ha-1) was recorded in irrigation scheduled at 0.8 IW/ CPE ratio followed by irrigation scheduled at critical growth stages of maize (71.68 q ha-1).

2.2 Effect of organic mulch:-

Singh and Nijhawan (1944) They observed higher yield of barley under wheat straw mulch than no mulch..

Tamlin, et al. (1973) found that late mulching with straw 5 week after planting proved beneficial as it increased grain and dry matter production of maize

Olson and Horton (1975) observed that straw mulch applied to corn field modified soil temperature and the microclimate sufficiently to increase the crop growth and yield.

Reddy et al. (1979) recorded increased grain yield upto 0.44 t/ha by the use of mulch.

Zribi et al.(2015).The benefits of the different types of mulching materials for water conservation are weather-dependent and rely on the balance between the water entering the soil from rainfall and irrigation, and the water leaving the soil by evaporation and transpiration.

2.3 Effect of Hydrogel on Maize:-

Dexter and Miyamota (1959) reported that surface coating of seeds in sugar beet with hydrophilic colloids had more rapid and complete emergence than uncoated seeds.

Gehring and Lewis (1980) When polymers are incorporated with soil, they retain large quantities of water and nutrients, which are released as required by the crop, crop growth could be improved with limited water and nutrient supply.

Yang et al. (2006) reported that drought stress had significant effect on plant height. Reduction in water supply caused decrease in cell elongation.

Sivapalan (2006) stated that the retained water in sandy soil was equal to 23 and 95% with application of polymer at 0.03 and 0.07% of its weight, respectively.

Huttermann et al. (2006) reported increased root growth with application of hydrophyllic polymer 0.4% w/w in aleppo pine.

Yazdani et al. (2007) the incorporation of SAP into soil improved crop yield. Superabsorbent polymers have been used as water retaining material in agriculture because when incorporated into soil, they can retain large quantities of water and nutrients. These stored water and nutrients are released slowly as required by the crop to improve growth under limited water supply. The incorporation of SAP into soil improved crop yield. Leaf area indicates good idea of the photosynthetic capacity of the plant and decreased leaf area is an early response to water deficit. With an increase in hydrophilic polymer, there was significant increase in leaf area. Hydrophilic polymer increases the turgor pressure inside the cells by maintaining sufficient amount of water as per crop requirement and thus causing increase in leaf area and other related growth parameters. Absolute growth rate (AGR) refers to dry weight increase per unit time. AGR was higher at 40-60 DAT and decreased later. Polymer treatments recorded higher AGR values at all the stages which clearly indicated that the efficiency of crop in terms of dry matter production is hindered due to water stress. Crop growth rate (CGR) is influenced by LAI, photosynthetic rate and leaf angle. A significant increase in CGR was observed in soil treated with SAP.

Islam et al. (2011) reported that maize yield increased slightly following superabsorbent polymer application by 11.2% under low and 18.8% under medium dose, but significantly at high and very high doses by 29.2 and 27.8% with only half amount (150 kg ha-1) of fertilizer as compared to control, which received conventional standard fertilizer dose (300 kg ha-1). Optimum dose of superabsorbent polymer for maize cultivation would be 30 kg ha-1 as it best increased the grain yield. Application of superabsorbent polymer @ 15 kg ha-1 plus only half the amount of conventional fertilizer dose @ 150 kg ha-1 would be more appropriate practice for sustainable maize production under arid and semiarid conditions of northern China. HE reported that the number of grains per plant reduced marginally under low application of superabsorbent polymer, whereas under medium and high application, it increased by 9.3 and 16.6%, respectively as compared to plant without superabsorbent polymer. Although, no marked changes were noted in 1000-grain weight due to low, medium and high superabsorbent polymer doses, the grain weight under very high dose increased significantly, seeds of maize treated with superabsorbent polymer were slightly heavier than those not treated. Above ground biomass accumulation increased with increasing superabsorbent polymer dose. The value increased by 10.4% only with lower dose of superabsorbent polymer, while it increased significantly by 20.5 and 32.9% with medium and higher dose, respectively.

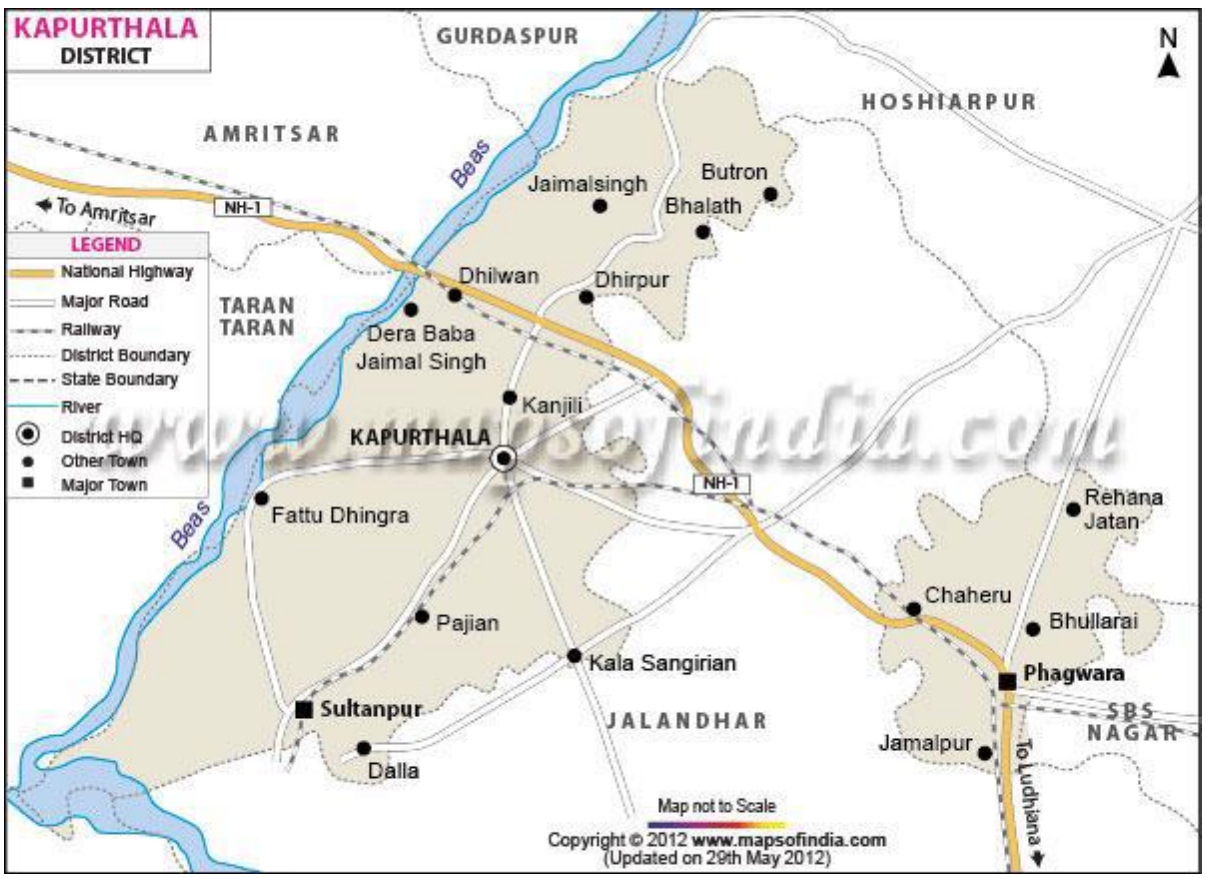
Materials and Methods

Study area:

The study was carried out at the official field of Lovely Professional University, Kapurthala, Punjab, India. Six agro climatic zones have been classified to characterized climatic zone distribution in Punjab and the study area in Chaheru village of Kapurthala district, which lies the heart of northern plain zones. Out of the six agro climatic zone of Punjab, the area lies in Central Plain region.

Topography :

Kapurthala is one of the smallest districts of Punjab. And is located at an altitude of 252 m MSL, latitude of 31022'31.81"N and longitude of 75023'03.02 E and total area of the district is 1633 km2. The area has three sub divisions Kapurthala, Phagwara and Sultanpurlodhi. The major portion of Kapurthala district lies between the Beas River and the Kali-Bein River and is called the 'BET' area.



Climate:

The climate is of typical Punjab plain i.e. hot in summer and cold in winter. June is the warmest month with temperature 33.4◦C and January the coldest month with average temperature of 12.7◦C. The area experiences minimum temperature during December to February months.

The average climatic temperature is 23.8◦C. It has subtropical monsoon type climate and average rain fall is 718 mm. The driest month of the year is November. There is 6 mm of precipitation in November. Major precipitation fall in july with 197 mm.

Local parameter:

Total geographical area of a Kapurthala district is 163 ha in which 134 ha is cultivable, 2ha as forest and remaining as non- agriculture.

Net sown area in the district is irrigated i.e 237.1 ha and gross cropped area is 422.4 hectare and 178% cropping intensity.

The whole agriculture land of the district is irrigated ie 273.1ha. Major source of irrigation in that area is tube well, bore pumps sets. Only 3% irrigated by canals .Water logging and alkalinity is the major problem of this area and it is prone to flood. The entire district is alluvial plain. The economy of this district is predominantly agriculture. Intensive cultivation in the district leaves no scope for forest cover and the wild life is practically nonexistent.

Soil:

Chaheru, covered with alluvial soil and the texture varies from course loamy to find loamy soil. Soil is slightly basic.

Estimation of pH, EC, NPK content, Organic carbon content of the soil:

The physicochemical properties of soil in the experimental plot are to be determined. The chemical properties such as pH, EC, NPK content, organic carbon content of the soil are analysed as well as certain soil physical properties. Soil samples are taken upto 4 times at the different growth stages of the maize crop. Sampling is done at depths of 0-15 cm and 15-30 cm respectively in a zig-zag pattern. 2 treatments in 3 replications are taken following the RBD design in the experimental plot provided. Selected maize varieties are to be sown during the *kharif* and *rabi* season respectively. Only short duration crop varieties recommended by SAU's and ICAR are to be utilized.

Plot

For the cultivation practices for maize, a plot size of about 550 m^2 is provided by the University for experimental purposes. The same field will be utilised for the cultivation of *Rabi* maize.

Plot design:

13.5M

6M | **1.5M** | **6M**

H1M1		H2M2
H2M3		H1M2
H2M1		H3M1
H3M2		H2M3
H1M2		H2M1
H3M3		H1M1
H1M3		H3M3
H2M2		H1M3
H1M2		H3M1
H3M2		H2M1
H1M1		H2M3
H3M1		H2M2
H3M2		H1M3
		H3M3

40.5M

Treatments:

A total of 2 treatments are provided which includes mulching and hydrogel at different concentration.

H1- 25 grams of hydrogel.

H2- 50 grams of hydrogel.

H3- 100 grams of hydrogel.

M1- no mulching.

M2-mulching with 4kg straw.

M3-mulching with 6.5kg straw.

Expected outcomes:

According to the treatments provided, certain outcomes can be predicted. The mulch will reduce the water evaporation from soil. The porosity of the soil could be improved proving that the soil aeration can be improved. Along with this, establishment of hydrogel for retention of water in the soil. Hydrogel will help in reduce leaching of NPK from soil surface. Water holding capacity of the soil will be improved. Mulching will help to maintain soil temperature. Which at last will help to provide better yield.

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