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By

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SYNOPSIS

To study the effect of intercropping wheat with Chickpea and mustard on yield attributes

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Certified that topic entitled " **To study the effect of intercropping wheat with Chickpea and mustard on yield attributes.**" has been decided and formulated by the student himself and is appropriate for his programme.

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DECLARATION

I hereby declare that the project work entitiled "**To study the effect of intercropping wheat with Chickpea and mustard on yield attribute**" 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. Geeta Kandpal, School of Agriculture, Lovely Professional University, Phagwara, Punjab.

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INTRODUCTION

Taxonomical description of Wheat (*Triticum aestivum* L.)

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 Wheat is one of the most prominent food source in many parts of the world. It is one of the most versatile crops among the cereal family stood third in position after rice with respect to area and productivity globally **(Shah and Pamir 2009).** Wheat is considered to be most vital cereal crop for majority of global population belonging to Poaceae (Graminae), of grass family. It is one of the staple food crop of nearly about two billion people, 36% of total world population which comprises of 55% of carbohydraes and food calories about 20% consumed all over the world **(Breiman and Gaur, 1995).**

Soil management practice plays a vital role for improving crop productivity. To achieve sustainability and profitability in agriculture **(Li, Lyang *et* a1., 1999).** Intercropping is growing of two or more crops on same piece of land alternating rows or in set of rows to attain significant use of resources to improve the productivity and yields more income as it helps in reducing the effort due to weeds, plant diseases and nitrogen losses which helps imparting higher yield **(Marer *et* a1., 2007).** Present statistical position of India in wheat production is second with a production of 80.4 million tons during 2008-09 in an area of 28 M ha **(Feldman, 2001).**

Taxonomical description of Chickpea (Cicer arietinum)

Chickpea is considered less labor-intensive crop and its production requires less external inputs as compared to cereals. Chickpea is widely grown around the world and serves as a multiuse

crop. It plays a significant role in improving soil fertility by fixing the atmospheric nitrogen. It can fix up to 140 kg N ha-1 from air and meet most of its nitrogen requirement. After harvest, it leaves substantial amount of residual nitrogen for subsequent crops and adds some amount of organic matter to maintain and improve soil health and fertility. This saves the fertilizer input cost not only for chickpea but also for the subsequent crops.

Chickpea is one of the major pulses cultivated and consumed in India, it is also known as Bengal gram. Chickpea is the major and cheap source of protein as compared to animal the protein. In India, chickpea accounts for about 45% of total pulses produced in the country. Chickpea is rich source of protein and form an important part of vegetarian diet Chickpea seeds contain about 17 to 20% of protein. Chickpea is an important rabi crop mainly sowned in September and November and harvested in February. Crop duration is 90-120 days, depending on the variety sown. Chickpea is best suited crop to areas having low to moderate rainfall and a mil cold weather. Chickpea is the third most important pulse crop after dry beans and peas, produced in the world. It accounts for the 20% of the world pulses production. India is the largest producer, with about 8 million tons per year accounting of about 70% of total world production of chickpea.

Taxonomical description of mustard (*Brasica spp*)

Mustard is a yearly grown in India as an oil seed crop or as a vegetable or as fodder. They are watery yellow or white mustard also known as Brassica hirta, brown mustard also known as Brassica juncea and black mustard also known as Brassica nigra. The leaves of the plant are lengthy, alternating and stubbly branched, covered with hair on both sides. Flowers are small yellow and have four patles, Flowers are small cruciform. Seeds are 1.5-3mm in length. Seeds of the mustard are very much used in cooking.

Mustard seed has 46-48 percent of oil. whole seed meal contains 43.6 percent protein. It is cultivated as a rabbi crop in North India. It is grown during the rainy season from July to November in South India Mustard plaster is a traditionally medical management used to take care of minor ailments. Mustard grows good in pleasant regions Mustard can also be used as a support for salad dressing when mixed with the vinegar and olive oil. Mustard use as an emulsifier which can alleviate a mixture of two or supplementary immiscible liquids, like oil and water. mustard is decrease the risk of curdling. Mustard contains an essential oil known as allyl isothiocyanate which

when applied to the outside of the body, increases the circulation and so helps the elimination of toxic wastes.

Intercropping

Intercropping is defined as growing of two or more dissimilar crops simultaneously on the same piece of land in a different row arrangement **(Katyayan 2005).** Mixed cropping is practice of growing more than one crop in a field a, while intercropping is the practice of growing more than one crop simultaneously in alternating rows of the same field **(Beets, 1990).** Intercropping can increase grain yields and stability, more efficiently use of davailable resources, reduced weed pressure and sustain the plant health **(Hauggaard-Nielsen *et* al., 2003; Jensen *et* al., 2006).**

Mixing species in cropping systems may lead to a range of benefits that are expressed on various space and time scales, from ashort-term increase in crop yield and quality, to longer-term sustainability, up to societal and ecological benefits (Malezieux et al.,2009). Intercropping is an age old practice in India, especially under rainfed conditions, which aims to increase total productivity per unit area and to utilize land resources and farming inputs including labor.Intercropping has been recognized as potentially beneficial system of crop production and evidences suggest that intercropping can provide sustainability yield advantage compared to sole programming **(Singh *et* al.1992**

According to Sullivan (2003) intercrops staggered the maturity dates or development periods and take advantage of variations in peak resource demands for nutrients, water, and sunlight. It helps in increasing its ability to reduce the absorption of nutrients in high amount or quantity from the soil when it is intercropped with that of legume crop as it fixes atmospheric nitrogen present in the soil available to the plant **(Adu-Gyamli *et* al., 2007).** According ***to*** **Ahmed *et* al. (2001)** reported that by intercropping we efficiently utilizes the land resource as it helps in reducing the additional shortage of land for, the crop and effectively reduce the drudgery of the labour and helps in maintaining the economically and sustainably viable cropping system.
According to **Sullivan (2003*)***.

Intercropping systems use resources more effectively than a monoculture method and amount of resources available decreases for use weed. Also intercropping will reduced weed dry and fresh weight and weeds number compared with monoculture. So in intercropping systems use

resources more effectively than a monoculture are and Annually 10% of the world's agricultural production is lost due to weed competition. To increase agricultural production. Reduce losses due to pests and plant diseases. The amount of damages to crops is determined 45% by weeds.One important method control weeds and sustain agriculture is using intercropping. Intercropping systems use resources more effectively than a Mono cropping takes place and there for the amount of available material **(Zimdahl, 1993).**.in Intercropping with increasing diversity in weed control is less and therefore the number of weeds per unit area decreases **(Javanshir *et* al.,2000).** Intercropping uniform population of weeds by reducing the relative abundance of dominant weed population changes **(Poggio, 2005; Asgharipour and Armin, 2010).**

The proposed work is planned to study the uptake of micronutrients and its effect on the yield under following objectives

- To know the effect of intercropping wheat with chickpea and mustard on yield attributes in different row proption
- To know the effect of intercropping wheat with chickpea and mustard on morphological character in different row proption
- To know the effect of intercropping wheat with chickpea and mustard on yield physiological characterstics in different row proption

REVIEW OF LITERATURE

Plant height of chickpea was found to be significant and recorded maximum under 2:2 row ratio but less then sole crop of chickpea. Whereas 4:2 row ratio gave highest yield with linseed. Dry matter accumulation increased with each wider row ratio (6:2) and produced significantly higher over sole crop of chickpea and mustard but non-significant in case of linseedWheat + intercrops 6:2 row ratio produced significantly highest wheat yields, while 2:2 row ratio produced significantly lowest yields. These yields are attributed directly to plant population of wheat under different row ratios **Hosmani *et* al., (1995) and Mandal *et* al., (1996)** As regards row ratio of wheat +intercrops could not affect the growth contributing characteristic viz. Plant height, dry matter accumulation and leaf area index but grain and straw yield significantly influenced by row ratio **(Tomar *et* al., 1997 and Hiremath *et* al., 1991).**

Wheat and mustard intercropping and observed that wheat when grown as sole crop it recorded significantly higher yield i.e., (grain-yield of 1185 kg / ha, straw yield of 2172 kg / ha, test weight of 39.68g and total dry matter production of 7.18, 43.55 and 57.71 g per every 0.5/m row length at different stages of crop growth on comparison with that of intercropped wheat **(Manjit *et* al., 2009).**wheat intercropping particularly on sowing at different rows and observed that the absorption of nutrients i.e., particularly uptake of nitrogen content in straw and grain of wheat and reported that nitrogen uptake in grain and straw of wheat is found to be significantly higher in 10:2 rows ratio of wheat and mustard which was at par with 6:2 row ratios as compared to remaining row ratios **(Raj Vir Singh *et* al., 2003)**

Conducted experiment wheat intercropping and suggested that wheat, mustard and chickpea when grown alone, or wheat in combination with mustard and chickpea affected branching and plant height in mustard and chickpea. However, wheat + mustard intercropping in'4z2 and 10:2 row ratio though remained comparable but produced significantly higher mustard branches plant-1 than 1:1 row ratio. **Mandal *et* al., (1985).**

Wheat and linseed intercropping observed that the highest grain yield was recorded under sole main crop than among intercropping systems, wheat + linseed 4:1 row proportion recorded the highest grain yield as compared to other intercropping systems. **(Dutta *et* al. ,1994).**

Conducted experiment on Wheat and mustard intercropping with different row proportions and observed significant yield was observed in sole crop i.e., effective tillers m-l row length (74.3) and grain yield of wheat (31.4 q ha-l) as compared to that of intercropping systems and 9:1 row ratio of wheat + mustard recorded higher effective tillers m-l row length (69.3) and grain yield of wheat (27.4 q ha-l) over other row proportion **(Singh *et* al., 1995).**

conducted experiment on wheat and mustard intercropping reported that sole wheat. recorded significantly higher grain yield (1185 kg ha1), straw yield (2172 kg ha-l), 1000 grain weight (39.68 g), total dry matter production (7.18, 43.55 and 57.71 g 0.5 m-l row length) at different stages of crop growth than intercropped wheat **(Manjit *et* al., 1995)**.

Among intercropping system, 5:1 row ratio of wheat + mustard recorded significantly higher wheat grain yield (1001 kg ha-l), straw yield (1880-kg ha-l), 1000-grain weight (39.55 g) and total dry matter production (6.85, 39.62 and 51.68 g 0.5 m-l row length) at different stages of crop growth than rest of the row proportions conducted experiment on wheat and mustard intercropping reported that the grain yield of wheat remained unaffected when grown in association with Indian mustard (8:1) row ratio with bonus yield of mustard (0-36 to 2.79 qha-l) under 100% recommended fertilizer as compared to sole and other intercropping systems **(Verma *et* al.,1997)**.

Advantages of intercropping

Intercropping gives additional yield income/unit area than sole cropping. It acts as an insurance against failure of crops in abnormal year. Inter-crops maintain the soil fertility as the nutrient uptake is made from both layers of soil. Reduction in soil runoff and controls weeds. Intercrops provide shade and support to the other crop. Inter cropping system utilizes resources efficiently and their productivity is increased **(Reddy and Redid, 1992).** Intercropping with cash crops is higher profitable. It helps to avoid inter-crop competition and thus a higher number of crop plants are grown per unit area.

Disadvantages of intercropping

Yield decreases as the crops differ in their competitive abilities. Management of Intercropping having different cultural practices seems to be difficult task. Improved implements cannot be used efficiently. Higher amount of fertilizer or irrigation water cannot be utilized properly as the component crops vary in their response of these resources.

Material and method

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

EXPERIMENT SITE

The experiment will conduct at college 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 TransGangetic plain region of agro climatic zone on Punjab India.

DESIGN AND LAYOUT OF THE EXPERIMENT

TECHANICAL PROGRAME :

EXPERIMENTAL DETAILS :

- Year of the experimentation : 2017
- No. of treatments : Six(6)
- No. of replications : Three(3)
- Total no. of plots : Twenty one(21)
- Plot size : 3m x3.5 m =10.5m^2
- Irrigation channel : 0.5 m
- Total area : 23mx13m =299m^2
- Row to row spacing

  wheat : 20 cm

  Chickpea : 35-40cm

  Mustard : 40-45cm
- Plant to plant spacing

  Chickpea : 20-25cm

Wheat : 10 cm

Mustard : 20-25cm

- Crop : wheat, mustard, chickpea

EXEPERIMANTAL DETAILS

Variety :

-Wheat : HD 3086

- Mustard : GS7

-Chickpea : PBG5

Sowing time : 9th December 2017

Sowing depth : wheat = 3-5 cm, Mustard = 3-5cm, chickpea = 5-7 cm

Plot Design : RCBD

Seed rate :

-Wheat = 120kg/ha

-Mustard = 6kg/ha

-Chickpea =75-100kg/ha

DETAILS

NO. of treatment = 7 (including control)

Replication = 3

T_0 : sole wheat

T_1 : wheat : Mustard (3:2)

T_2 : wheat : Mustard (4:1)

T_3 : wheat : Mustard (1:1)

T_4 : wheat : Chickpea (3:2)

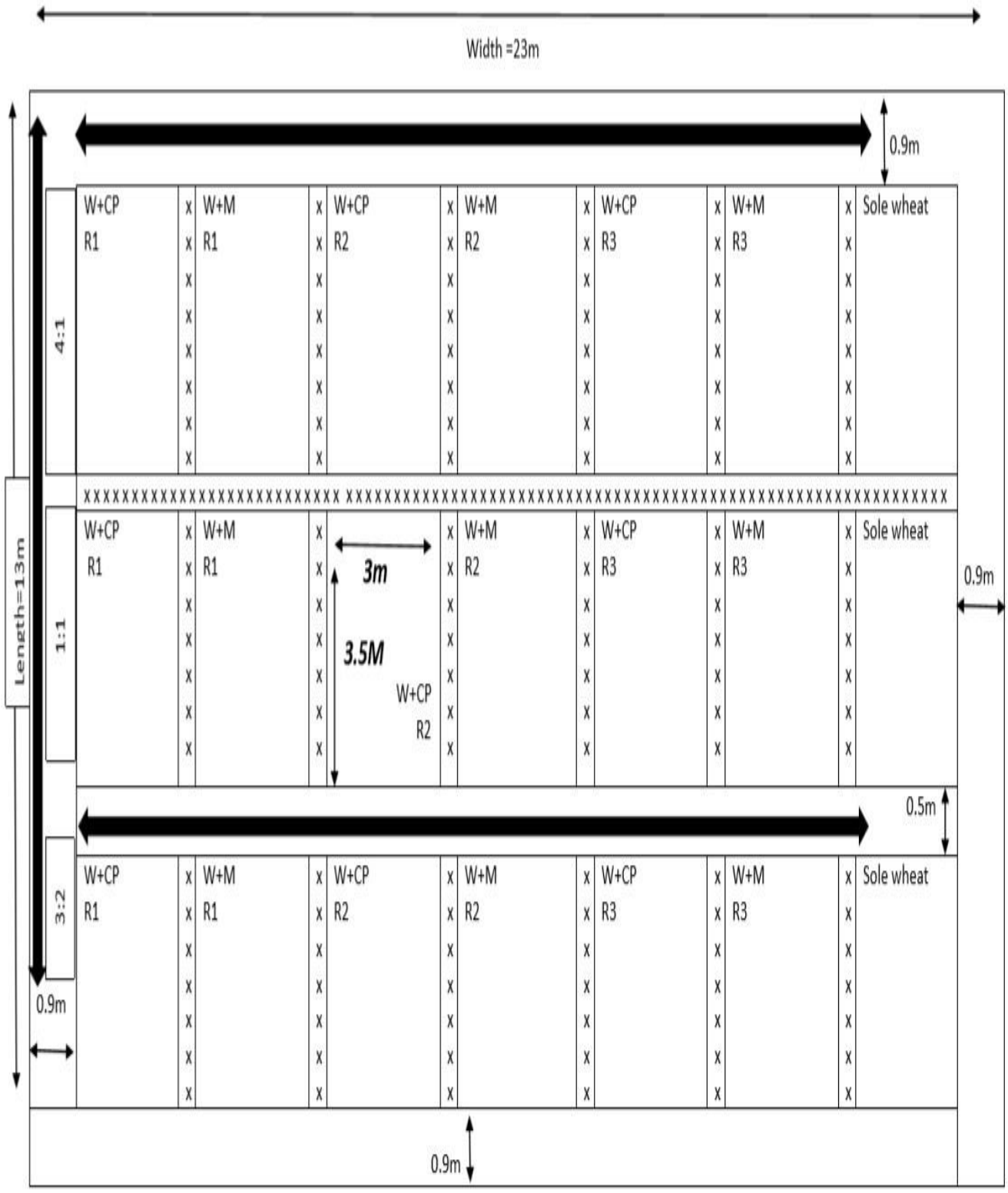
T_5 : wheat : Chickpea (4:1)

T_6 : wheat : Chickpea (1:1)

Layout details :

- Main irrigation channel = 1
- Sub irrigation channel = 2
- Number of irrigation = 4
- Width of plot = 13m
- Length of plot = 23m
- Length of sub plot = 3.5m
- Width of sub plot = 3m
- R1 = replication 1
- R2 =replication 2
- R3 = replication 3
- W= wheat
- CP = Chickpea
- M= mustard

Field Layout



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

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

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)

1. **pH:** pH is a logarithmic scale used to specify the acidity or basicity of an aqueous solution. It is approximately the negative of the base 10 logrithm of the molar concentrations, measured in units of moles per liter of hydrogen ions.

2. EC: Electrical conductivity a measure of a materials ability to conduct an electrical current.soil electrical conductivity is a measurement that correlates with soil properties that affect crop productivity, including soil texture, cation exchange capacity, drainage conditions, organic matter level, salinity, and subsoil characteristics.

3. Estimation of chlorophyll content:

Chlorophyll content was estimated in freshly harvested leaves at active tillering and flowering stage by DMSO method.

i. To estimate chlorophyll content 50 mg of finely chopped leaves were taken in test tube in triplicate.

ii. Add 10 ml DMSO in each test tube.

iii. Incubate the sample at 65 degre c for 3 hours in an oven.

iv After incubation of 3 hours absorbance of sample were determined at 663 and 645 mm using a UV spectrophotometer against pure DMSO as a blank. The chlorophyll content was then calculated by using the formula.

$$\text{Chlorophyll a} = \frac{(12.7Xa663-2.63xa645)x\ V}{\text{Weight (g)} \times 1000}$$

$$\text{Chlorophyll b} = \frac{(22.9XA645-4.48XA663)xV}{\text{Weight (g)} \times 1000}$$

$$\text{Total Chlorophyll} = \frac{(20.2XA645-8.02XA663)XV}{\text{Weight (g)} \times 1000}$$

OBSERVATION TO BE RECORDED :

Growth attributes

Different growth parameters were taken at different growing stages

i. Plant height (cm)

ii. No. of leaves per plant

iii. pH

iv. Available Nitrogen

v. Available Phosphorus

vi. Available Potassium

vii. EC (Electrical conductivity)

viii. Leaf length
ix. No of leaves
x. Total no of branches
xi. Leaf length
xii. Leaf width
xiii. Spikelet length
xiv. Chlorophyll content

Photographs :

Photograph taken at Germination Stage

Photograph taken at Vegetative Stage

Photograph taken at Intial Flowring Stage

Photograph taken at 50 % Flowring stage

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