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EFFECT OF MAIZE LEGUME INTERCROPPING SYSTEM ON GROWTH AND YIELD ATTRIBUTES OF MAIZE (*Zea mays L.)*

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CERTIFICATE

This is to certify that this synopsis entitled **"Effect of Maize legume Intercropping System On Growth and Yield Attributes Of Maize *(Zea mays L.)"*** submitted in partial fulfilment of requirements for degree – Master of Science in Agronomy by **Purnima, Registration no. 11717677** 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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DECLARATION

I hereby declare that the project work entitled **"Effect of Maize legume Intercropping System On Growth and Yield Attributes of Maize (*Zea mays* L.)"** 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 **Dr. Geeta Pandey** Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

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Table of Content

Introduction

Maize is one of the most important cereal crops after wheat and rice with regards to cultivated area in the world and is known as miracle crop worldwide. It has a very high yield potential, there is no cereal on earth which has so immense potentiality and that is why it is called 'queen of cereals'. It is an annual crop, belonging to family poaceae and is used as a source of carbohydrate to both human (in the developing countries) and animal feed worldwide Its also a good feed for poultry, piggery and other animals and is used in the production of biofuel. It ranks below wheat and sorghum, but above rice in nutrition. It occupies third position next to wheat and rice in cereal production in the world. Maize protein Zein is deficient in tryptophane and lysine and has significant quantities of vitamin A, nicotinic acid, riboflavin and vitamin E. It is low in calcium but fairly high in phosphorus. Maize yield is often high in solar intensities, lower night temperatures and lower incidence of pest and diseases **(Adesoji *et al*., 2013)**. It is food security crop in the country where recurrent drought is a common phenomenon . Maize production requires adequate supply of nutrients, particularly nitrogen, phosphorus and potassium for good growth and high yield.

Maize is widely grown in nearly 163 countries. USA is leading in maize cultivation followed by china. They nearly produce half of total world production. It covers 68% of world area ,most of which are the developing countries, with a production of 46%. It covers 10.2 million hectares area in India and about 1.15 lakh hectares in Punjab. It accounts for 26.26 million tones production in India and 4.42 lakh tones in Punjab. It gives an annual yield of about 2.48 quintals per hectare in india and 3.68 quintals in Punjab.

The maize is cultivated throughout the year in all states of the country for various purposes including grain, fodder, green cobs, sweet corn, baby corn, pop corn in peri-urban areas. The predominant maize growing states that contributes more than 80 % of the total maize production are Andhra Pradesh (20.9 %), Karnataka (16.5 %), Rajasthan (9.9 %), Maharashtra (9.1 %), Bihar (8.9 %), Uttar Pradesh (6.1 %), Madhya Pradesh (5.7 %), Himachal Pradesh (4.4 %). Apart from these states maize is also grown in Jammu and Kashmir and North-Eastern states. Hence, the maize has emerged as important crop in the non-traditional regions i.e. =peninsular India as the state like Andhra Pradesh which ranks 5th in area (0.79 m ha) has recorded the highest production (4.14 m t) and productivity (5.26 t ha-1) in the country although the productivity in some of the districts of Andhra Pradesh is more or equal to the USA.

Green gram(Vigna radiata L.Wilczek) is an excellent source of high quality protein, containing about 25% protein. When they are allowed to sprout, ascorbic acid (vitamin C) is synthesized and the amount of riboflavin and thiamine also gets increased. It is also used as a green manuring crop. Being a leguminous crop it has the capacity to fix the atmospheric nitrogen and also helps in preventing soil erosion. It is also used as a feed for cattle. After pod harvesting, the green plants are uprooted or cut from ground level and chopped into small pieces and fed to the cattle. It contributes 14% in total pulses area and 7% in total pulses production of India.

Green gram originated in India and spread to other asian countries, china, Pakistan, Bangladesh, Sri Lanka, Thailand, Indo-Malaysia etc. It is grown in states of Maharashtra, Orissa, Andhra Pradesh, Rajasthan, Bihar, Madhya Pradesh, Uttar Pradesh and Karnataka. If we talk

about Punjab this crop is grown very less in this area. During its short duration, we can adjust this in cropping system and can take three crops.

Intercropping is a cropping system which integrates crop production with soil conservation. Intercropping, 'the cultivation of two or more crops at the same time in the same field. It mostly involves cereal legumes (Maize – soybean, maize – cowpea, maize – groundnuts, millet groundnuts etc. Intercropping is an economical method of crop growing as compared to sole cropping. Benefits of intercropping includes better use of resources, improvement of soil fertility by legume components of the system, soil preservation through covering the bare land between the rows, reduction of biotic and abiotic risks by increasing diversity, suppression of weeds infestation, etc. The greater income here is in fact attributed to the efficient use of inputs, soil, and other resources. The study suggests that intercropping can reduce dependence on the synthetic herbicides for weed management. In addition it is an environmentally safe way of managing and minimizing the associated weeds **[Singh & Balyan (2000)** and **Barik *et al*.,(1998)]**

They usually give higher yield then sole cropping and acts as an insurance against failure or fluctuating market price of single crops. Several weed control methods such as planting density, herbicides ,hand weeding were unsuccessful in maize. Intercropping is a sort of effective practice in maize production which not only helps in reducing the available space for weed growth but also in increasing the production per unit area. Moreover, in case of a severe disease or insect attack there are least chances of 100% crop loss, as the same disease or insect can't attack two different type of crops at the same time in the same field.

Objectives

- To determine the effect of maize legume intercropping on soil nitrogen.
- To study the effect of intercropping on growth characters of maize.
- To study the effect of intercropping on yield and yield attributes of maize.
- To study the effect of maize- moong intercropping quality of maize seed.

Review of Literature

- **Legwaila *et al.*, (2012)** investigated the effects of intercropping maize and cowpeas on the performance of maize and cowpeas. The treatments were sole maize crop, sole cowpea crop, intercrop 1 (spacing of 40 cm between of maize and cowpea) and intercrop 2 (spacing of 30 cm between maize and cowpea served as treatments. The results show that only maize dry matter was significantly reduced by intercropping. Intercropping reduced the number cowpea flowers per plant but had no significant effect in the number of seeds per pod and weight of seeds. It was found that that the sole cropping of maize performed better than all the intercrops.
- **Dahmardeh *et al.*, (2010)** studied Sole crops and intercrops of maize (*Zea mays* L.) and cowpea (Vigna unguiculata L.) at eight planting ratios of maize: cowpea (100:100, 50:100, 100:50, 25:75, 75:25, 50:50, 0:100 and 100:0) and two harvest times (milky stage and dough stage). Results indicate that intercropping can increase nutrient elements of soil compared to sole maize and improve conservation of soil fertility. Based on high grain and improve soil fertility intercrop productivity compared to sole crop could be selected for improving the productivity of maize/cowpea mixture.
- **Zenebe *et al.*, (2017)** conducted an experiment to find out the effect of intercropping of legumes and rates of nitrogen fertilizer on yield and yield components of maize (Zea mays L.). The experiment consisted of 0, 23, 46, 69 and 92 kg·N·ha−1 and sole maize, maize + commom bean, maize + common bean − mung bean cropping systems with Random Complete Block Design factorial experiment in three replications. The, maximum marginal rate of return was obtained from maize + common bean − mung bean and applying 69 kg·N·ha−1 (1080%).
- **Shahbazi *et al.*, (2012)** Conducted an experiment in the form of a randomized complete block design with four replications. Treatments of the experiment included four different ratios of maize / mungbean planting density: 25/75, 50/50/ 75/25, 100/0. Results indicated that different ratios significantly affected most of the measured traits except for plant height and the number of ears in plant. 75% maize + 25% mungbean gave the highest yield and yield components.

- **Jamshidia *et al.*, (2013)** Conducted Field experiments to investigate the influence of cowpea (Vigna unguiculata) density (0, 15 or 30 plants/m2 and maize (Zea mays) planting density (7.5 or 9 plants/m2) on weed biomass and maize crop yield. Results showed that increasing the maize density from 7.5 to 9 plants/m2 reduced the weed biomass by 21.5%. Furthermore, cowpea acted as a living mulch, reducing weed biomass by up to 45.5% and 39.6% when intercropped with maize at a density of 7.5 and 9 plants/m2 respectively.
- **Rana, *et al.*, (2001)** studied intercropping of legumes viz. Soybean, cowpea, frenchbean and urdbean with maize at varying levels of NPK to legume component revealed that intercropping systems were superior to sole crop. In intercropping systems, application of 50 per cent of the recommended dose of NPK fertilizers to legume component was statistically at par with 100 per cent fertilizers. On an average, available N content at harvest in intercropping system was higher by 30 kg N/ha maize equivalent yield by 15-20 q/ha and LER by 30-37 per cent as compared to that in sole stand. Paired row planting 30/60 cm of maize could not enhance yield as compared to uniform row 60 cm planting.

Material and Methodology

Experimental Site

The experiment was conducted in the agricultural farm of Lovely professional Univrsity, Phagwara,Punjab, situated geographically at 31˚14'48.0"N 75˚41'45.0"E and 252 m above sea level. It falls under central plain zone of agro climatic zones of India.

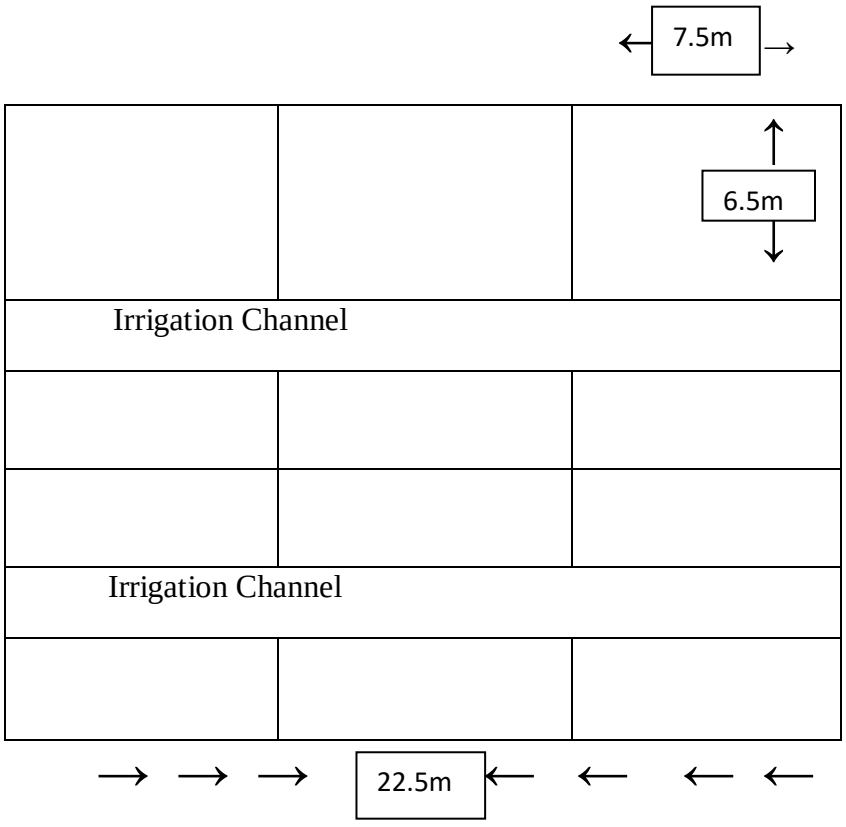
Variety of maize-Pioneer H18M473

Variety of Green Gram-SML 832

Seed rate of maize =1kg

Seed rate of Green Gram=1/2kg

Experiment Layout



The maize crop was grown in different ratios with gram *i.e.* (maize **:** Gram) with four treatments in three replications.

T1=Control

T2=3:3

T3=5:1

T4=2:4

Total Plots=12

Total Area=504 m^2

Area of 1 Plot=42m^2

Row to row distance =60cm

Plant to plant distance=25m^2

No of rows per plot=12

Date of sowing=3rd march

Date of 2nd sowing=28th march

Layout of Treatment

T_4R_1	T3R2	T2R3
T2R1	T4R2	T3R3
T3R1	T4R2	T4R3
T4R1	T2R2	T4R3

Land Preparation

The soil is very alkaline in nature. The land was ploughed and made weed free. The land was previously covered with eucalyptus trees. Following shows the soil details. Raised bed were prepared. Sowing/planting was done on the southern side of the east-west ridges/beds, which helps in good germination. Planting was done at proper spacing.

Physicochemical Properties of Soil

The physical and chemical properties of the soil of the experimental site from a composite soil sample of 0 - 30 cm depth was analyzed and the result is presented in the following table.

EC	1.5
pH	8

Sowing The seeds were dipped in water overnight and were sowed next morning.

Date of 1st sowing	3rd march
Date of 2nd sowing	28th march

Sowing

Maize germination

Irrigation

1	5th march	2 days after sowing
2	14th march	11 days after sowing
3	23rd march	20 days after sowing
4	2nd April	29 days after sowing
5	9th April	36days after sowing

Fertilizer Application

NPK dose

Nitrogen= 100-120 kg /ha

Phosphorus=60kg/ha

Potassium=40kg/ha

Date of fertilizer application

3rd march –At the time of sowing

24th march-At knee high stage

12th May -At tasseling stage

Fertilizer doze

Nitrogen

- 10,000m^2 area - 120kg N
- 1m^2 area - 120/10,000
- 504m^2 area - 120/10,000 X 504
- 6.00kg N

Phosphorus

- 10,000m^2 area- 60kg P
- 504m^2 area - 60/10,000 X 504
- 3.0kg P

Potash

- 10,000m^2 area 40kg
- 504m^2 area 40/10,000 X 504
- 2.0kg K

DAP

- 46 g P-100g DAP
- 3000g P-100/46 X 3000
- 6521.73g
- 6.5Kg DAP

Similarly

- 100g DAP-18g N
- 6500g DAP-18/100 X 6500
- 1170g
- 1.17 kg N

MOP

- 50g K -100g MOP
- 2000g K-100 X 2000/50
- 4000g MOP
- 4kg MOP

Urea

Nitrogen needed : - 6 - 1.17 = 4.83 kg N

- 46g N-100g Urea
- 4830 g N-100 X 4830/46
- 10,500g Urea

Observations to be recorded

Growth attributes

Plant Height

Stem Diameter

Maize leaf area

Number of leaves per plant

Ear length

Days to maturity

Weed biomass

No of leaves

Yield attributes

- Kernel number per ear
- 100 seed weight
- Grain yield/plot
- No of Cobs

Soil parameters

- Soil PH
- N,P and K content of soil
- Organic carbon (%)
- Organic matter (%)

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