REPORT ON

Effect of Paclobutrazol, Rhizobium, Mycorrhiza on growth and yield of "green gram"

(*Vigna radiata* L.)

Dissertation - I

AGR 596

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CERTIFICATE:

This is to certify that this synopsis entitled **"Effect of Paclobutrazol, Rhizobium, Mycorrhiza on growth and yield of "Green Gram"** submitted in partial fulfillment of requirements for degree – Masters of Science in Agronomy by **Prasenjit, Registration no. 11719020** to the Department of Agronomy, School of Agriculture, Lovely Professional University, has been formulated and finalized by the student himself on the subject.

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DECLARATION

I hereby declare that the project work entitled **"Effect of Paclobutrazol, Rhizobium, Mycorrhiza on growth and yield of "Green Gram"** is an authentic record of my work carried at **Lovely Professional University** as requirements of project work for the award of degree -Masters of Science in Agronomy, under the guidance of **Mr. Ajeet Prakash,** Assistant Professor, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India.

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Introduction

The green gram (*Vigna radiata* L.), alternatively known as the moong bean, monggo, or mung. Mungbean (*Vigna radiata* L.) is the important pulse crop belonging to the family Fabaceae. It has worldwide productivity and commonly cultivated in Asia. The seeds contain 22-28% carbohydrates, protein 60-65%, 1-1.5% fat, 3.5-4.5% fibers and 4.5-5.5% ash.

This crop can be used for both seeds and forage since it can produce a large amount of biomass and then recover after grazing to yield abundant seeds. The green gram is mainly cultivated in Indian Subcontinent India, Pakistan, Bangladesh, Nepal. including China, Korea, South Asia and Southeast Asia.

Green gram is a protein rich diet. In India it is consumed in the form of whole pulse as well split pulse. Some of the hybrid varieties of green gram in India :-

RUM -1, HUM -12, BM-4, PDM-4, JM-72, K-851 & PDM-11

Agro-climatic conditions for Green Gram Cultivation :-Best climatic condition for green gram cultivation is warm humid and within temperature range of 25C – 35C,with moderate rain of 85 to 100 cm, well distributed throughout its growing period of 100 days.

Best season to grow green gram :-Usually march to june period has high temperature and low humidity and this will keep insects and diseases at their lowest.

Green gram is cultivated during warm and wet kharif season in North India where as in South India in mild winter season.

Soil requirement :-Green gram can be cultivated in wide range of soils, from black cotton soils in North India red laterite soils in South India and sandy soils in Rajasthan. For best production of green gram one should select the soil like well drained loamy to sandy loam soil. Avoid water logging soils and saline soils as they are not suitable for green gram cultivation.

Field Preparation :-The main field selected for green gram cultivation must not have been sown with green gram in the previous seasons to avoid volunteer plants that will cause admixture. Prepare main field by ploughing for fine tilth and form channels and beds for green gram cultivation.To supplement the soil with proper nutrient, apply lime at the rate of 2 tones/ha along with farm yard manure @12.5 tones/ha or composite coir pith at 13 tones/ha to get an extra yield of about 15 to 20%.

Seed Rate :-Seed rate depends on the variety of seed and that may vary from 8 to 10 kg/acre.

Seed Selection :-Seed used for cultivation must be form genuine authorized source which will help you to select proper seed that has genetic purity and seed must be vigorous to have good field stand. In the process of seed selection, one must check for diseased seeds, hard seeds, shrunken seeds immature seeds, deformed seeds.

Seed treatment :-Treat the seeds with thiram or carbendazim at 2 grams/kg of seed 1 day before sowing the seeds or pseudomonas fluorescens @10 grams/kg seed or with talc formulation of trichoderma viride @4grams/kg of seed. First treat the green gram seeds with biocontrol agents and then with 'rhizobium'.

Fertilizers and Manures :-Apply the following fertilizers basally before sowing green gram seed :-10 cartloads (5 tones) of well decomposed compost like cow dung or any other good compost should be spread along with basal application of 120 kg super phosahate and 20kg urea/acre

Irrigated conditions: 50kg P_2O + 25 kg N + 50kg P_2O_5 +20kg S/ha

Rainfed condition: 25kg P_2O_5 + 12.5kg N + 10kg S/ha

Spacing :-Dibble the green gram seeds making a space of 30 x 10cm in green gram farming. In case of bund crop, dibble the seeds with 30cm spacing.

Irrigation :-Irrigation should be done after sowing, followed by life irrigation on 3rd day. Irrigate at intervals of 6 to 9 days depending upon climatic condition and soil type. Irrigation must be provided at flowering & pod formation stages. Makes sure soil has proper drainage the avoid water logging at all stages of plant growth. Should apply KCL at 0.5% as foliar spray during vegetative stage of the crop, if there is any moisture stress.

Weed control :-As soon as sowing and irrigation is done basalin weedicide should be applied by dissolving 2ml of basalin/liter of water. The spraying of weedicide must be done within 3 days of sowing the seeds. If done later, it can damage the seed crop. To manage and control later emerging weeds in the crop, manual weeding should be preferred one month after sowing.

Harvesting :-The best time to harvest the crop, when 85% of the pods are fully matured. Avoid harvesting in the bas weather condition and keep the harvested stack for drying in the field after cutting on the threshing floor. Remove any admixtures before start of harvesting.

Yield :-Yield of green gram depends upon the seeds and farm management practices, at an average of 10 to 14 quintals/ha can be expected.

Paclobutrazol :

Paclobutrazol (**PBZ**) is a plant growth retardant and triazole fungicide. It is a known antagonist of the plant hormone gibberellin. It acts by inhibiting gibberellin biosynthesis, reducing internodial growth to give stouter stems, increasing root growth, causing early fruitset and increasing seedset in plants PBZ has also been shown to reduce frost sensitivity in plants. Moreover, paclobutrazol can be used as a chemical approach for reducing the risk of lodging in cereal crops. PBZ is used by arborists to reduce shoot growth and has been shown to have additional positive effects on trees and shrubs. Among those are improved resistance to drought stress, darker green leaves, higher resistance against fungi and bacteria, and enhanced development of roots.

Vesicular arbuscular mycorrhiza :

Vesicular arbuscular mycorrhizal (VAM) fungi is always stimulate absorption of zinc (Zn) and copper (Cu) (Zygomycetous fungi from the order Glomales) the most and also increase plant resistance to various stresses like common symbiosis of the plant kingdom and colonize drought, salt, heavy metal and water [4]. However, AM more than 80% of vascular plants [1]. A symbiosis refers fungi have been interact with some another beneficiary to an association of living organisms that benefits both soil microorganisms like N fixer, phosphate solubilizer partners, enabling them to survive and reproduce more and PGPS producing microbial strains [5]. AM fungal successfully and also it acquires increased resistance to strains are used to enhance production of roots, shoots environmental stresses such as drought, cold and root and fruits and it is used as a substitute biofertilizer. pathogens [2]. There are extensive microbial activities in Generally it is used to maintain the soil nutrients and rhizosphere soil which is colonized by a wide range of water resources for next cohort of cultivated area. More microbes having important effects on plant nutrition, and more reports are coming on the ability of AM fungi's growth and health. Generally VAM fungi are known to ability to alter water relations and play a great role in the enhance phosphate uptake, which in turn improve plant growth of host plant in the conditions of drought stress growth and nitrogen fixation.

Rhizobium :

Rhizobium is a genus of gram negative soil bacteria that fix nitrogen. rhizobium species form an endosymbiotic nitrogen fixing association with roots of legumes and Parasponia.

The bacteria colonize plant cells within root nodules, where they convert atmospheric nitrogen into ammonia and then provide organic nitrogenous compounds such as glutamine or ureides to the plant. The plant, in turn, provides the bacteria with organic compounds made by photosynthesis.

Objectives

- To observe the effects of paclobutrazol, rhizobium and mycorrhiza in the growth of "green gram".

- To compare the interaction of paclobutrazol, rhizobium and mycorrhiza in the yield attributing characters of "green gram".

- To evaluate the effects of Paclobutrazol and mycorrhiza in increasing the yield of "green gram".

Scope of study :-

Studying and evaluating the role of paclobutrazol, rhizobium and mycorrhiza in enhancing the yield and yield attributes of green gram (*Vigna radiata* L.).In this field experiment we will evaluate role of paclobutrazol, rhizobium and mycorrhiza that can enhance the yield of green gram. We will also compare the interaction of paclobutrazol, rhizobium and mycorrhiza in the yield attributing characters of "green gram.

Review of Literature

A brief review of literature pertinent to present study is presented in this chapter. An attempt has been made to cite the relevant literature on "**Effect of Paclobutrazol, Rhizobium, Mycorrhiza on growth and yield of green gram"(Vigna radiata *L*.)** The available literature strongly conveys that little work has been done on green gram to levels of paclobutrazol, micorrhiza and rhizobium. Therefore, similar work done on other field crops has also been reviewed in this chapter.

Effect Of Bio-Fertilizer On Green Gram :

Soil-borne phytopathogenic fungi pose serious threats to yield of several pulses crops.
Uses of biofertilizers are an ecofriendly approach in the effective management of growth, yield and diseases of crops by secretion of different hydrolytic enzymes.

Street *et al*. (1986) conducted a three year study in rice with paclobutrazol applied 2 weeks after panicle initiation; and @ 0.7, 0.14 and 0.28 kg paclobutrazol ha-1. Results indicated that, application of 0.28 kg of paclobutrazol ha-1, 2 weeks after panicle initiation, reduced rice height each year and increased rough rice yield.

Lee *et al*. (1987) studied the performance of high quality rice cv. Damageum, Nongrim-6, Chuchung and Kashihikari, in comparison with the non-lodging cv. Dorgjin and Milyang 23, following the application of 50, 100 and 150 kg N ha-1 and 0, 30 and 45 kg paclobutrazol ha-1. Among the growth parameters plant height, length of 3rd internode and lodging liability all increased with increasing N rate. Field lodging occurred with 50 kg N/ha in cv. Damageum, with 100 kg/ha N in cv. Kashihikari and 150 kg N in cv. Nongrim-6. However, paclobutrazol applied at 0.6 per cent, 15 days before heading reduced the plant height, length of the 3rd internode and lodging liability. Field lodging was also reduced by the application paclobutrazol.

Vikram *et al.* (2008) observed that inoculation of green gram seeds with PSBV-14 recorded the highest nodule number, nodule dry weight, shoot dry matter and total dry matter in green gram plants 45 days after sowing. Similarly, treatment receiving the inoculation of PSBV-13 recorded the highest root length, root dry matter, P content and P uptake in root and shoot in green gram plants.

On clay loam soil of Srinagar (J & K), Hussain *et al.* (2011a) reported that the combined inoculation of rhizobium + PSB slightly improved plant height, dry matter production, numberand weight of nodules per plant of black gram (cv. Pant Urd-19) over rhizobium and PSB inoculated separately.

Berova and Zlatev (2000) observed that the paclobutrazol (PBZ) accelerates fruit formation and increases early fruit yield.

Choi *et al*. (1988) observed that, when rice seeds soaked in 3, 10 or 30 ppm uniconazole, paclobutrazol, fluriprimidol and inabenfide, respectively and sprayed on seedling at 10 and 30 days after transplanting, except inabenfide rest the three components shows retarded seedling growth and plant height.

Sattar *et al.* (2013) conducted a field experiment at the field laboratory of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh Bangladesh during February to June 2010. The soil of the experiment field was sandy loam. The experiment comprised of four fertilizer combinations *viz.*, No biofertilizer and urea (F0), Biofertilizer only (F1), Biofertilizer with one-third urea (13 kg urea ha-1) of recommended dose (F2), Recommended dose of urea(40 kg urea ha-1) only (F3) and two varieties *viz*., Binamoog-5 (V1) and Binamoog-6 (V2). The application of biofertilizer and urea alone or in combination had positive effects on plant growth and development compared to control in mungbean. Highest plant height, branches plant-1 and nodules number plant-1, LA and chlorophyll were recorded in Biofertilizer with one-third urea (13 kg urea ha-1) treatment followed by no urea application treatment.

Reddy *et al.* (2000**)** studied the effect of 3 levels of phosphorus (0, 13.1 and 26.2 kg P ha-1) on mungbean. They observed that with an increase in phosphorus level from 0 to 26.2 kg P ha, yield attributes like pods plant, grains pod, grain yield and haulm yield ha also increased under the highest level by 53.5, 15.3, 50.6 and 26.3 per cent, respectively over the control. But grains pod-1 at 26.2 kg P was comparable with that of 13.1 kg P ha-1. Phosphorus content in haulm and grain increased significantly by the application of 26.2 kg P ha-1.

Srinivas *et al.* (2002) studied the effects of seed inoculation with *Rhizobium*, along with application of different rates of N (0, 20, 40 and 60 kg ha-1) and P (0, 25, 50 and 75 kg ha-1) on the yield and economics of green gram cv. LGG-450 in a field experiment conducted in Hyderabad, Andhra Pradesh, India during the kharif season of 1999. Seed and haulm yield increased with increasing rates of P and with increasing rates of N up to 40 kg ha-1 followed by a decrease with further increase in nitrogen.

Shahi *et al.* (2002) conducted a field experiment at Allahabad, Uttar Pradesh during *kharif* season and found significant increase in protein content (21.22 per cent) by the application of 20 kg P ha-1 and Rhizobium inoculation over its uninoculated treatment.

Singh and Pareek (2003) reported that the seed yield of greengram with application of 45 kg P2O5 ha-1 with dual inoculation of *Rhizobium* + PSB gave significantly higher seed yield of mungbean.

Material and Methods

Research Topic : Effect of Paclobutrazol, Rhizobium, Mycorrhiza on growth and yield of "green gram"(Vigna radiata *L.*)

Experimental Site: Experiment is conducting at the Agricultural Farm of Lovely professional University, Phagwara 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.

Experimental details :

Year of crop :- 2018

Recommended doses of fertilizer :-

Irrigated conditions: 50kg P2O + 25 kg N + 50kg P2O5 +20kg S/ha

Rainfed condition: 25kg P2O5 + 12.5kg N + 10kg S/ha

Crop Variety : SML 832

No. Of plots : 24

Gross plot area : 720 m²

Net plot area : 600 m²

No. Of treatments : 8

No. Of Replications : 3

Design : Randomized Block Design

Spacing : P×P = 10cm

R×R = 30cm

Sowing date : First fort night of april

Treatments :-

T_0 = Control

T_1 = Paclobutrazol

T_2 = Mycorrhiza

T_3= Rhizobium

T_4 = Paclobutrazol + Mycorrhiza

T_5= Paclobutrazol + Rhizobium

T_6 = Mycorrhiza + Rhizobium

T_7= Mycorrhiza + Rhizobium + Paclobutrazol

Layout

T0	**IRRIGATION CHANNEL**	**T4**	**IRRIGATION CHANNEL**	**T7**
T1		**T3**		**T6**
T7		**T2**		**T5**
T5		**T1**		**T4**
T6		**T0**		**T3**
T4		**T5**		**T2**
T3		**T6**		**T1**
T2		**T7**		**T0**

Observation

Morphological Observation

i. Plant height (cm) at 25, 50 DAS and at harvest stage

ii. Stem Girth (cm)

iii. No. of leaves per plant

iv. No. of pods per plant

v. No. of branches per plant

vi. Pod weight per plant

vii. Leaf area

Biochemical Observation

i. Total Soluble Sugar

ii. Total Soluble Protein

iii. Total Carbohydrate

iv. Total Chlorophyll content of leaves

Yield attributes

i. Yield (kg/ha)

ii. Harvest index

iii. Seed Index (100 seed weight)

5.4 Soil Analysis

Collection of samples

Soil samples will be taken for analysis to check soil status (pH, EC, N, P, K, and organic carbon) of experimental field before crop season.

Analytical methods to be followed during investigation are as under

S. No	Test parameter	Method	References
Soil parameters			
1	pH	Glass electrode	Sparks(1996)
2	EC	Conductivity meter	Sparks(1996)
3	Organic carbon	Wet digestion	Walkley and black(1934)
4	Available N	Alkaline potassium permanate method	Subbiah and Asija(1956)
5	Available P	Olsen's method	Olsen et al.(1954)
6	Available K	Flame photometer	Jackson(1973)

5.6 Statistical analysis

Data generated in the experiment will be analysed as per standard statistical procedure described by Rangaswamy (2002)

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