SYNOPSIS

FOR

"Effect of different type of Mulches on growth and quality of Bitter Gourd (*Momordica charantia* L.)"

DISSERTATION REPORT-1

Submitted To:

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CERTIFICATE

Certified that this synopsis of Lovepreet Singh, registration no. 11616567, entitled **"Effect of different type of Mulches on Bitter Gourd (*Momordica charantia* L.)"** has been formulated and finalized by the student himself on the subject.

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Introduction

Bitter Gourd (*Momordica charantia L.*) also known as Bitter Melon or Karela belongs to family Cucurbitaceae, It is native to India or China and is one of the most valuable warm season vegetable crop grown in India, having chromosome number (2n=22). It has a typical morphology i.e. pointed ends, narrower shape and surface cover with jagged, triangular teeth and have a strong bitter taste. It is grown in many tropical and subtropical parts of the world but most popular in Southeast Asia with India as largest producer of bitter gourd in the world. The fruit of bitter gourd continues to mature after harvesting, So that fruit for local market is harvested when they are physiological mature and for long distance market it should be harvested when immature (Vujovic *et al*. 2000).

Mature fruit is a rich source of vitamin C and vine tips are an excellent source of vitamin A. Its leaves contain calcium (1%), magnesium (4%), potassium (7%), phosphorus (5%), and iron (3%). Moreover, fruit and leaves are greater source of vitamins like Thiamine (vit.B1) 4%, Riboflavin (vit.B2) 4%, Niacin (vit.B3) 2%, (vit.B6) 3% and (vit.B9) 13%. All parts of bittergourd plant have very bitter taste, due to presence of a compound known as momordicin. In Ayurveda, various plant parts of *Momordica charantia* (Karela) are used for treatment of many diseases like; diarrhoea, cholera, anaemia, blood diseases, bronchitis, ulcer, dysentery, sexual tonic and also cure for gonorrhoea. Bitter Gourd contain biologically active compounds like tri-terpens, alkaloids, flavonoids, saponins, acids and steroids, therefore plant possess anti-bacterial, anti-fungal, anti-parasitic, anti-fertility, anti-tumorous, anti-viral, anti-carcinogenic and hypoglycemic properties (Grover, J.K. and Yadav, S.P. *et al.* 2004). Medicinal properties of fruits are useful for prevention of various diseases like: gout, rheumatism, worms, disease of liver and spleen. Moreover, it is also useful for the treatment for diabetes and cancer. According to WHO, over 391 million people affected due to diabetes and it emerge as 7^{th} leading cause of death in 2030 (WHO 2014). It is a potent hypoglycemic agent due to alkaloids and insulin like peptides and a mixture of steroidal sapogenins known as charantin (Scartezzini P and Speroni E *et al.* 2000).

Bitter Gourd is grown throughout the India, but in terms of area and production, Andhra Pradesh is at first position followed by Assam, Odisha, Madhya Pradesh,

respectively. The total area under this crop was 78.12 thousand hectare during 2012-2013 and production was near about 883.69 thousand metric tonnes.

Bitter Gourd required sandy loam soil contain high organic matter for their better growth and development. The optimum soil range is 6.0-6.7, but plant can tolerate alkaline soil up to 7.5. It is warm season crop which required minimum temperature of 18 ^{o}C for early growth, but optimum temperature is in between 24-27 ^{o}C. It can tolerate low temperature, but growth is retarded at low temperature, however, frost may kill the plant completely.

In addition, the impact of weeds in the field of bitter gourd cannot be ignored. Some of the most common weeds of cucurbit crops include nut sedges, Bermuda grass, morning glories, pigweeds, common cocklebur, rag weeds, and horse nettle (Webster *et al.* 2006). The minimum weed-free period in cucurbit crops has been observed as the first 3 to 4 weeks after transplanting (Noble *et al.* 2009). Organic weed management is herculean task at this time, because mechanical removal can destroy crop vines and shallow roots of plant, and manual removal of weeds is costly due to high number of labour requirement. Late-emerging weeds set many seeds, during their long maturation periods of the cucurbits (Stall *et al.* 2009).

Mulching reduces the deterioration of soil by way of preventing the runoff and soil loss, minimizes the weed infestation and checks the water evaporation. Thus, it facilitates for more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil, as it adds nutrients to the soil and ultimately enhances the growth and yield of crops. Further, reported that mulching boosts the yield by 50-60 per cent over no mulching under rainfed situations. Different kinds of mulching materials are available now-a-days. Some are organic and some are inorganic, fulfilling the same purpose.

Organic mulches used from longer period as a traditionally practices in which mostly straw, farm yard manure (FYM) and some other biological waste of household is used as a mulch. While inorganic mulches includes use of polythene sheet, newspaper, pebble, etc.
Therefore, considering the importance of different mulching in various vegetable crops, the present investigation will be carried out to study the effect of different mulching material on growth, yield and quality of bitter gourd with the following objectives:

1. To study the effect of different mulches on weeds population/density.
2. To evaluate the effect of different mulching materials on growth, yield and quality of bitter gourd.
3. To evaluate performance of different mulching materials on moisture conservation.

Review of Literature

Aniekwe and Anike, (1999) observed the effects of different mulching materials and plant densities on the environment, growth and yield of cucumber, in a 4 x 3 factorial experiment in three replications for two cropping seasons. They showed that rice hull mulch had the highest vine length (145.5 cm), leaf area (184.63 cm2), fruit weight (1.27 kg), fruit length (62.7 cm) and fruit diameter (9.43 cm) than the control and raised the average daily soil temperature from 28.1ºC - 27.4ºC, while transparent plastic mulch had the highest number of vine (5.2), number of leaves (32.5), number of fruits (7.98) and made the greatest improvement on the average daily soil temperature (28.8ºC). They concluded that both mulching and plant spacing are good crop production techniques, for the small holder farmers of this zone, especially plastic film mulches and medium plant densities for efficient cucumber production and management.

Ekinci and Dursun, (2009) studied the effects of different mulch materials on plant growth, some quality parameters and yield in Melon *(Cucumis melo* L.) cultivars in high altitude environmental condition. They showed that clear mulch application affected more plant growth than the other applications. They also investigated the fruit width, fruit length, dry matter in fruit, total soluble solid, color, husk thickness, fruit fresh thickness, fruit firmness, pH, total and reducing sugar of the cultivars. They showed that average marketable yield in the study years increased by 25-28% in clear plastic mulch and 15% in black plastic mulch compared to the control application.

Haapala *et al.,* (2015) analysed the effect of different paper mulches and two different biodegradable plastic mulches on the yield of field grown cucumber. They found that all the mulches increased the yield as compared to control. They also concluded that the dark coloured mulches had the greatest soil warming effect and controlled the weeds efficiently.

Khan *et al.,* (2011) studied the influence of different mulches on growth and yield of sponge gourd (*Luffa clyndrica* L.). They used seven different treatments in Randomized Block

Design (RBD) with three replications viz., T1- mulching with goat manure, T2– control (no mulch), T3– white polythene mulch, T4–grass mulch, T5– farm yard manure mulch, T6– black polythene mulch, T7– rice straw mulch. They found that the maximum values for vine length (125.00 cm.) and yield characters, days to flowering, vine spread (cm), fruit length (cm), fruit weight (g), fruit diameter (cm), no. of fruits per plant and fruit yield (213.47q/ha) were significantly superior with black polyethylene mulch while, plants without mulch (control) resulted poor growth and yield.

Luqman *et al.,* (2013) studied the integrated weed management in bitter gourd in the agro-ecological conditions of Peshawar. They used four different mulch (Rumex crispus, Silybum marianum, newspapers, and saw-dust) and a herbicide i.e. Stomp 330 EC (pendimethalin) as pre-emergence. They found that the performance of the mulching treatments was significantly more effective than the weedy check plots.

Nyoike *et al.,* (2008) studied the suppression of Whiteflies, *Bemisia tabaci* (Hemiptera: Aleyrodidae) and incidence of *Cucurbit Leaf Crumple Virus*, a Whitefly-transmitted Virus of Zucchini Squash New to Florida, with Mulches and Imidacloprid. They found that both living and reflective mulches were more effective than white mulch in reducing the densities of whiteflies and the incidence of CuLCrV on zucchini plants.

Parmar *et al.,* (2013) studied the effect of mulching material on growth, yield and quality of watermelon (citrullus lanatus thunb) cv. Kiran. The results revealed that different types of mulching materials significantly influenced the growth parameters of watermelon viz., number of branches per vine, main vine length and number of nods per vine over control. They also showed that all the plant growth, yield and quality characters were superior with silver on black polyethylene mulch while, plants without mulch (control) resulted poor growth and yield.

Ram *et al.,* (2013) studied the effect of mulching and training on growth,byield and economics of pointed gourd. They observed that use of organic mulches proved to be beneficial for all the characters. They also reported that among the organic mulches paddy straw produced maximum vine length, number of branches. Number of nodes, average fruits weight and yield per plant followed by typha except average fruits weight where water

hyacinth and mustard were next to paddy straw. They suggested that use of organic mulches proved to be helpful in the enhancement of fruits yield of parwal as compared to control.

Mohammed *et al.,* (2017) ihe experiment was carried out in the greenhouse condition on Bottle gourd (*Lagenaria siceraria).* The objective of this work was to investigate the effect of polyethylene mulching (black and white) and Mycorrhizae inoculation on plant growth, fruit yield, seed yield and seed oil content. The experiment was designed in a split plot design in the two growing seasons. Using polyethylene mulching enhanced both of soil temperature and soil moisture content comparing to bare soil as a control. The obtained results showed that a significant increase in the vegetative growth in covered-inoculated treatments comparing with control and the black polyethylene mulch was more effective than the white mulching. For instance, the average of vine length 60 days after transplanting in the first season; in the black and white mulch without mycorrhizae treatments was 1.34 and 1.16 fold of control and with mycorrhizae, the ratio was 1.44 and 1.27 fold of control, respectively.

Ashrafuzzaman *et al.,* (2015) an experiment was conducted to investigate the effect of GABA (GA3 1% & SBA Brassicasteroids as STC 0.3%) application on growth, yield and yield contributing traits of bitter gourd. GABA was applied at 0.5, 1.0, 1.5 and 2.0 mg L-1 as foliar spray at 30 days after sowing, while control plants received no GABA. It was found that 1.5 mg L-1 was found the most effective in improving length and diameter of main vine, individual branch length, number of branches, total branch length, number of nodes per plant, vine diameter, days to first male and female flowering, numbers of male and female flower, number of fruit, weight of individual fruit, length and diameter of fruit, percentage of fruit set and number of seeds per fruit.

Taia *et al.,* (2016) To investigate the effect of different mulches (without mulch, WM as a control, farmyard manure: FYM, rice straw: RSM and white polyethylene: PM) on soil salinity, plant water status, water-use efficiency (WUE),and yield of squash under three levels of irrigation (100%, 85%, 75%). All mulching materials effectively reduced salt accumulation in the root zone. Mulching treatments markedly increased WUE and yield in the order of FYM > RSM > PM > WM. Results showed that, under different mulches, the 85%strategy studied here could be successfully applied during summer and fall seasons in commercial squash production allowing water savings of 15% without any detrimental effect on plant growth or yield.

Taha *et al.*, (2011) conducted at the Vegetable Research Farm, College of Agriculture, University of Dhok, Iraq during spring season of 2009, was to obtain high production with better quality of two summer. By using a bio-fertilizer i.e. Azotobacter with a squash cultivarscontrol treatment, and three levels (0, 1.5 and 3.0 t dunam-1; 1 dunam equals 0.1 hectares) of an organic fertilizer i.e. heep residues, thus making a total of 12 treatments. The experiment was implicated in a Factorial Randomized Complete Block Design (F-RCBD) and replicated three times. The interaction effect of both the bio and organic fertilizers was also significant and resulted in best performance of both the summer squash cultivars in terms of vegetative as well as reproductive characteristics.

Atif (2014) Water use efficiency in agriculture can be enhanced by several strategies mainly by reducing evaporation from the soil surface. The mulching techniques were being used widely in irrigated crop production worldwide. The mulching techniques can be also implemented in summer vegetables production under rain-fed conditions. In addition, fruit number and weight had also an increasing trend as fruit yield. Plots covered with black plastic mulch were produced higher fresh and dry weights of both vegetable crops. It ban be concluded that using black plastic mulch as a soil cover increased okra and squash vegetative growth and yield under rain-fed conditions.

Leigh (2016) Substrate nutrient and moisture management are two major concerns in green roof agriculture, especially when using extensive systems, but there are currently no recommendations or best management practices. The purpose of this study was to explore three mulching strategies (pine bark, living sedum, and no mulch) and three fertilization regimens (25, 50, and 100 g·m−2 of 14-14-14 N-P-K slow release fertilizer applied twice each growing season). With the exception of whole plot, tomato, and cucumber grades, there was a positive dose response to fertilizer. Further research into more types of mulch, their effects on the green roof microclimate, and fertilizer composition and release rates is required.

Quinn (2016) Conservation tillage combined with cover crops or mulching may enhance natural enemy activity in agro ecosystems by reducing soil disturbance and increasing habitat structural complexity. In particular, weed seed predation can increase with vegetation cover and reduced tillage, indicating that mulches may improve the quality of the habitat for weed

seed foraging. Study demonstrates the potential importance of weed seed predators in reducing weed seed banks in vegetable agro ecosystems, and suggests that early-season tillage may not be detrimental to epigeal predator assemblages.

Maboko *et al.,* (2017) it considered as a water scarce country and water shortage is a major constrains that often limits growth, yield, and quality of Swiss chard. A field experiment was conducted on Swiss chard (*Beta vulgaris* L.). Water use efficiency declined in the newspaper, maize-meal, and bare-soil treatments at 179, 130 and 74.7 kg ha-1 mm-1 *WUE*, respectively. Thus, the study reveals that the use of mulch under drip irrigation has an explicit role in increasing water productivity of Swiss chard.

Torres-Olivar *et al.,* (2016) the aim of this study was to realize whether soil mulching, with different plastic mulch colors, is a suitable practice under shade house (SH) conditions for the culture of cucumber. To do so, cucumber was cultured mulched or not with black, blue, red or white-on-black plastic films under SH, and contrasted against mulched cucumber in open field (OF). Mulch color mainly impacted leaf phosphorus (P) and magnesium (Mg) content while the SH affected nitrogen (K), calcium (Ca) and magnesium (Mg). Our results confirm that soil mulching, and shading positively impact the cucumber yield and quality but also show that soil mulching under SH enhances cucumber crop.

Siva *et al.,* (2017) Cucurbits comprise 117 genera and 825 species. Out of this 30 species of nine genera are used as cultivated plants. Most of the cucurbits *viz.,* cucumber, bottle gourd, ridge gourd, bitter gourd, snake gourd, water melon and muskmelons are monoecious and annul in habit. However plants like pointed gourd, spine gourd, ivy gourd and chow-chow are dioecious and perennials. The relevant literature pertaining to the fertilizer and plant densities on growth, yield and yield attributes is reviewed and presented here under with the following sub-heads. Fertilizer studies on growth, yield and yield attributes of cucurbits. Plant density studies on growth, yield and quality yield attributes of cucurbits. Interaction studies between different fertilizer and plant densities on growth, yield and yield attributes of cucurbits.

Franczuk *et al.,* (2016) the effect of different transplanting dates (May 15, May 25, and June 4) and date of polypropylene fiber removal (4 and 8 weeks after transplanting, and control without covering) on the growth, development, and yield of melon (*Cucumis melo* L.) were investigated. The covering of plants planted at each date contributed to an increase in yield and in the share of marketable fruit yield in the total yield. However, the length of the cover application period did not affect yield levels.

MATERIAL AND METHODS

EXPERIMENT SITE: The experiment will be conducted at Main Experimental Farm, Lovely Professional University Phagwara (Jalandhar) during March – July cropping season of 2017.

EXPERIMENTAL MATERIAL: Five different mulching treatment will be used with three replications by using single varieties (Leena F1 Hybrid) as experimental material.

Treatment	Material used	Type of material
T_1	Control(no mulch)	
T_2	Black plastic mulch	Inorganic
T_3	Paddy straw	Organic
T_4	Pebbles	Inorganic
T_5	Farm yard manure	Organic

LOCATION OF FIELD – Geographically it is situated 31^0 5’ 47’’ North and 75^0 35’ 48’’ East at an average elevation of 105 m^2 near Maheru in Jalandhar district of Punjab State, India.

CLIMATE and SOIL - The annual temperature is 24.1 ^{o}C and highest temperature 43.6 ^{o}C in the month of July and lowest in month of January i.e. 6.2 ^{o}C. The soil is loamy in nature, well drained and highly fertile with annual rainfall 686 mm throughout the year.

Work Schedule

	2016					2017											
Working	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Research Discussion				×	×	×	×										
Material Collection			×	×	×	×											
Review of Literature							×	×									
Report Submit									×								
Crop Planning							×										
Field Preparation								×									
Crop Sowing								×	×								
Seedling Transplanting									×								
Data Collection										×	×	×	×				
Crop Harvesting										×	×	×	×				
Data Analysis														×	×	×	

OBSERVATIONS TO BE RECORDED

A. Growth Parameters: -

1. Vine length (m).
2. Number of branches per vine.
3. Days to flower.

B. Yield Parameters: -

1. Fruit length (cm).
2. Number of fruits per plant.
3. Average fruit weight (g).
4. Fruit yield (kg).

C. Quality Parameters: -

1. Juice percent.
2. Vitamin C (mg).

D. Weeds Parameters: -

1. Weed density.
2. Species richness.
3. Growth rate height to be measured at 2 day interval for a week.

E. Water Conservation: -

1. Soil moisture percentage.

Methods

A. Growth Parameter: -

Vine length (m) and number of branches was recorded at 30 days, 45 days and 60 days after sowing and at the time of harvesting. Days to flower were recoded when the first flower appeared on the vine.

B. Yield Parameter: -

Fruit length (cm), Number of fruits per plant, Average fruit weight (g) and Fruit yield were recorded at each harvest. In total there were 15 harvesting taken.

C. Quality Parameter: -

$$\text{Juice percent: -} \frac{\text{Juice weight of bitter gourd (ml)}}{\text{Fresh weight of bitter gourd (gm)}} \times 100$$

Vitamin C: -

- Chemical Required: - Metaphosphoric acid (30gm), 2-6-dichloroindophenol dye (5mg), L- ascorbic acid (100mg) stock sol^{n}, Sodium bicarbonate (42mg).

- Chemical Formation: -
  - Metaphosphoric acid: - Dilute 30gm of metaphosphoric acid in 1L distilled water.
  - 2-6- dichloroindophenol dye: - 42mg Sodium bicarbonate in 120ml distilled water & heat it slightly for few minutes (5-10). Add 50mg of dye in it. Cool it & makeup the volume to 200ml with distilled water.
  - L-ascorbic acid: - 100mg of L- ascorbic acid in 100ml of 30gm of metaphosphoric acid sol^{n} (stock solution).
  - Working Solution: - 10ml of stock sol^{n} makeup the volume to 100ml with 30gm of metaphosphoric acid.

- Procedure: -
  - Take 10ml of juice pulp & makeup the volume to 100ml of 3% metaphosphoric acid (aliquot).
  - Take 10ml of (aliquot) in conical flask.
  - Titrate it against dye.

- Standardization: -
  - 100ml of L- ascorbic acid (working sol^{n}) in conical flask.
  - Titrate it against dye.

Dye factor was determined by the following equation: -

$$\text{Juice percent: -} \frac{0.5}{\text{Titrate value (ml)}} \times 100.$$

Ascorbic acid was estimated as mg of ascorbic acid / ml, and was determined by the

Following equation: -

$$\text{Juice percent: -} \frac{\text{Titrate vol. (ml of dye used)} \times \text{dye factor} \times \text{vol. made up (ml)}}{\text{Aliquot of sample taken for estimation (ml)} \times \text{vol. of sample (ml)}} \times 100$$

D. Weeds Parameter: -

Weed density observation data starting from the first flowering. The area for measuring the weed density is $50cm^2$ and count total no weeds under $50cm^2$. Moreover, in case of species richness we count total no of weed species. Secondly, growth rate height to be measured at 2 day interval for a week.

E. Water Conservation: -

Soil moisture percentage: - Fresh weight – Dry weight

STATISTICAL ANALYSIS

Statistical analysis:-

I. Analysis of variance (ANOVA) in Randomized Block Design.
II. Correlation analysis
III. For quality parameter, titrimetric analysis.

Results & Discussion

Table 1: - Effect of different types of mulching on bitter gourd fruit parameters.

Treatment	Average Fruit length (cm)	Average fruit per plant (no.)	Average Fruit Weight (gm)	Average Fruit Yield (kg)	Juice(%age)	Vit C in mg (per 100g fresh fruit)
Plastic	14.26	1.85	69.78	9.45	16.89	72
Open	13.46	1.78	69.42	10.32	23.58	90.65
FYM	14.80	1.99	72.88	10.60	27.05	74
Straw	13.64	1.95	67.91	9.56	19.41	88.8
Pebbles	14.16	1.74	70.48	9.65	21.65	78.2

I study five different type of mulching material like Plastic, Open, FYM, Straw and Pebbels to see the effect of mulching material on bitter gourd plant. The preliminary data from this study is presented in Table 1. From whole mulching material, there is no change in fruit length, fruit per plant and fruit weight. Moreover, in case of yield parameter the maximum yield was observed in open (10.32) and FYM (10.60) as compare rest of mulching material as well as maximum juice percentage was observed in FYM (27.05) followed by open (23.58) and Vitamin C in open (90.65). The detailed statistical analysis of various parameters is being analysed.

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