



RESEARCH ARTICLE

INFLUENCE OF DIFFERENT CHEMICAL FERTILIZERS AND LEAF EXTRACTS ON GROWTH AND YIELD PARAMETERS OF BLACK GRAM, *Vigna mungo* L.

\*Gayathri, V., Prabha Sherlina, F. and Anju Singh

Avinashilingam Institute for Home Science and Higher Education for Women Coimbatore – 641043  
(Tamil Nadu, India)

ARTICLE INFO

Article History:

Received 28<sup>th</sup> July, 2013  
Received in revised form  
07<sup>th</sup> August, 2013  
Accepted 26<sup>th</sup> September 2013  
Published online 10<sup>th</sup> October, 2013

Key words:

DAP, Manure, superphosphate,  
*Lantana camara*, *Ocimum basilicum*,  
*Vigna mungo* L., Yield parameters.

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ABSTRACT

Manures enrich the soil and nutrients used by crops. The word “Manure” most often refers to any kind of fertilizers. The benefit of using green manure by organic farmers (and other farmers) is that, it adds organic matter to the soil by releasing important plant nutrients, including nitrogen and helps to increase crop yield. Thus, the use of manures that supply nutrients to the soil is needed for plant growth. An experiment was conducted to study the influence of chemical fertilizers (DAP and superphosphate) and leaf extracts (*Ocimum basilicum* and *Lantana camara*) singly and in combination on the germination, growth and yield parameters of black gram (*Vigna mungo* L.). The effect of chemical fertilizer and leaf extracts on the seed germination of black gram was recorded and higher germination percentage was noticed in T<sub>5</sub> (*Ocimum basilicum* and *Lantana camara*). The yield parameters also increased when combination of chemical fertilizers and herbal extracts were used.

INTRODUCTION

India has been universally accepted as the original home of pulse crop black gram (*Vigna mungo* L.). The black gram has remained more or less confined to south Asia. The progenitor of black gram is believed to be *Vigna trilobata*, grown wild in India. The Latin name of black gram is *Vigna mungo*. Black gram is an important pulse crop belonging to the family Fabaceae. This beans have worldwide productivity and commonly cultivated in Asia (Poehlman, 1991 and Jansen, 2006). They are the summer pulse crops with short duration and high nutritive value (Karamany, 2006). Among the legumes, this is more useful, because, it is the main source of amino acid as well as protein (Imrie, 2005 and Kulsum et al., 2007). Many recent studies have been conducted on the nutritional quality of *V. radiata* and *V. mungo* (Hussain et al., 2010 and Blessing and Gregory, 2010). Hussain et al. (2011) reported the response of nitrogen and phosphorus on growth and yield attributes of black gram. Studies have suggested that these beans are good source of protein, carbohydrate and minerals (Agugo and Onimawo, 2009 and Suneja et al., 2011). The nutritional analysis revealed that these beans possess rich protein content, hence, their protein isolates can be easily made. Protein isolate can serve as a nutritional supplement because protein malnutrition is one of the major problems in the developing countries and animal proteins are more expensive as compared to plant protein and so people are more dependent on plant proteins (Butt and Baloat, 2010). Black gram seeds are highly nutritious containing high amount of protein (24 – 26%) and are reported to be rich in potassium, phosphorus and calcium. It is also reported to be rich in vitamins A, B and B<sub>3</sub>. It has some medicinal properties like curing diabetes, nervous disorder, hair disorders, digestive system disorders and rheumatic afflictions. It is valued for its high digestibility and freedom from flatulence effect.

The increase in crop productivity is by way of helping in solubilization of insoluble phosphorus, stimulating growth by providing hormones, vitamins and growth factors. The availability of phosphorus to legume crop is a key constraint in its production. The soil microorganisms are responsible for transfer of the immobilized soil phosphorus into available form through which phosphorus is easily available to these legume crops (Singh et al., 2008). Therefore, an experiment was conducted to study the influence of biofertilizer on growth and yield of black gram. Being a legume crop, it requires less nitrogen, but phosphorus and potassium are very vital nutrients to get its high yield. The pulse crops are attacked by wide range of insects and pests, both in the field and at storage. So, the use of herbal extracts may control the insect pests.

MATERIALS AND METHODS

A study was conducted to assess the effect of leaf extracts on growth and yield parameters of black gram.

Collection of various materials

Red sandy loam soil was collected from Kovaipudur Pirivu, Coimbatore.

Collection of seeds

The seeds of black gram (*Vigna mungo* L.var.co.6) were procured from Department of Pulses, Tamil Nadu Agricultural University, Coimbatore.

Collection of *Ocimum basilicum* and *Lantana camara*

*Ocimum basilicum* and *Lantana camara* leaves were collected from Kovaipudur Pirivu, Coimbatore. Leaf extracts were taken afresh by grinding the leaves in a mixie and filtering with the help of a muslin cloth.

\*Corresponding author: Gayathri, V.,  
Avinashilingam Institute for Home Science and Higher Education for Women  
Coimbatore – 641043 (Tamil Nadu, India).

## Farm yard manure

Farm Yard Manure (FYM) is prepared basically using cow dung.

## Herbal Extract

### 1. *Ocimum basilicum* L.

The other names are basil, garden basil and sweet basil. The plant belongs to the family Lamiaceae. Basil is a low growing (30 – 100 cm) annual plant. It has slightly hairy stem and ovate, entire to slightly toothed leaves. The plant is generally used in treatments for problems concerning digestion and nervous system. Leaves are taken (fresh or dried) in case of fever, abdominal cramps, gastro-enteritis, nausea and poor digestion.

### 2. *Lantana camara* L.

*Lantana camara* L. belongs to the family Verbenaceae. It grows as a perennial shrub. Leaves are opposite, ovate with very small rounded teeth, somewhat rough and hairy. Leaves are aromatic when crushed. Flowers are borne in dense clusters. Fruits are fleshy, greenish that changes to black and each fruit contain one seed. The methanolic extract of *Lantana camara* show healing of gastric ulcers and also prevents development of duodenal ulcers in rat.

## Chemical Fertilizer

### 1. Di-Ammonium Phosphate

Di-Ammonium Phosphate (DAP) is used as a chemical fertilizer. When applied to plant, it temporarily increases the soil pH resulting in increased growth of the plant.

### 2. Super Phosphate

- It is a cost effective fertilizer for pasture development.
- Ideal for capital or maintenance applications.
- Readily available phosphorus and sulphur.
- Super phosphate sulphur is a readily available form of sulphate for plants to absorb.

## METHODS

The soil was cleaned by removing stones and other unwanted materials. The red soil and sand soil were mixed in the ratio of 1 : 1

and also FYM is well mixed and filled in pots having 7 kg capacity. A study was conducted to assess the effect of leaf extracts (*Ocimum basilicum* and *Lantana camara*) and chemical fertilizer (di-ammonium phosphate and super phosphate) singly and in combination on the growth, biochemical and yield parameters. The treatments were given at every 10 days interval i.e., on 25<sup>th</sup> day, 35<sup>th</sup> day and 45<sup>th</sup> day after sowing the seeds. The leaf extracts and chemical fertilizers were used singly and in combination also to observe the change in growth parameters. The treatments were T<sub>0</sub> –Control, T<sub>1</sub> –Di-ammonium phosphate (DAP) – (1%), T<sub>2</sub>– Super phosphate (SP) – (1%), T<sub>3</sub> –Leaf extract of *Ocimum basilicum* (extract 1) – (1%), T<sub>4</sub> –Leaf extract of *Lantana camara* (extract 2) – (1%), T<sub>5</sub>–Combination of both the leaf extracts, T<sub>6</sub> –DAP + leaf extracts 1 and 2, T<sub>7</sub>– DAP + SP + leaf extracts 1 and 2.

## I. Germination percentage

Seeds of black gram were soaked for 6 hours in different treatments given above. For control, the seeds were soaked in distilled water. On 7<sup>th</sup> day, the seeds were tested for germination.

## II. Growth parameters

Plant samples were uprooted carefully on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the following growth parameters were measured according to Shukla and Mishra, (1986) – Root length (cm), Shoot length (cm), Fresh weight (gm), Dry weight (gm), Number of nodules.

## III. Yield parameters

The yield parameters observed were fresh weight of the pod (gm), dry weight of the pod (gm), number of seeds per pod, weight of seeds per pod (gm).

## Statistical analysis

The data obtained from various biometric observations were subjected to statistical analysis and based on the results inference were drawn.

## RESULTS AND DISCUSSION

The experiments were conducted in black gram (*Vigna mungo* L.) with two different leaf extracts (*Ocimum basilicum* and *Lantana camara*) and chemical fertilizers such as di-ammonium phosphate and super phosphate on the growth parameters as shown in Table 1.

**Table 1. Influence of chemical fertilizers and leaf extracts on the growth parameters of black gram (*Vigna mungo* L.)**

Treatment	Shoot length (cm)			Root length (cm)			Fresh weight (g)			Dry weight (g)			Number of nodules		
	35 <sup>th</sup> day	45 <sup>th</sup> day	55 <sup>th</sup> day	35 <sup>th</sup> day	45 <sup>th</sup> day	55 <sup>th</sup> day	35 <sup>th</sup> day	45 <sup>th</sup> day	55 <sup>th</sup> day	35 <sup>th</sup> day	45 <sup>th</sup> day	55 <sup>th</sup> day	35 <sup>th</sup> day	45 <sup>th</sup> day	55 <sup>th</sup> day
T <sub>0</sub>	28.93 ± 1.45	30.00 ± 1.00	31.67 ± 0.58	6.33 ± 0.29	7.17 ± 0.29	9.33 ± 0.58	1.65 ± 0.03	1.72 ± 0.02	3.25 ± 0.04	0.41 ± 0.02	0.47 ± 0.01	0.84 ± 0.02	5.00 ± 1.00	4.00 ± 1.00	2.33 ± 0.58
T <sub>1</sub>	32.17 ± 1.04	32.67 ± 1.53	34.57 ± 2.46	8.94 ± 0.92	13.67 ± 2.52	15.00 ± 1.00	3.18 ± 0.06	4.11 ± 0.10	15.10 ± 0.03	1.05 ± 0.02	1.82 ± 0.02	2.67 ± 0.03	10.00 ± 2.00	8.00 ± 1.00	7.33 ± 1.15
T <sub>2</sub>	36.83 ± 1.04	43.00 ± 2.00	46.33 ± 0.58	16.33 ± 1.53	18.90 ± 1.28	24.00 ± 2.00	3.91 ± 0.10	6.78 ± 0.04	20.17 ± 0.05	1.09 ± 0.03	2.65 ± 0.04	4.80 ± 0.03	7.33 ± 2.52	7.33 ± 0.58	5.00 ± 1.00
T <sub>3</sub>	31.67 ± 1.53	33.57 ± 2.89	34.67 ± 0.58	10.07 ± 1.90	11.83 ± 2.25	15.33 ± 3.06	1.98 ± 0.07	2.92 ± 0.03	7.24 ± 0.04	0.65 ± 0.03	0.93 ± 0.03	1.25 ± 0.05	12.33 ± 2.52	9.00 ± 2.00	6.67 ± 1.15
T <sub>4</sub>	33.87 ± 2.58	35.27 ± 0.64	38.33 ± 1.53	12.94 ± 1.10	16.33 ± 1.53	19.67 ± 1.53	2.26 ± 0.05	3.21 ± 0.04	3.76 ± 0.05	0.87 ± 0.05	1.28 ± 0.04	1.66 ± 0.05	8.67 ± 1.53	6.33 ± 1.53	5.00 ± 1.00
T <sub>5</sub>	36.31 ± 2.41	38.33 ± 1.53	42.33 ± 2.52	12.03 ± 2.00	13.67 ± 1.53	20.33 ± 1.53	4.83 ± 0.04	5.16 ± 0.04	5.61 ± 0.04	1.88 ± 0.04	2.55 ± 0.04	3.03 ± 0.03	11.00 ± 2.00	9.00 ± 1.00	6.67 ± 1.00
T <sub>6</sub>	32.33 ± 1.15	35.33 ± 2.52	38.00 ± 2.00	10.33 ± 1.53	15.00 ± 3.00	14.00 ± 2.00	1.75 ± 0.05	3.44 ± 0.04	7.33 ± 0.03	0.58 ± 0.03	1.49 ± 0.03	1.80 ± 0.03	8.00 ± 3.00	8.00 ± 1.00	5.53 ± 0.58
T <sub>7</sub>	32.33 ± 1.53	38.33 ± 2.08	43.67 ± 1.53	11.00 ± 2.00	11.67 ± 2.08	20.67 ± 4.04	4.07 ± 0.06	6.56 ± 0.05	13.11 ± 0.04	1.62 ± 0.02	2.21 ± 0.03	3.68 ± 0.02	9.33 ± 3.06	9.33 ± 0.58	7.00 ± 1.00
SEd	1.43229			1.57268			0.03916			0.02375			1.31233		
CD (P < 0.05)	2.87997			3.16226			0.07874			0.04775			2.63877		

Values are mean ± SD of three samples in each group, SED– Standard Error Deviation, CD – Critical Difference

## Germination percentage

The higher germination percentage (100%) was obtained in T<sub>5</sub> (*Ocimum basilicum* + *Lantana camara*) shown in Figure 1. The percentage was calculated on 7<sup>th</sup> day after sowing (DAS). The species of *Striga* used as green manure showed higher seed germination in rice (Kayekke *et al.*, 2007).

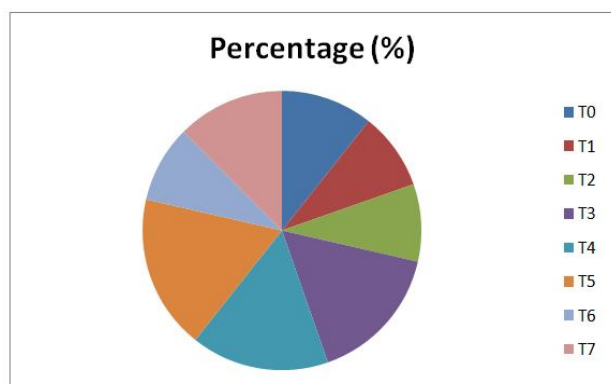


Figure 1. Germination percentage of black gram (*Vigna mungo* L.)

Table 2. Influence of chemical fertilizers and leaf extracts on the yield parameters of black gram (*Vigna mungo* L.) on 60<sup>th</sup> day

Treatment	Fresh weight of the pod (g)	Dry weight of the pod (g)	Number of seeds per pod	Weight of seeds per pod (g)
T <sub>0</sub>	0.53 ± 0.02	0.08 ± 0.01	2.67 ± 0.58	0.12 ± 0.02
T <sub>1</sub>	0.83 ± 0.02	0.12 ± 0.01	5.00 ± 1.00	0.57 ± 0.06
T <sub>2</sub>	0.84 ± 0.02	0.16 ± 0.02	8.00 ± 1.00	0.14 ± 0.02
T <sub>3</sub>	0.86 ± 0.04	0.23 ± 0.02	6.00 ± 1.00	0.12 ± 0.02
T <sub>4</sub>	0.86 ± 0.02	0.26 ± 0.02	5.67 ± 2.08	0.16 ± 0.02
T <sub>5</sub>	0.94 ± 0.04	0.26 ± 0.01	5.67 ± 0.58	0.18 ± 0.02
T <sub>6</sub>	0.63 ± 0.02	0.16 ± 0.02	5.67 ± 1.53	0.80 ± 0.10
T <sub>7</sub>	1.06 ± 0.05	0.33 ± 0.02	4.67 ± 0.58	0.21 ± 0.03
SEd	0.0247	0.0132	0.9248	0.0361
CD (P < 0.05)	0.0523	0.0280	1.9987	0.0765

Values are mean ±SD of three samples in each group, SEd – Standard Error Deviation, CD- Critical Difference

## Growth parameters

The growth parameters of black gram were analysed on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and tabulated. The maximum root length was observed in T<sub>2</sub> (super phosphate) on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the readings were 16.33, 18.90 and 24.00 cm respectively. The minimum root length was shown by control (T<sub>0</sub>) on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days and the values were 6.33, 7.17 and 9.33 cm. Wang *et al.* (2008) have reported that the nitrogen supply in urea influenced the growth of maize plants especially in the roots. Ne Meat Alla and El-Geddawy (2001) reported that the use of foliar spray of macronutrients significantly increase the root length of sugar beet. The highest shoot length was obtained in T<sub>2</sub> (super phosphate) on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days and the readings were found to be 36.83, 43.00 and 46.33 cm. The minimum shoot length was found in control (T<sub>0</sub>) and the values were 28.93, 30 and 31.67 cm respectively. The results are in accordance with Shiralipour and Faber (1996) on broccoli (*B. oleraceavas italica*) plant that had the tendency to increase shoot length by the application of organic manure. This view has been supported by Arisha *et al.* (2003) on the plant growth of broccoli. The fresh weight was found to be maximum in T<sub>5</sub> on 35<sup>th</sup> day and the value was 4.83 g. On 45<sup>th</sup> and 55<sup>th</sup> day, the maximum fresh weight occurred in T<sub>2</sub> (super phosphate) and the readings were 6.78 and 20.17 g. The minimum fresh weight was shown by control plants on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the values were 1.65, 1.72 and 3.25 g. The maximum fresh weight content in broccoli was obtained by application of 60 and 80 kg organic manure along with 60 kg inorganic fertilizer (Ouda and Mahadeen, 2008). Maximum dry weight of 1.88 g was observed in T<sub>5</sub> on 35<sup>th</sup> day. On 45<sup>th</sup> day and 55<sup>th</sup> day, the maximum dry weight was observed in T<sub>2</sub> (superphosphate) and the readings were 2.65 and 4.80 g respectively. The minimum dry weight was found in control plants (T<sub>0</sub>) and the readings were 0.41, 0.47 and 0.84 g on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day. Wong *et al.* (1999) and Magnusson

(2002) obtained increased dry weight by the use of organic manures in Chinese cabbage (*B. chinensis*). The nodules were higher in T<sub>3</sub> (*Ocimum basilicum*) on 35<sup>th</sup> day and it was 12.33. On 45<sup>th</sup> day the number of nodules increased in T<sub>7</sub> (DAP + SP + *Ocimum basilicum* + *Lantana camara*) 9.33. On 55<sup>th</sup> day, the maximum number of nodules was found in T<sub>1</sub> (DAP) and the value was 7.33. The least number of nodules was observed in control plants (T<sub>0</sub>) and the values were 5.00, 4.00 and 2.33. According to Sangeetha *et al.* (2006) and Delfine *et al.* (2005), the foliar application of humic substance have a positive impact on nodulation in wheat.

## Yield Parameters

The yield parameters of black gram (*Vigna mungo*) were analysed on 60<sup>th</sup> day and the results are tabulated in Table 2. The fresh weight of the pod was high in T<sub>7</sub> and value was 1.06 g. The minimum fresh weight of the pod was shown by control plants (T<sub>0</sub>) and the value was 0.53 g. Onim *et al.* (1990) reported similar results on the residual effects of green manure on *Leucaena*, *Sesbania* and *Cajanus* species in cropping systems. The dry weight of the pod was maximum in T<sub>7</sub> and it was 0.33 g. The minimum dry weight of the pod was shown by control plants 0.08 g. The green manure gave a higher yield than the conventional treatment method (or) barley treatment (Jeon *et al.*, 2008 and Lee *et al.*, 2010) rice plant. The number of seeds / pod were

observed on 60<sup>th</sup> day after sowing. The maximum number of seeds / pod was found in T<sub>2</sub> 8.00. The least number of seeds / pod was shown in control plants 2.67. The number of seeds / pod increased in wheat / jantar, mungbean-wheat treated cropping system and the result was 11.78 seeds per pod (Kamal, 2011). The weight of seeds / pod was more in T<sub>6</sub> 0.80 g. The minimum weight of seeds / pod was observed in control plants (0.12 g). For weight per pod, the results revealed that all green manure treated plants were highly significant over the control treatments (Benjawan *et al.*, 2007).

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