



## EFFECT OF INORGANIC FERTILIZERS AND HERBAL LEAF EXTRACTS ON BIOCHEMICAL PARAMETERS OF BLACK GRAM (*Vigna mungo* L)

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### ABSTRACT

Green manures play a key role in providing subsequent crops with nutrients, maintaining soil quality, and helping to control weeds and pests. The most important features of a green manure are large dry matter production and high ability to fix nitrogen. Green manure can be used directly or after composting as a nutrient input that will, after decomposition, be taken up by crops to produce biomass and grain. The effectiveness of green manuring as a soil fertility management technology depends on the stage of crop during incorporation, placement (incorporated or surface placement), nutrient content and carbon to nitrogen ratio of material which influences decomposability and mineralization. In the present study, the efficacy of certain organic and inorganic fertilizers on the biochemical parameters such as chlorophyll, protein and carbohydrates were analyzed. It was found that the Di ammonium phosphate and leaf extract either singly or in combination showed higher biochemical activity.

**KEY WORDS:** Black gram, carbohydrate, chlorophyll, inorganic fertilizers, organic fertilizers, protein.

### INTRODUCTION

*Vigna mungo*, known as black gram, black lentil, white lentil, black matpe bean, is a bean grown in Indian subcontinent. It, along with the mung bean, was placed in *Phaseolus*, but has since been transferred to *Vigna*. At one time it was considered to belong to the same species as the mung bean. The product sold as "black lentil" is usually the whole urad bean or *urad dal*. The product sold as "white lentil" is the same lentil with the black skin removed. Black gram originated in India, where it has been in cultivation from ancient times and is one of the most highly prized pulses of India. It is an erect, suberect or trailing, densely hairy, annual herb. The tap root produces a branched root system with smooth, rounded nodules. The pods are narrow, cylindrical and up to six cm long. 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>. 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). Makeen *et al.* (2007) suggested that

the main pigments of black gram is chlorophyll a. Erulan *et al.* (2009) have studied the effects of seaweed liquid fertilizer (*Sargassum polycystum*) on seed germination, growth, yield, biochemical parameters and pigment characteristics of *Cajanus cajan*. Organic manures such as Farm Yard Manure, green manure in the form of leaf extracts, etc. when incorporated into the soil not only add the nutrients such as nitrogen etc. but the soil is enriched by the fixation of the atmospheric nitrogen.

### MATERIALS AND METHODS

A study was conducted to assess the effect of leaf extracts on biochemical 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 mixer and filtering with the help of a muslin cloth.

#### Farm yard manure

Farm Yard Manure (FYM) is prepared basically using cow dung. It is highly useful to increase the fertility of the soil.

#### 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 biochemical 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 biochemical parameters.

**Treatment details:**

- 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

**BIOCHEMICAL PARAMETERS**

Chlorophyll – estimated on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days (Arnon, 1949)

Protein – estimated on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days (Lowry et al., 1951)

Total carbohydrate – estimated on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days (Hedge and Hofreiter, 1962).

The above parameters were estimated by collecting leaf samples.

**RESULTS & 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 biochemical parameters. All the parameters have been statistically analysed.

**TABLE : 1** Influence of inorganic fertilizers and leaf extracts on the chlorophyll “a”, chlorophyll “b” & “Total” chlorophyll content (mg / g) of black gram (*Vigna mungo* L.)

Treatment	Chlorophyll 'a' (mg / g)			Chlorophyll 'b' (mg / g)			"Total" Chlorophyll (mg / g)		
	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>	2.38 ± 0.02	1.75 ± 0.03	0.84 ± 0.04	2.03 ± 0.05	0.86 ± 0.03	0.71 ± 0.06	2.75 ± 0.07	1.44 ± 0.02	1.68 ± 0.05
T <sub>1</sub>	3.02 ± 0.03	4.01 ± 0.03	8.34 ± 0.01	2.28 ± 0.04	2.23 ± 0.05	4.84 ± 0.04	3.24 ± 0.01	3.55 ± 0.04	7.67 ± 0.21
T <sub>2</sub>	2.68 ± 0.02	1.88 ± 0.01	6.34 ± 0.01	2.72 ± 0.04	1.22 ± 0.03	3.95 ± 0.07	3.48 ± 0.05	1.82 ± 0.03	6.00 ± 0.06
T <sub>3</sub>	5.34 ± 0.03	2.52 ± 0.03	2.37 ± 0.03	3.95 ± 0.07	1.56 ± 0.05	1.83 ± 0.02	5.61 ± 0.07	2.38 ± 0.04	2.56 ± 0.13
T <sub>4</sub>	5.33 ± 0.02	2.21 ± 0.02	5.13 ± 0.02	3.19 ± 0.08	1.74 ± 0.04	3.09 ± 0.02	4.92 ± 0.08	2.42 ± 0.04	4.76 ± 0.02
T <sub>5</sub>	3.36 ± 0.03	3.02 ± 0.01	0.94 ± 0.02	2.04 ± 0.07	1.77 ± 0.03	4.80 ± 0.03	3.13 ± 0.06	2.76 ± 0.03	4.65 ± 0.04
T <sub>6</sub>	4.20 ± 0.03	2.03 ± 0.03	1.83 ± 0.02	3.39 ± 0.04	1.28 ± 0.06	1.84 ± 0.06	4.67 ± 0.03	1.92 ± 0.08	2.36 ± 0.06
T <sub>7</sub>	2.86 ± 0.02	3.46 ± 0.03	6.57 ± 0.02	2.22 ± 0.05	2.07 ± 0.12	1.46 ± 0.04	3.10 ± 0.04	3.23 ± 0.07	3.17 ± 0.05
SEd	0.02045			0.04341			0.05195		
CD (P < 0.05)	0.04113			0.08728			0.10445		

Values are mean ±SD of three samples in each group

SEd – Standard Error Deviation

CD – Critical Difference

**Biochemical Parameters**

The biochemical parameters such as chlorophyll a, chlorophyll b, total chlorophyll, protein and carbohydrate were analysed on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> days and the results are tabulated.

**Chlorophyll**

The maximum chlorophyll ‘a’ was observed in T<sub>3</sub> (*Ocimum basilicum*) on 35<sup>th</sup> day and the value was found to be 5.34 mg / gm (Table – 1). On 45<sup>th</sup> and 55<sup>th</sup> day, the chlorophyll content increased in T<sub>1</sub> (DAP) and the values

were 4.01 and 8.34 mg / g. The chlorophyll 'b' content was more in T<sub>3</sub> on 35<sup>th</sup> day (3.95 mg / g). On 45<sup>th</sup> and 55<sup>th</sup> day, the maximum chlorophyll 'b' was found in T<sub>1</sub> (DAP) and the values were 2.33 and 4.84 mg / g. The highest total chlorophyll content was obtained in T<sub>3</sub> (*Ocimum basilicum*) on 35<sup>th</sup> day and the value was 5.61 mg / g. On 45<sup>th</sup> and 55<sup>th</sup> day, the maximum total chlorophyll content was found to be 3.55 and 7.67 mg / g in T<sub>1</sub> (DAP). Least chlorophyll content was observed in control plants (T<sub>0</sub>) on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the readings were found to be 2.38, 1.75, 0.84 mg / g (chlorophyll 'a'), 2.03, 0.86, 0.71 mg / g (chlorophyll 'b') and 2.75, 1.44 and 1.68 mg / g (total chlorophyll) respectively. The observations of the present work agrees with the previous findings obtained in other vegetable crops (Arisha and Beadisi, 1999 and Al-Tarawneh, 2005). Abbasniyazare (2012) have shown that the use of biofertilizers (NK and Barvai) increases the

chlorophyll content. According to Mahla *et al.* (1999), the application of NAA and mixtalol NAA spray, increased the chlorophyll contents in leaves of black gram.

#### Protein

The highest protein content was present in T<sub>4</sub> on 35<sup>th</sup> and 45<sup>th</sup> day and the readings were 0.82 and 2.26 mg / g. On 55<sup>th</sup> day, the protein content increased in T<sub>3</sub> and the value was 5.20 mg / g (Table – 2). The protein content was low in control plants on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the readings were 0.40, 1.64 and 3.05 mg / g respectively. Experiment in chick pea by Mohammadi *et al.* (2010) has shown that application of green manure increases the protein content of the seed. In *Amaranthus dubius*, Manoharan *et al.* (2011) showed an increase in the amount of carbohydrate and protein in plant treated with cyanospray compared to other treatments.

TABLE 2: Influence of inorganic fertilizers and leaf extracts on the Protein and carbohydrate content of black gram (*Vigna mungo* L.)

Treatment	Protein content (mg / g)			Carbohydrate Content (mg / g)		
	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>	0.40 ± 0.03	1.64 ± 0.05	3.05 ± 0.08	26.96 ± 0.28	56.44 ± 0.17	58.46 ± 0.22
T <sub>1</sub>	0.66 ± 0.07	1.92 ± 0.05	3.27 ± 0.05	62.01 ± 0.34	64.10 ± 0.17	72.85 ± 0.33
T <sub>2</sub>	0.58 ± 0.08	2.16 ± 0.08	3.73 ± 0.07	72.30 ± 0.49	81.13 ± 0.39	93.14 ± 0.17
T <sub>3</sub>	0.51 ± 0.05	1.86 ± 0.05	5.20 ± 0.05	52.08 ± 0.22	63.66 ± 0.17	97.21 ± 0.28
T <sub>4</sub>	0.82 ± 0.07	2.26 ± 0.12	4.53 ± 0.07	81.60 ± 0.28	100.10 ± 0.29	104.76 ± 0.41
T <sub>5</sub>	0.56 ± 0.12	1.88 ± 0.07	3.89 ± 0.07	84.13 ± 0.28	106.00 ± 0.17	108.27 ± 0.35
T <sub>6</sub>	0.56 ± 0.07	1.82 ± 0.07	3.56 ± 0.07	63.29 ± 0.22	70.61 ± 0.28	94.28 ± 0.22
T <sub>7</sub>	0.63 ± 0.07	2.02 ± 0.08	4.80 ± 0.08	64.06 ± 0.22	78.86 ± 0.28	105.87 ± 0.31
SEd	0.05834			0.23035		
CD (P < 0.05)	0.11731			0.46317		

Values are mean ±SD of three samples in each group

SEd – Standard Error Deviation

CD – Critical Difference.

#### Carbohydrate

The carbohydrate was higher in T<sub>5</sub> (*Ocimum basilicum* and *Lantana camara*) and the values were found to be 84.13, 106 and 108.27 mg / g on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day respectively (Table – 2). Minimum carbohydrate content was shown by control plants on 35<sup>th</sup>, 45<sup>th</sup> and 55<sup>th</sup> day and the readings were observed to be 26.96, 56.44 and 58.46 mg / g respectively. Rajula and Padmadevi (2000) have recorded an increase in biochemical parameters like chlorophyll, protein and carbohydrate in *Helianthus annuus* L. by the use of cyanopith and cyanospray.

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