

**Research paper**

**PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF TWO CULTIVARS OF  
*PHASEOLUS VULGARIS* L. TO APPLICATION OF ORGANIC FERTILIZERS AND  
NILE COMPOST IN SANDY SOIL**

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**Key Words:** *Phaseolus vulgaris*, sandy soil, free amino acids , phytohormones,

**Abstract**

A cultivated sandy soil was supplemented with compost ( rice straw and maize stalk) in the presence and absence of Nile composts to evaluate their effects on growth, yield, free amino acids and phytohormones of two cultivars of *Phaseolus vulgaris* L. cv. Paulista and cv. Bronco . The fertilizers treatments consisted of seven groups of fertilizers for each cultivar. The results showed that the significant differences in growth in all the stages and percent of free amino acids and phytohormones in shoot in vegetative stage in two cultivars of bean were obtained with mixture of compost or maize stalk and maize stalk decompost. Generally, the addition of organic fertilizer with compost led to improve the yield of two cultivars as compared to controles. (Hence, it could be suggested that the treated plants, with these organic residues and Nile compost increased the growth , yield and the above chemical compositions).

**Introduction:**

Fertilizer is any material, organic or inorganic, natural or synthetic, that supplies plants with the necessary nutrients for plant growth and optimum yield. Organic fertilizers are natural materials of either plant or animal origin, including livestock manure, green manures, crop residues, household waste, compost, and woodland litter. [Organic manure plays direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization and improving physical and chemical properties of soils (Chaterjee *et al.* 2005)]. It plays an important role in increasing growth, yield and yield components of

many crops. Ryan *et al.* (1985) reported that organic manures significantly affected tomato plant height, leaf area and fruit number plant .

Compost has been recognized as a low cost and environmentally sound process for treatment of many organic wastes (Hoitink 1993). It is a plant residue , animal residue or a mixture of both that has been decomposed and recycled as a fertilizer and soil amendment. The application of compost has been shown to positively affect the structure , porosity, water holding capacity, compression strength, nutrient content and organic matter content of the soil all of these improve plant growth, crop yield and crop quality (Smith 1996).

Organic fertilizer effect on amino acid on plant , that it increased the latter by treating the soil with different organic fertilizer. Rajaa and Saadi (2011), showed that organic fertilizer leads to new amino acids compared with the amino acid in the control treatment in wheat grain and dry shoots. Banerjee *et al.* 2012 showed that application of compost significantly increased the level of total free amino acid in the leaves of mustard when compared to control.

Furthermore, organic matter increased plant hormone-like activity (Atiyeh *et al.* 2002, Bachman and Metzger 2008). The alteration in different aspect of cellular metabolisms including the content of phytohormones could be arising from the different compounds present in the organic fertilizer.

Snap bean (*Phaseolus vulgaris* L.) is one of the most important members of leguminous crops in Egypt grown for either local consumption or exportation, it is known as green bean or snap bean it is an important source of protein and energy for many developing countries. It's Rich in protein, dietary fibers, minerals (Ca, P, Fe, K, Mg & Mn) and vitamins (A, B1, B2 & C) with high amino acids (Şehirali 1988)).

The present work aims to stimulate some physiological changes in the plants using organic fertilizer and compost by enhancing some compounds such as total amino acids and phytohormones in two cultivars of snap bean.

## Materials and methods:

Seeds of (*Phaseolus vulgaris*) L. CV. Bronco and *Phaseolus vulgaris* L. CV. Paulista were obtained from Agriculture Research Center, Ministry of Agriculture, Giza, Egypt.

Seeds of Snap bean were surface sterilized for 1 min in 70 % (v/v) ethanol, 20 min in 5% (v/v) sodium hypochlorite and rinsed five times with sterile bidistilled water. A pot experiment was conducted in the greenhouse of Faculty of Education, Cairo, Egypt with a sandy soil collected from Arab Guhaina, Qalyubia,

Egypt has pH 7.3 , EC 2.56 MHz/cm, organic matter 0.2%, CaCO<sub>3</sub> 2.3%. All pots will contain equal amounts of sandy soil and kept inside an open- air wire house during plant growth and development . 140 pots (about 30 cm) were divided into two groups consisting 70 pots for each cultivar of *Phaseolus vulgaris*. The pots of the first group were divided into 7 sub-groups they will be prepared as in the following scheme:

Seven treatments via

1- control T<sub>1</sub>

2- Nile compost T<sub>2</sub>.

3- compost and rice straw T<sub>3</sub>.

4- compost and maize stalks T<sub>4</sub>.

5- rice straw and maize stalks T<sub>5</sub> .

6- rice straw T<sub>6</sub>.

7- maize stalks T<sub>7</sub>.

And were replicated times for *Phaseolus vulgaris* L. CV, Paulista from T<sub>8</sub>-T<sub>14</sub>

The pots were watered for the germination of seeds. After 45 days (vegetative stage) ,90 days for (flowering stage) and 130 days for (fruiting stage) ) the plants were harvested and washed with distilled water . The morphology fresh weights of shoots and roots and shoot length were determined in 10 plants. The samples were oven dried at 70°C for 72 h. and the dry weights of shoot and root were determined . The obtained data were analyzed statistically by using t test at 5% and 1%.

## ***Determination of phytohormones :***

Extraction and estimation of phytohormones were carried out as according to the method of Unyayar *et al.* (1996). Indol 3-acetic acid (IAA), Gibberellic acid (GA), Absciscic acid (ABA) were analyzed. (Five gram fresh weight samples were placed in 100 ml methanol: chloroform: 2 N ammonium hydroxide (12:5:3 v/v/v) and homogenized using a Kinematic Polytron Homogenizer. After addition 1 µg/100 ml Butylated Hydroxytoluene (BHT), the samples were frozen at -80°C for one week, for further analysis. Then the extracts were transferred into 250 ml conical flasks and added 22.4 ml bi-distilled water. To obtain a homogeneous mixture, the conical flasks were shaken 3 or 4 times. Thus, with the exception of plant growth substances, the other organics in methanol were allowed to pass into the chloroform phase.) The extraction, purification and quantitative determination of total IAA, GA<sub>3</sub> and ABA were done according to literature methods of Unyayar *et al.* (1996).

## **Quantitative determination of total amino acids :**

Total amino acid composition of Snap bean seeds was determined by amino acid analyzer apparatus model “Eppendorf LC3000” using the method of Stevens et al. (1989).

### **Acid hydrolysis:**

0.3 g of Snap bean seeds powder was defeated with soaking in diethylether overnight to be sure that the sample does not contain any fats and remove pigments and impurities in the samples to be clear. A known weight (0.3 g) of defeat plant material received 10 ml 6 N hydrochloric acid in a sealed tube, and then placed in an oven at 110 °C. For 24 hours.

Hydrolyzates were transferred quantitatively into a porcelain dish and the hydrochloric acid was then evaporated to dryness at 50-60°C on a water bath. Distilled water (5 ml) was added to the hydrolyzate and then evaporated to dryness to remove the excess of hydrochloric acid and finally the residue was dissolved in 10 ml distilled water and filtrate through a 0.45 mm filter. The filtrate was dried under vacuum with a rotary evaporator, then 10 ml of distilled water was added and the samples dried a second time. One ml of 0.2 N sodium citrate buffer at pH 2.2 was added and the samples stored frozen in a sealed vial until separation of amino acids by the amino acid analyzer.

Separation of amino acids by amino acid analyzer: Samples of amino acids were injected in amino acid analyzer (Eppendorf LC 3000). Each amino acid is separated at specific pH, and then colored by reagent named Ninhydrin. Ninhydrin (triketohydrindene hydrate) is an oxidating agent which leads to the oxidative deamination of alpha-amino groups. It is very important for the detection and the qualitative analysis of amino acids. Ninhydrin also reacts with primary amines however the formation of carbon dioxide is quite diagnostic for amino acids. Alpha amino acids yield a purple substance that absorbs maximally at 570 NM. Amino acids (Proline) yield a yellow product (absorption maximum 440 NM).

## **Results and discussion:**

### *Growth Parameters:*

The data in (Table 1,2) revealed that there are significant differences between the studied cultivars in the vegetative stage (length of stems, length of roots, number of leaves and leaflets, fresh weight of stems and roots) .

These results indicate that significant increases occurred in all growth parameters in two cultivars at groups T<sub>4</sub>, T<sub>7</sub>, T<sub>11</sub> and T<sub>14</sub> in compared to control, at the same time the two cultivars were shown no significant differences in the number of leaflets at T<sub>2</sub>, T<sub>3</sub>, T<sub>5</sub>, T<sub>6</sub>, T<sub>9</sub>, T<sub>10</sub>, T<sub>12</sub> and T<sub>13</sub> treatment in both the cultivars. On the other hand no significant difference in the number of leaves for all treatments in both the cultivars. At the second stage all tested organic fertilizers in combination with Nile compost caused a highly significant increase in the growth parameters (length of stems and roots, number of leaves and leaflets, fresh weights of stems and roots and the number of flowers) in *Bronco CV*. Cultivar (Table 3). On the other hand there were no significant differences in the number of leaves except the treatment at a mixture of compost and maize T<sub>14</sub>. Similary in case of *Paulista CV*, the number of leaflets increased significant except in the treatment of T<sub>12</sub> and T<sub>13</sub> as compared to control.

The fresh weight of roots showed no significant difference due to adding straw ric only T<sub>13</sub>. Furthermore, the data revealed that no. of leaves in *Paulista CV*. Showed no significant differences in all treatments, except in T<sub>9</sub>, T<sub>11</sub> and T<sub>14</sub>.

In fruiting stage, growth parameters of *Bronco CV*. cultivar exhibited highly significant difference at L.S.D. 0.05% and 0.01%, in all treatments, except in leaves and leaflets number of T<sub>2</sub> and in root fresh weight of T<sub>5</sub>. The increases were highly significant in length of stem, number, of legume, number of seed legume, weight of pods, fresh weight of stem, and root (Table 6).

The number of leaves showed no significant difference in all treatments except, decomsted maize stalk only T<sub>14</sub> which showed highly significant difference at 0.05% and 0.01% levels.

The number of leaflets was exhibited no significant difference as a result of organic fertilizer application alone or combined with Nile compost in all groups except T<sub>11</sub> and T<sub>14</sub> where a highly significant increase was observed as compared to control (Table 6). Organic fertilizer play a direct role in plant growth (Mazhar *et al.* 2011). Muhammad *et al.* (2008) observed that similar results were obtained in wheat treated with the application of organic manure and compost. The effects of organic manure on the vegetative growth parameters could be related to the role of released nitrogen, phosphorus and potassium from organic manure. In addition they play a vital role in photosynthesis, carbohydrate transport, protein synthesis, control of ionic balance, regulation of plant stomata functions, water use and activation of plant enzymes and other processes (El-Ghamry 2011, Najm *et al.* 2010, Al- Hisnawy 2011).

Rubins and Bear (1942) observed that carbon compounds like cellulose and hemicellulose contained in plant residues, are easily broken down and then can exert a considerable depressing effect on the nitrifying of the low-N materials. This could cause temporary immobilization of N in the soil, which would thus interfere with plant growth. However, the effects of organic fertilizers on plant growth seem to vary, and some studies showed decreased plant growth or yields when using organic fertilizers compared with conventional fertilizers (Zhao *et al.* 2009, Treadwell *et al.* 2007). This variation could be the result of the differences in organic fertilizer sources being used and application rates and timing (Rosen and Allan 2007).

The increase in growth and development during the following data could be due to the presence of phytohormones in organic fertilizers that stimulate plant growth (Nogales *et al.* 2005).

### ***Phytohormones:***

Data in Table (7) revealed that the effect of organic fertilizers stimulated the synthesis of phytohormone in two cultivars. The phytohormone IAA increased in all treatments in two cultivars except by adding straw rice, there was reduced in IAA synthesis in comparison to control. However, using compost, mixture of compost and maize stalk, mixture of maize stalk and straw rice and decompost maize stalk only, increased GA when compared to control in CV. bronco. On the other hand, there were increases in GA synthesis in CV. Paulista due to organic fertilization..

ABA differed values in most of tested samples. However there was reduced in ABA when treated with a mixture of compost and maize stalk and decompost maize stalk only.

The better efficiency of organic manures might be due to the fact that the organic manures would have provided the micronutrients such as Zn, Cu, Fe, Mn, and Mg in an optimum level. Zinc is involved in the biochemical synthesis of the most important phytohormone, IAA through the pathway of conversion of tryptophan to IAA (Premsekhar and Rajashree 2009).

Arisha *et al.* (2003) reported that organic manures activate many species of living organisms which release phytohormones and may stimulate the plant growth and absorption of nutrients.

This data was directly related to leaf nitrogen content due to the action of this nutrient on the process of cell multiplication and plant organ development. Furthermore, nitrogen is a factor and considered as the characteristic constituent of functional plasma, an integral part of chlorophyll molecules, proteins, amino acids, nucleic acids, nucleotides, alkaloids, enzymes, coenzymes, hormones and vitamins (Castellanos *et al.*

2000). It alteration in different aspect of cellular metabolisms including the content of phytohormones could be arising from the different compounds present in the used vermicompost (Moghadam *et al.* 2012).

The gibberellic acid (GA) is involved in many aspect development throughout the life-cycle of higher plants. They also mediate certain environmental effects on plant development and are signaling molecules that regulate and integrate developmental processes during the entire life-cycle of higher plants, including shoot elongation and root development (Lange *et al.* 2005). Gibberellin (GA) signaling may enable integration of aerial and root development (Gou *et al.* 2010).

### **Free amino acid:**

The amino acid content in leaves exhibited difference in values in treating samples as response to organic fertilizers ( Table 8). Fifteen of amino acid composition were estimated in the shoot in vegetative stage. However, the application mixture of compost and maize or decomposed maize stalk only increased most of amino acids in two cultivars when compared to control.

The results showed that compost, the mixture of compost and maize and maize stalk decomposing only, shown the highest number of amino acids compared with the amino acid in the rest treatments .

The results agreed with Bohm (1997) who showed that the increased percentage of crude protein, free amino acids and nitrate in tubers of potato increased with increasing the rate of the fertilizers. Rajaa and Saadi (2011) reported that organic fertilizer lead to new amino acids compared with the control in wheat Also Banerjee *et al.*( 2012) reported that application of compost significantly increased the level of total free amino acid in leaves of mustard when compared to control. Application of (mixture of compost and maize stalk and decomposed maize stalk only) were found as the most effective ones to increase of that contents of amino acid and phytohormone of two cultivars.

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Table1. Effect of compost and organic fertilizers on growth parameters of *Phaseolus vulgaris* Bronco CV.

( vegetative stage)

| Soil treatments |                              | Length of stem (cm) | Length of root (cm) | No. of leaves (/ 10 plants) | No. of leaflets (/ 10 plants) | Fresh weight of stem g/plant | Fresh weight of root g/plant |
|-----------------|------------------------------|---------------------|---------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|
|                 | Quantity (g/pot)             |                     |                     |                             |                               |                              |                              |
| T <sub>1</sub>  | —                            | 11.50               | 25.60               | 3.00                        | 5.00                          | 2.67                         | 2.04                         |
| T <sub>2</sub>  | 17 gm / pot                  | 13.00**             | 22.30**             | 3.00 ns                     | 5.00 ns                       | 2.76*                        | 2.02 ns                      |
| T <sub>3</sub>  | 8.5 gm of each component/pot | 12.80**             | 22.00**             | 3.00 ns                     | 5.00 ns                       | 3.00**                       | 1.85*                        |
| T <sub>4</sub>  | 8.5 gm of each component/pot | 13.80**             | 28.00**             | 3.00 ns                     | 6.00**                        | 3.51**                       | 2.60**                       |
| T <sub>5</sub>  | 8.5 gm of each component/pot | 13.00**             | 24.00**             | 3.00 ns                     | 5.00 ns                       | 3.50**                       | 2.21*                        |
| T <sub>6</sub>  | 17 gm / pot                  | 12.00**             | 21.10**             | 3.00 ns                     | 5.00ns                        | 2.50**                       | 1.50**                       |
| T <sub>7</sub>  | 17 gm / pot                  | 13.50**             | 31.00**             | 3.00 ns                     | 6.00**                        | 3.95**                       | 4.01**                       |
| L.S.D. 0.05%    |                              | 0.14                | 0.63                | 0.00                        | 0.09                          | 0.09                         | 0.14                         |
| 0.01%           |                              | 0.20                | 0.91                | 0.00                        | 0.12                          | 0.13                         | 0.21                         |

(1,Control; 2, composts; 3, compost + rice straw; 4, compost + maize stalk; 5, rice straw + maize stalk; 6, rice straw; 7, maize stalk).

Table 2. Effect of compost and organic fertilizers on growth parameters of *Phaseolus vulgaris* paulista CV. (vegetative stage).

| Soil treatments |                              | Length of stem (cm) | Length of root (cm) | No. of leaves (/ 10 plants) | No. of leaflets (/ 10 plants) | Fresh weight of stem g/plant | Fresh weight of root g/plant |
|-----------------|------------------------------|---------------------|---------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|
|                 | Quantity (g/pot)             |                     |                     |                             |                               |                              |                              |
| T <sub>8</sub>  | —                            | 13.70               | 19.30               | 3.00                        | 5.00                          | 2.10                         | 0.96                         |
| T <sub>9</sub>  | 17 gm / pot                  | 18.20**             | 26.00**             | 3.00ns                      | 5.00ns                        | 2.90**                       | 1.20**                       |
| T <sub>10</sub> | 8.5 gm of each component/pot | 14.50**             | 19.80ns             | 3.00ns                      | 5.00ns                        | 2.80**                       | 1.30**                       |
| T <sub>11</sub> | 8.5 gm of each component/pot | 15.60**             | 26.20**             | 4.00ns                      | 6.00**                        | 3.62**                       | 1.80**                       |
| T <sub>12</sub> | 8.5 gm of each component/pot | 15.00**             | 26.00**             | 3.00ns                      | 5.00ns                        | 3.40**                       | 1.72**                       |
| T <sub>13</sub> | 17 gm / pot                  | 14.00*              | 19.00ns             | 3.00ns                      | 5.00ns                        | 3.08**                       | 1.41**                       |
| T <sub>14</sub> | 17 gm / pot                  | 16.00**             | 29.00**             | 4.00**                      | 8.00**                        | 3.09**                       | 1.20**                       |

|              |      |      |      |      |      |      |
|--------------|------|------|------|------|------|------|
| L.S.D. 0.05% | 0.27 | 0.72 | 0.09 | 0.20 | 0.09 | 0.05 |
| 0.01%        | 0.38 | 1.04 | 0.12 | 0.29 | 0.12 | 0.08 |

(8, Control; 9,composts; 10, compost + rice straw; 11, compost + maize stalk; 12, rice straw + maize stalk; 13, rice straw; 14, maize stalk ).

Table 3. Effect of compost and organic fertilizers on growth parameters of *Phaseolus vulgaris* Bronco CV. ( flowering stage)

| Soil treatments | Quantity (g/pot)             | Length of stem (cm) | Length of root (cm) | No. of leaves (/ 10 plants) | No. of leaflets (/ 10 plants) | Fresh weight of stem g/plant | Fresh weight of root g/plant | No. of flowers (/plant) |
|-----------------|------------------------------|---------------------|---------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|-------------------------|
| T <sub>1</sub>  | —                            | 17.00               | 20.10               | 4.00                        | 12.00                         | 5.45                         | 1.50                         | 5.00                    |
| T <sub>2</sub>  | 17 gm / pot                  | 19.50**             | 21.50**             | 5.00**                      | 9.00**                        | 4.97**                       | 1.93**                       | 6.00**                  |
| T <sub>3</sub>  | 8.5 gm of each component/pot | 18.50*              | 18.30**             | 7.00**                      | 13.00**                       | 3.48**                       | 1.73**                       | 8.00**                  |
| T <sub>4</sub>  | 8.5 gm of each component/pot | 20.90**             | 27.20**             | 7.00**                      | 16.00**                       | 5.77**                       | 2.90**                       | 8.00**                  |
| T <sub>5</sub>  | 8.5 gm of each component/pot | 19.00**             | 20.20ns             | 5.00**                      | 17.00**                       | 5.04**                       | 2.08**                       | 6.00**                  |
| T <sub>6</sub>  | 17 gm / pot                  | 20.00**             | 20.90**             | 5.00**                      | 15.00**                       | 5.10**                       | 3.07**                       | 8.00**                  |
| T <sub>7</sub>  | 17 gm / pot                  | 23.80**             | 22.90**             | 9.00**                      | 17.00**                       | 7.29**                       | 3.29**                       | 14.00**                 |
| L.S.D. 0.05%    |                              | 0.37                | 0.50                | 0.30                        | 0.52                          | 0.20                         | 0.13                         | 0.50                    |
| 0.01%           |                              | 0.54                | 0.72                | 0.44                        | 0.75                          | 0.29                         | 0.18                         | 0.71                    |

(1,Control; 2, composts; 3, compost + rice straw; 4, compost + maize stalk; 5, rice straw + maize stalk; 6, rice straw; 7, maize stalk).

Table 4. Effect of compost and organic fertilizers on growth parameters of *Phaseolus vulgaris* paulista CV. ( flowering stage)

| Soil treatments | Quantity (g/pot)              | Length of stem (cm) | Length of root (cm) | No. of leaves (/ 10 plants) | No. of leaflets (/ 10 plants) | Fresh weight of stem g/plant | Fresh weight of root g/plant | No. of flowers (/plant) | (8, |
|-----------------|-------------------------------|---------------------|---------------------|-----------------------------|-------------------------------|------------------------------|------------------------------|-------------------------|-----|
| T <sub>8</sub>  | —                             | 18.00               | 21.00               | 4.00                        | 10.00                         | 3.88                         | 1.01                         | 5.00                    |     |
| T <sub>9</sub>  | 17 gm / pot                   | 17.20**             | 23.60**             | 5.00**                      | 13.00**                       | 5.61**                       | 1.71**                       | 6.00**                  |     |
| T <sub>10</sub> | 8.5 gm of each component/ pot | 17.40**             | 23.00**             | 4.00ns                      | 11.00**                       | 5.52**                       | 1.98**                       | 6.00**                  |     |
| T <sub>11</sub> | 8.5 gm of each component/ pot | 19.00**             | 24.30**             | 6.00**                      | 13.00**                       | 6.55**                       | 2.26**                       | 7.00**                  |     |
| T <sub>12</sub> | 8.5 gm of each component/ pot | 17.50**             | 21.40*              | 4.00ns                      | 10.00ns                       | 4.88**                       | 1.15*                        | 6.00**                  |     |
| T <sub>13</sub> | 17 gm / pot                   | 17.40**             | 20.70**             | 4.00ns                      | 10.00ns                       | 4.04ns                       | 1.12ns                       | 6.00**                  |     |
| T <sub>14</sub> | 17 gm / pot                   | 21.00**             | 25.00**             | 7.00**                      | 17.00**                       | 6.71**                       | 2.88**                       | 7.00**                  |     |
| L.S.D. 0.05%    |                               | 0.24                | 0.30                | 0.21                        | 0.45                          | 0.20                         | 0.12                         | 0.12                    |     |
| 0.01%           |                               | 0.35                | 0.43                | 0.31                        | 0.65                          | 0.28                         | 0.17                         | 0.17                    |     |

Control; 9, composts; 10, compost + rice straw; 11, compost + maize stalk; 12, rice straw + maize stalk; 13, rice straw; 14, maize stalk).

Table 5. Effect of compost and organic fertilizers on growth of yield of *Phaseolus vulgaris* Bronco CV. (fruting stage)

| Soil Treatments | Quantity (g/pot)             | Length of stem (Cm) | Length of root (Cm) | No. of leaves/ plant | No. of leaflets /plant | No. of legume /plant | No. of seeds /pod | Weight of legume (g) | Fresh weight of stem g/plant | Fresh weight of root g/plant |
|-----------------|------------------------------|---------------------|---------------------|----------------------|------------------------|----------------------|-------------------|----------------------|------------------------------|------------------------------|
| T <sub>1</sub>  | —                            | 17.00               | 21.50               | 6.00                 | 13.00                  | 2.0                  | 4.0               | 1.94                 | 2.33                         | 1.91                         |
| T <sub>2</sub>  | 17 gm / pot                  | 18.50ns             | 22.50**             | 6.00ns               | 13.00ns                | 3.00**               | 6.00**            | 3.04**               | 3.22**                       | 1.76*                        |
| T <sub>3</sub>  | 8.5 gm of each component/pot | 18.00**             | 23.10**             | 7.00**               | 15.00**                | 4.00**               | 9.00**            | 4.13**               | 3.33**                       | 2.31**                       |
| T <sub>4</sub>  | 8.5 gm of each component/pot | 20.00**             | 24.03**             | 7.00**               | 15.00**                | 4.00**               | 10.00**           | 4.26**               | 4.81**                       | 2.54**                       |

|                |                                    |         |         |        |         |        |         |        |        |        |
|----------------|------------------------------------|---------|---------|--------|---------|--------|---------|--------|--------|--------|
| T <sub>5</sub> | 8.5 gm of<br>each<br>component/pot | 19.00** | 23.40** | 7.00** | 14.00** | 3.00** | 8.00**  | 3.05** | 3.03** | 1.98ns |
| T <sub>6</sub> | 17 gm / pot                        | 18.00*  | 23.20** | 7.00** | 14.00** | 3.00** | 6.00**  | 3.55** | 2.74** | 2.09** |
| T <sub>7</sub> | 17 gm / pot                        | 22.00** | 26.80** | 8.00** | 17.00** | 4.00** | 12.00** | 6.66** | 5.40** | 3.71** |
| L.S.D. 0.05%   |                                    | 0.75    | 0.29    | 0.12   | 0.24    | 0.13   | 0.48    | 0.26   | 0.20   | 0.12   |
| 0.01%          |                                    | 1.08    | 0.42    | 0.17   | 0.35    | 0.19   | 0.69    | 0.37   | 0.28   | 0.17   |

(1,Control; 2, composts; 3, compost + rice straw; 4, compost + maize stalk; 5, rice straw + maize stalk; 6, rice straw; 7, maize stalk).

Table 6. Effect compost and organic fertilizers on growth of yield of *Phaseolus vulgaris paulista* CV. ( fruting stage)

| Soil<br>Tretments | Quantity<br>(g/pot)                    | L. of<br>stem<br>(Cm) | L. of<br>root<br>(Cm) | No. of<br>leaves/<br>plant | No.<br>of<br>leaflets/<br>plant | No.<br>of<br>Legu<br>mes/<br>plant | No. of<br>seeds/<br>leguem<br>s | Weight<br>of pods<br>(g/<br>Plants) | Fresh<br>w. of<br>stem<br>g/plant | Fresh<br>w. of<br>root<br>g/plant |
|-------------------|----------------------------------------|-----------------------|-----------------------|----------------------------|---------------------------------|------------------------------------|---------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|
| T <sub>8</sub>    | -                                      | 21.20                 | 20.9                  | 6.00                       | 13                              | 2                                  | 5                               | 3.32                                | 3.96                              | 1.99                              |
| T <sub>9</sub>    | 17 gm / pot                            | 22.30**               | 25.00**               | 6.00ns                     | 13.00ns                         | 4.00**                             | 9.00**                          | 3.87**                              | 3.58**                            | 1.75**                            |
| T <sub>10</sub>   | 8.5 gm of<br>each<br>component/<br>pot | 22.00**               | 23.60**               | 6.00ns                     | 13.00ns                         | 4.00**                             | 9.00**                          | 4.78**                              | 3.03**                            | 1.72**                            |
| T <sub>11</sub>   | 8.5 gm of<br>each<br>component/<br>pot | 25.80**               | 27.20**               | 6.00ns                     | 14.00**                         | 4.00**                             | 9.00**                          | 5.79**                              | 4.63**                            | 2.16**                            |
| T <sub>12</sub>   | 8.5 gm of<br>each<br>component/<br>pot | 22.00**               | 23.00**               | 6.00ns                     | 13.00ns                         | 4.00**                             | 9.00**                          | 4.43**                              | 3.06**                            | 1.67**                            |
| T <sub>13</sub>   | 17 gm / pot                            | 21.80*                | 21.00ns               | 6.00ns                     | 13.00ns                         | 4.00**                             | 9.00**                          | 4.37**                              | 3.44**                            | 1.25**                            |
| T <sub>14</sub>   | 17 gm / pot                            | 27.90**               | 29.20**               | 5.00**                     | 16.00**                         | 4.00**                             | 11.00**                         | 7.91**                              | 5.03**                            | 3.51**                            |
| L.S.D.            |                                        | 0.44                  | 0.54                  | 0.07                       | 0.20                            | 0.14                               | 0.32                            | 0.27                                | 0.13                              | 0.13                              |
| 0.05%             |                                        | 0.64                  | 0.78                  | 0.10                       | 0.29                            | 0.20                               | 0.46                            | 0.38                                | 0.19                              | 0.18                              |

(8, Control; 9, composts; 10, compost + rice straw; 11, compost + maize stalk; 12, rice straw + maize stalk; 13, rice straw; 14, maize stalk ).

Table 7. Effect of compost and organic fertilizers on Phytohormones of two cultivars of *Phaseolus vulgaris* ( vegetative stage)

| No. | Phytohormones mg/100g |       |        |
|-----|-----------------------|-------|--------|
|     | GA3                   | IAA   | ABA    |
| 1   | 16.332                | 7.233 | 14.463 |

|    |        |        |        |
|----|--------|--------|--------|
| 2  | 21.033 | 8.934  | 23.721 |
| 3  | 11.968 | 9.776  | 20.130 |
| 4  | 55.012 | 10.291 | 8.902  |
| 5  | 43.562 | 10.221 | 3.492  |
| 6  | 2.888  | 7.028  | 10.451 |
| 7  | 64.918 | 24.714 | 4.542  |
| 8  | 2.546  | 8.054  | 12.611 |
| 9  | 5.993  | 9.368  | 16.017 |
| 10 | 4.131  | 11.122 | 7.232  |
| 11 | 21.237 | 16.334 | 7.249  |
| 12 | 13.344 | 12.921 | 11.648 |
| 13 | 4.131  | 1.111  | 11.159 |
| 14 | 46.202 | 22.185 | 6.967  |

*Phaseolus vulgaris* ( CV. bronco. ) ( 1, Control; 2, composts; 3, compost + rice straw; 4, compost + maize stalk; 5, rice straw + maize stalk; 6, rice straw; 7, maize stalk).

*Phaseolus vulgaris* ( CV. Paulista ) ( 8, Control; 9, composts; 10, compost + rice straw; 11, compost + maize stalk; 12, rice straw + maize stalk; 13, rice straw; 14, maize stalk).

Table 8: Effect of compost and organic fertilizers on amino acid contents of two cultivars of *Phaseolus vulgaris* (vegetative stage)

| Total amino acids % | <i>Phaseolus vulgaris</i> ( CV. bronco. ) |       |       |       |       |       |       | <i>Phaseolus vulgaris</i> ( CV. Paulista ) |       |       |       |       |       |       |
|---------------------|-------------------------------------------|-------|-------|-------|-------|-------|-------|--------------------------------------------|-------|-------|-------|-------|-------|-------|
|                     | 1                                         | 2     | 3     | 4     | 5     | 6     | 7     | 8                                          | 9     | 10    | 11    | 12    | 13    | 14    |
| Asp                 | 4.262                                     | 2.716 | 2.845 | 4.740 | 3.418 | 1.895 | 5.896 | 2.281                                      | 3.973 | 4.054 | 5.063 | 4.864 | 2.686 | 5.547 |
| Thr                 | 0.710                                     | ---   | 0.564 | 0.925 | 0.715 | 0.630 | 2.805 | 0.394                                      | 0.761 | 0.694 | 0.872 | 0.782 | 0.508 | 1.134 |
| Ser                 | 0.520                                     | 0.678 | 0.598 | 2.647 | 2.283 | 0.650 | 4.736 | 2.925                                      | 4.284 | 3.171 | 4.265 | 3.140 | 3.088 | 3.614 |
| Gly                 | 1.508                                     | 1.830 | 1.653 | 2.190 | 2.110 | 1.425 | 2.565 | 1.385                                      | 2.198 | 1.886 | 2.457 | 2.287 | 0.940 | 2.802 |
| Ala                 | 1.804                                     | 1.590 | 1.653 | 2.190 | 1.872 | 1.445 | 2.282 | 1.908                                      | 2.064 | 1.688 | 2.324 | 2.265 | 1.178 | 2.387 |
| Val                 | 1.130                                     | 1.332 | 1.460 | 1.573 | 1.312 | 0.602 | 2.120 | 0.795                                      | 1.489 | 1.398 | 1.520 | 1.493 | 1.404 | 1.770 |
| Lle                 | 0.756                                     | 0.496 | 0.864 | 1.067 | 0.867 | 0.605 | 1.215 | 0.311                                      | 0.652 | 0.572 | 0.847 | 0.667 | 0.542 | 1.018 |
| Leu                 | 2.150                                     | 1.160 | 2.251 | 2.540 | 2.272 | 1.861 | 2.625 | 1.198                                      | 2.080 | 2.502 | 2.685 | 2.598 | 2.209 | 3.460 |
| Tyr                 | 0.890                                     | 0.350 | 0.639 | 0.972 | 0.899 | 0.314 | 1.294 | 0.618                                      | 0.795 | 0.876 | 1.475 | 1.100 | 0.681 | 1.526 |
| Phe                 | 0.805                                     | 0.128 | 0.588 | 1.095 | 0.828 | 0.400 | 1.450 | 0.705                                      | 0.719 | 1.014 | 1.312 | 1.125 | 0.980 | 1.356 |
| Lys                 | 0.597                                     | ---   | 0.508 | 0.835 | 0.632 | 0.470 | 0.932 | 0.402                                      | 0.456 | 0.558 | 0.710 | 0.637 | 0.391 | 1.556 |
| Amm                 | 0.587                                     | 0.409 | 0.984 | 1.155 | 1.062 | 0.096 | 1.370 | 0.365                                      | 0.280 | 0.344 | 1.050 | 0.395 | 0.043 | 1.306 |
| Arg                 | 2.217                                     | 1.102 | 4.540 | 6.684 | 6.175 | 1.951 | 6.802 | 1.149                                      | 2.028 | 1.605 | 4.605 | 2.223 | 1.641 | 4.857 |
| Glu                 | ---                                       | 3.097 | ---   | ---   | ---   | ---   | ---   | ---                                        | ---   | ---   | ---   | ---   | ---   | 1.033 |
| His                 | ---                                       | -     | ---   | 0.415 | ---   | ---   | 0.792 | -                                          | ---   | ---   | 1.267 | ---   | ---   | ---   |

CV. Bronco (Line 1, Control; line2, compost; line3, composts + rice straw; line4, compost + maize stalk; line5, rice straw + maize stalk; line6, rice straw; line7, maize stalk).

CV. Paulista (Line 8, Control; line9, compost; line10, compost + rice straw; line11, compost + maize stalk; line12, rice straw + maize stalk; line13, rice straw; line14, maize stalk).