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Research Article

Effect of Different Organic Fertilizers on the Growth of *Amaranthus tricolor* (L.)

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ABSTRACT

The growth parameters of amaranth were tested on the 30th and 45th day. On the 30th day, shoot length and root length was higher in T_1 and T_4 respectively. The other growth parameters such as number of leaves, fresh weight and dry weight were higher in T_4 only. On the 45th day, all the growth parameters tested were maximum in plants treated with combination of fertilizers.

Keywords: *Amaranthus*, *Azospirillum*, growth, Phosphobacteria, VAM fungi.

INTRODUCTION

Organic fertilizers are fertilizers that are obtained from animal matter, animal excreta, human excreta and vegetable matter. Organic farming is the best way for sustainable production of vegetable crops. The application of organomineral fertilizer increased the fresh matter and number of leaves of grain amaranth (Akanni *et al*., 2011). Application of bio-fertilizers such as PSB and *Azospirillum* has reduced the use of chemical fertilizers, but, provided high quality organic products free of harmful agrochemicals for the safety of public health.

Azospirillum is a micro-Europhilic nitrogen fixer. It fixes nitrogen in an environment of low oxygen tension. *Azospirillum* are free-living N_2 fixing bacteria that in the rhizospheric zone have the ability to synthesize and secrete some biologically active substances that enhance root growth. The bacteria induce the plant roots and secrete mucilage, which creates low oxygen environment that helps to fix atmospheric nitrogen. It fixes N_2 10-14 kg/ha/season in many vegetable crops. They also increase germination and vigour in young plants, leading to improved crop stands. *Azospirillum* can freely fix molecular nitrogen and be considered as biological fertilizer. Research has shown that organic based fertilizers are less leached into ground water than the chemical fertilizer (Sridhar and Adeoye, 2003).

Amaranthus species are being cultivated since centuries as a leafy vegetable, as well as an important subsidiary food grain crop in many parts of the world. Vegetable amaranth serves as an alternative source of nutrition for people in developing countries since it is a rich and inexpensive source of carotenoid, protein, vitamins and dietary fibre. Unlike other leafy vegetables, vegetable amaranth is cultivated during hot summer months when no other green vegetables are available in the market. Besides immense nutritional importance, it can also be successfully grown under varied soil and agro climatic conditions. Recently, current interest in amaranth also resides in the fact that it has a great amount of genetic diversity and phenotypic plasticity. Amaranth is extremely adaptable to adverse growing conditions, resists heat and drought, has no major disease problem and is among the easiest of plants to grow. Vegetable amaranth (*Amaranthus tricolor* L.) remains a subsidiary under exploited crop for vegetable purose. In spite of immense nutritional qualities, not much work has been done for its genetic improvement.

MATERIALS AND METHODS

Collection of seeds

Seeds of *Amaranthus tricolor* (L.) was obtained from Tamil Nadu Agricultural University, Coimbatore.

Collection of Fertilizers

The bio-fertilizers such as *Azospirillum*, VAM and Phosphobacteria were collected from TNAU, Coimbatore. The dosage used were as per the TNAU Agriportal.

Methods

Pot culture experiment

Pot culture experiment was conducted with the test plant. The experiment was carried out in the period from

Plate 1 - Habit of *Amaranthus tricolor* (L.)

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Plate 2 - Growth of *Amaranthus tricolor* (L.) on 30th day

Plate 3- Growth of *Amaranthus tricolor* (L.) on 45th day

December 2017 to February 2018. The size of the experimental pot was 30 cm × 24 cm × 30 cm. Triplicates were maintained for each treatment.

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 filled in pots of 7 kg capacity. A study was undertaken to assess the effect of different organic fertilizers on the growth and yield parameters of the plant.

The seeds were soaked in different organic fertilizers such as *Azospirillum*, Phosphobacteria and Vesicular Arbuscular Mycorrhizal (VAM) fungi for 12 hours. In the growing stages of the plants, the fertilizers were sprayed on the plants and growth study was carried out on 30th and 45th day of the plant.

The infection to the plant by various insects were controlled by spraying thulasi extract on the leaves.

Treatments

T_0 – Control

T_1 – *Azospirillum*

T_2 – VAM

T_3 - Phosphobacteria

T_4 – *Azospirillum* + VAM + Phosphobacteria

Growth Parameters

Plant samples were uprooted carefully on 30th and 45th day.

Table 1: Growth parameters *Amaranthus tricolor* (L.) using different organic fertilizers on the 30th day.

Treatments	Shoot length (cm)	Root length (cm)	No. of leaves	Fresh weight (gm)	Dry weight (gm)
T_0	25.88 ± 0.54	12.67 ± 0.81	97.67 ± 4.51	26.74 ± 0.63	2.47 ± 0.27
T_1	38.00 ± 2.34	16.50 ± 0.56	116.00 ± 12.12	51.82 ± 5.69	5.31 ± 0.59
T_2	31.50 ± 1.32	16.87 ± 1.76	216.00 ± 26.06	48.22 ± 1.44	4.05 ± 0.07
T_3	35.57 ± 2.40	17.83 ± 0.93	234.33 ± 31.56	43.03 ± 1.65	4.75 ± 0.19
T_4	36.43 ± 1.99	19.07 ± 0.93	249.33 ± 10.02	55.08 ± 3.36	5.51 ± 0.43
SEd	1.5179	0.8796	16.0955	2.5512	0.2938
Cd (p<0.05)	3.3821	1.9600	35.8633	5.6844	0.6546

Values are mean ± SD of three samples in each group

The following growth parameters were measured and recorded for all the treatments.

Root length (cm)

Shoot length (cm)

Number of leaves

Fresh weight (g)

Dry weight (g)

Root Length

The plants were taken from control pot and other treatment pots and washed to get rid of adhering soil particles. Then, the length of the roots was measured with the help of a scale from root collar point to root tip and expressed in centimeter. Ten seedlings were randomly selected from each treatment and their root length was measured using cm scale and recorded as cm/seedling.

Shoot Length

The shoot length of the plants was measured with the help of scale from the root collar point to shoot apex and expressed in centimeter. Ten seedlings were randomly selected from each treatment and their shoot length was measured using cm scale and recorded as cm/seedling. Three readings were taken for statistical analysis.

Number of leaves

The number of leaves present in the uprooted plants was also calculated.

Fresh Weight

Fresh weight of the plants was measured with the help of an electronic digital balance and expressed in grams.

Dry Weight

The collected plant materials were kept in hot air oven at 55º C for 24 hours. Then, the dry weight of the plants was measured using an electronic digital balance and expressed in grams.

Yield Parameters

The yield of the green leafy vegetable was calculated by measuring the weight of the vegetable on the 45th day, because the leafy vegetables grow up to 45 days only. After that, the plants start drooping.

Statistical Analysis

The data obtained from various biometric observations were subjected to statistical analysis as per the procedure of Panse and Sukhatme (1978). The significance and critical differences of various treatments were analysed.

RESULTS AND DISCUSSION

The experiments conducted in *Amaranthus tricolor* (L.) using different organic fertilizers treatments showed the following results.

Description

Amaranthus tricolor (L.)

Systematic Position

Kingdom - Plantae

Order - Caryophyllales

Family - Amaranthaceae

Genus - *Amaranthus*

Species - *A. tricolor* (L.)

Amaranthus tricolor belongs to the family Amaranthaceae. The family is well represented in the tropical regions of the world.

The plants are ascending or erect annual herb (Plate 1).

The plants grow up to 125cm tall, usually much branched.

The leaves are generally spiral, simple, usually covered with hairs, without stipules.

The petiole is upto 8 cm long.

Usually the flowers are very minute.

Inflorescence is axillary, globose cluster upto 2.5 cm in diameter.

The fruits are generally dry.

Medicinal values

The plant is rich in vitamins and minerals.

The whole plant is an astringent.

A decoction of the root is used with *Cucurbita* tocontrol haemorrhage following abortion.

A decoction of very old plants is taken internally to improve vision and strengthen the liver.

Amaranthus is a green leafy vegetable which grows for a maximum period of one and half month. So, the growth parameters were studied in this plant on the 30th day and 45th day. After that, the plant started dying (Plate 2 and 3)

On the 30th day, the shoot length and root length (Table 1) under different organic fertilizer treatment was found to be higher in T_1 (38.00 + 2.34 cm) and T_4 (19.07 ± 0.93 cm) respectively. The number of leaves was more in T_4 (249.33 ± 10.02).

The fresh weight and dry weight of *Amaranthus tricolor* (L.) was also higher in T_4 (55.08 ± 3.36 g and 5.51 ± 0.43 g) respectively.

On the 45th day of growth, the green leafy vegetable showed a higher shoot length (88.90 ± 3.99 cm), root length (28.50 ± 2.88 cm), number of leaves (562.33 ± 30.01), fresh weight (91.26 ± 4.33 g) and dry weight (18.89 + 0.69 g) in plants treated with the combination of organic fertilizers such as *Azospirillum*, VAM, phosphobacteria

Table 2: Growth parameters *Amaranthus tricolor* (L.) using different organic fertilizers on the 45th day.

Treatments	Shoot length (cm)	Root length (cm)	No. of leaves	Fresh weight (gm)	Dry weight (gm)
T_0	67.10 ± 6.27	21.43 ± 0.68	289.33 ± 9.87	289.33 ± 9.87	12.02 ± 0.53
T_1	73.17 ± 4.95	26.77 ± 2.73	293.67 ± 85.56	293.67 ± 85.56	18.34 ± 1.32
T_2	84.40 ± 2.79	26.67 ± 0.76	453.33 ± 20.13	453.33 ± 20.13	17.05 ± 0.63
T_3	80.67 ± 6.15	26.10 ± 2.88	460.67 ± 50.00	460.67 ± 50.00	17.68 ± 0.72
T_4	88.90 ± 3.99	28.50 ± 2.88	562.33 ± 30.01	562.33 ± 30.01	18.89 ± 0.69
SEd	4.0890	1.8305	38.6862	38.6862	0.6761
Cd ($p<0.05$)	9.1108	4.0786	86.1986	86.1986	1.5064

Values are mean ± SD of three samples in each group

(Table 2). This shows that when the organic fertilizers of vegetable crops could be increased there by an increase in the yield could be obtained.

The study on the influence of chemical fertilizers and bio-fertilizers on dry matter yield and NPK uptake by Cabbage (Singh *et al*., 2013) had shown a significant variation in dry matter yield/ plant due to the inoculation of *Azospirillum*. The maximum dry matter yield obtained might be due to the ability of *Azospirillum* to produce some growth promoting substances involved in increasing the accumulation of food in plant.

The results on the application of microbial inoculants to onion produced maximum plant height, number of leaves per plant and fresh weight of plant. This result is on par with the current study, where the use of organic fertilizers such as *Azospirillum*, VAM fungi and Phosphobacteria has resulted in height growth parameters of lady's finger and amaranth. The current result also correlates with the findings of Rather *et al*. (2003) Yadav *et al*. (2005) and Jha *et al*., (2006). Organomineral and unamended organic compost were found to have better residual effects on soil nutrients than NPK fertilizer (Olowoake, 2014).

Amaranthus is one of the plants that accumulate nitrates especially when soil fertility is very high (Alegbejo, 2013). Green leafy vegetables represent an excellent component of the habitual dot in the tropical and temperate countries (Ashok Kumar *et al.*, 2013).

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