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Infleuence of Vermicompost, Amirthakaraisal and Abda Gold on the Growth of *Capsicum annum*

J. Ketsiyal (Corresponding Author)
PG and Research Department of Zoology, The American College, Madurai-625002, Tamil Nadu, India
Email: ketsichristy@gmail.com

A. Joseph Thatheyus
PG and Research Department of Zoology, The American College, Madurai-625002, Tamil Nadu, India

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Abstract

Organic farming has emerged as crucial priority area globally in view of the growing demand for safe and healthy food and future sustainability and concerns on environmental pollution associated with indiscriminate use of agrochemicals. The effect of vermicompost, amirthakaraisal, and AbdAgold separately and in combination on the growth of *Capsicum annum* was determined studying the parameters germination percentage, root length, shoot length, wet weight, dry weight, chlorophyll A,B and total chlorophyll content, and protein content. Application of vermicompost, and amirthakaraisal, in the field enhance the growth parameters in *Capsicum annum*.

Keywords: Organic manure; Vermicompost; Amirthakaraisal; AbdA gold *capsicum annum* growth.

1. Introduction

Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment. Agriculture remains the key sector for the economic development for most developing countries. It is critically important for ensuring food security, alleviating poverty and conserving the vital natural resources that the world's present and future generations will be entirely dependent upon for their survival and well-being. The world population will inevitably double by the middle of the twenty-first century, which is in the space of just two generations. Over 90% of the developing nations, especially in Asia and to an even greater extent will be in the urban areas which follow up the green revolution strategy. Vermicomposting is a biotechnological process in which earthworms are employed to convert the organic wastes into humus like material known as vermicompost. Certain earthworm species are capable of consuming a wide range of organic wastes from sewage sludge, animal wastes, agricultural residues, domestic wastes, and industrial wastes. Frederickson, *et al.* [1], under favuorable conditions of temperature and moisture, earthworms maintain the aerobic condition in the vermicomposting process, ingest organic waste materials and egest a humus-like substance which is more homogeneous than the organic wastes or raw materials used. Amirthakaraisal is a foliar spray. It is a blend of two products from cow. It contains jaggery, water, cow urine and cow dung. When suitably mixed and used, it acts as an effective growth promoter and pest repellent. Some macronutritents (N, P, and K) and micronutrients (Zn, Fe, Mn, and Cu) along with reducing sugars are present in amirthakaraisal. Chemolithoautrotrophic nitrifiers, which colonize in the leaves, increase the ammonia uptake and enhance total N supply. Effective microorganisms present in amirthkaraial improved soil quality, growth and yield of crops [2]. Hence the present work has been designed to study the effect of Vermicompost, Amirthakaraisal and AbdA gold on the growth of *Capsicum annum*.

2. Materials and Methods

The present study was carried out for testing the effect of Vermicompost, Amirthakaraisal, and Abda gold plant vitalizer and their combinations on the growth of the plant, *C. annum*.

2.1. Chemical Parameters

Soil sampling for chemical analysis was done according to standard methods. Samples were processed and their chemical properties such as pH, Electrical conductivity, nitrogen, phosphorus, potassium, copper, zinc, iron and manganese were estimated and recorded. Vermicompost, Amirthakaraisal, and AbdA gold were applied once in a week. Chemical parameters were analysed in soil, vermicompost, amirthakaraisal and AbdA gold [3].

2.2. Vermicompost

Vermicompost was obtained from the Agriculture College and Research Institute, Madurai. The nutrient composition of vermicompost was analysed following standard methods [4].

2.3. Amirthakaraisal

Amirthakaraisal is an organic formulation derived from the four ingredients, fresh cow dung, cow urine, jaggery and water. Amirthakaraisal is an effective stimulator, growth promoter and immunity booster. Amirthakaraisal proved its value by providing strength and resistance to the crop. All the ingredients were mixed well and stirred three times a day. Within 24 hours the manure was ready. Manure was kept under the shade covered with a white mesh or plastic mosquito net to prevent house flies from laying eggs and formation of maggots in the solution. This manure can be used as foliar spray or as a solution that can be mixed with water. One liter of solution is diluted with ten liters of water.

2.4. AbdA Gold

AbdA gold is an organic product that ensures balanced root: shoot ratio and early establishment of crops. It stimulates plant for enhanced nutrient uptake which leads to improved yield. It boosts the thickness of the stem and increases the height of the crops. AbdA gold increases leaf area, greenness and chlorophyll content leading to enhanced photosynthesis.

2.5. Dosage

The pots had red soil with pH 5.57. Eight pots with 15 cm diameter and 30 cm depth were used in this study. Each pot was filled with 1.5kg of the soil and planted with seeds. Fifteen days after seeding 100 g of vermicompost, amirthakaraisal and AbdA gold individually and in combinations were used per pot once in a week in the morning.

2.6. *Capsicum annum*

Chilly belongs to the family Solanaceae. The plant is not an annual plant but in the absence of winter frosts it can survive several seasons and grow into a large perennial shrub. The single flowers are white in colour while the stem is densely branched and up to fifty centimeters tall. The fruits are berries that may be green, yellow or red when ripe. While the species can tolerate most climates, *C.annum* in especially productive in warm and dry climate.

2.7. Treatments

The eight treatments as given in Table 1 were conducted for the crop, *Capsicum annum* (*chilly plant*) and for each treatment the seeds were applied in the soil. The germination of seeds was observed after four days of sowing. The germination process was noticed for the first eight days. The root and shoot length, dry and wet weight of the plant and number of leaves were calculated fifteen days once. The analysis of protein and chlorophyll content was carried out using standard procedures.

The following parameters were recorded after 15, 25, 35, and 45 days after seeding (DAS).

1. **Shoot length**: It was measured from the ground surface to the tip of the plant.
2. **Root length:** It was measured from the ground level to the tip of the longest root hair.
3. **Wet weight:** The plant was removed from the soil and washed out off any loose soil. The plant was gently blotted with soft paper towel to remove any free surface moisture and weighed immediately.
4. **Dry weight:** The plants were cut and packed separately and dried in a hot air oven at 50^{o} C until the moisture content was totally lost and then weighed.
5. **Chlorophyll content:** One gram of fresh leaves was taken and minced well with scissors. To this about 5ml distilled water was added and homogenized in a blender. The final volume was made up to 10 ml. An aliquot (10.5 ml) was taken and mixed with 4.5 ml of 80% acetone. The acetone extracts the pigment. The supernatant after centrifugation was collected and measured for optical density at two wavelengths 645nm and 663nm for chlorophyll A and B respectively with the solvent blanks. The amount of chlorophyll present in the extract (mg chlorophyll/g tissue) was calculated using the following equations.

mg chlorophyll a /g tissue= 12.7 (A_{663}) - 2.69 (A_{645})× V/ 1000×W

mg chlorophyll b/ g tissue = 22.9 (A_{645}) - 4.68 (A_{663})×V/1000×W

mg total chlorophyll /g tissue=20.2(A_{665})+ 8.02(A_{663}) ×V/ 1000×W

Where,

A=absorbance at specific wave length

B=final volume of chlorophyll extract in 80% acetone

W=fresh weight of tissue extracted

2.8. Protein Content

Protein content of the chilly was analyzed by Lowry's method using Folin-ciocalteau reagent. *C. annum* were cleaned and washed with distilled water and allowed to air dry. Two grams of samples were weighed and made into paste using pestle and mortar. The juice was extracted and made up to 5ml with distilled water and poured into a centrifuge tube and after the process of centrifuging the aqueous extract collected was packed in polythene pouch and stored in the refrigerator.

The amount of 0.1ml to 1ml working standard solutions in five test tubes was taken and one ml of distilled water was added to each. After that 5.0ml of Folin-ciocalteau reagent was added and then 0.3ml of copper sulphate reagent was added in each test tube. Then all the test tubes were covered with cotton and they were kept undisturbed for thirty minutes. The optical density (OD) of each test tube was measured using colorimeter [5].

2.9. Statistical Analysis

The data collected were subjected to two way analysis of variance (ANOVA) for the different factors. Statistical analysis was carried out by taking the average of five plants from each pot. The level of significance used in 'F' test was P = 0.05.

3. Results

The growth of *C. annum* was estimated in the present investigation in various treatments like vermicompost, amirthakaraisal, and AbdA gold and their combinations. The chemical composition of soil, vermicompost, amirthkaraisal and AbdA gold were tested and tabulated in Table 2, 3, 4, 5 respectively. The chemical parameters of soil are shown in Table 2. The highest value was found for potassium (50 mg/kg) and the lowest for Electrical conductivity (0.30 Ds/m). Chemical parameters of vermicompost are shown in Table 3. Organic carbon, nitrogen, phosphorous, potassium, and sodium, were found in vermicompost. The chemical parameters of Amirthakaraisal are shown in Table 4. The highest value was observed for potassium (317 mg/kg) and the lowest value was found for zinc (0.22). Chemical parameters of AbdA gold are shown in Table 5. Vitamins, proteins, Fat, Carbohydrates, Phosphorous, Sodium, Zinc, and Magnesium were found in AbdA gold organic manure.

3.1. Seed Germination

Fig 1. indicates the germination percentage of *C. annum* in various treatments, it was found to be higher in vermicompost treatment (T1) and seedling emerged only on the 5 day after seeding. The lower value was found in control (T8) and seedlings emerged only on the 6 day after seeding.

3.2. Root Length

The effect of various treatments on the root length of *C.annum* on 15, 25, 35, and 45 days after seeding is highlighted in Fig 2. The highest root length was recorded from vermicompost mixed with amirthakaraisal treatment (T4) and the lowest was recorded in control treatment (T8).

3.3. Shoot Length

The effect of various treatments on the shoot length of *C.annum* on 15, 25, 35, and 45 days after seeding is shown in Fig 3. The highest shoot length was recorded in amirthakaraisal mixed with AbdAgold treatment (T6) and the lowest shoot length was recorded in control treatment (T8).

3.4. Wet Weight

The effect of various treatments on the wet weight of *C.annum on* 15, 25, 35, and 45 days after seeding is divulges in Fig 4. The highest value of wet weight was recorded in the vermicompost mixed with amirthakaraisal treatment (T4). The lowest value was recorded in amirthakaraisal treatment (T2).

3.5. Dry Weight

Fig 5. exhibits the effect of various treatments on the dry weight of *C. annum* on 15, 25, 35, and 45 days after seeding. The highest value of dry weight was recorded in vermicompost mixed with AbdA gold treatment (T5). The lowest value of dry weight was recorded in vermicompost mixed with amirthakaraisal treatment (T4).

3.6. Chlorophyll Content

Figure 6 indicates the effect of various treatments on the chlorophyll A content of *C.annum* on 15, 25, 35, and 45 days after seeding. The highest content of chlorophyll A was recorded in amirthakaraisal + AbdAgold treatment (T6). Figure 7 shows the effect of various treatments on the chlorophyll A content of *C. annum* on 15, 25, 35, and 45 days after seeding. The highest chlorophyll B content was recorded in amirthakaraisal treatment (T2) and the lowest was recorded in vermicompost + Amirthakaraisal + AbdAgold treatment (T7). Figure 8 shows the effect of various treatments on the total chlorophyll content of *C. annum* on 15, 25, 35, and 45 days after seeding. The highest total chl orophyll content was recorded in amirthakaraisal treatment (T2) and the lowest value was recorded in control treatment (T8).

3.7. Protein Content

Figure 9 highlights the effect of various treatments on the protein content of *C.annum* 45 days after seeding. This was found maximum in amirthakaraisal treatment (T2) with 0.32mg/g chilly. The minimum was recorded in AbdAgold treatment (T2) with 0.19mg/g chilly.

3.8. Statistical Analysis

Table 6 indicates the two way analysis of variance (ANOVA). Variations due to treatment types are statistically significant at 5% level for the factors root length, shoot length, wet weight and variations due to treatment period are statistically not significant at 5% level for the factors germination percentage, dry weight, chlorophyll A, chlorophyll B and total chlorophyll content in *C.annum.*

4. Discussion

In the present work, the effect of organic manure like vermicompost, amirthakaraisal, and AbdA gold was studied using *C. annum* as model plant. The combination of vermicompost and amirthakaraisal produced the highest germination percentage for *C. annum* compared to AbdA gold plant vitaliser. The vermicompost contains some micronutrients that stimulate plant growth. Vermicompost treated pots might have fixed large amount of atmospheric nitrogen which maybe the reason for increased nitrogen content in soil [6]. The factor attributed to decreased levels of available N, P, K and organic carbon in the control pots could be the nutrient hungry plants which would have used up all the nutrients in the soil. These results are typical of what other researchers have found [7]. Thus, the organic manures like vermicompost, amirthakaraisal and AbdAgold when used as components in various strategies, show promising results in *C. annum*. It has also been found that vermicompost treatment gives enhanced growth in combination with amirthakaraisal and AbdAgold [8, 9].

Sunanda and Mallareddy [10] reported reasonably high content of nitrogen, potassium and organic carbon in cow dung manure; high content of copper and lower content of fibrous material in organic manure, and very high content of N, P, K, Ca and micronutrients in organic manure. The high contents of these macro and micronutrients have the capacity to improve morphological characters and yield of cultivated crops. Organic manures also have strong tendency to neutralize soil acidity, raise soil buffering capacity and provide micronutrients such as Zn, B, Cu and Fe that can influence crop production positively. In the present work, the effect of organic manures like vermicompost, amirthakaraisal and AbdA gold were studied using *C.annum* as model plants. The vermicompost produced the highest germination percentage for *C.annum* compared to the other combinations. The vermicompost contains some micronutrients that stimulate plant growth. Organic manures like vermicompost, and amirthakaraisal increase the soil organic carbon. Greater number of root nodules in the plant grown in vermicompost treated pots might have fixed large amount of atmospheric nitrogen which maybe the reason for increased nitrogen content in soil. The factor attributed to decreased levels of available N, P, K and organic carbon in the control pots could be the nutrient hungry plants which would have used up all the nutrients in the soil [11].

Initially, the plants in the vermicompost treated pots were the healthiest. The shoots were longer and thicker. These plants recorded the maximum shoot length on 25 and 35 days after seeding. The AbdAgold contained nutrients like S, M, and Zn which might have enhanced the shoot growth. Eventually with the application of amirthakaraisal, on 25 and 35 days after seeding, there is a significant increase in the height of the plant when compared with AbdAgold in both plants. Khatik [12], reported the integrated use of organic manures and inorganic fertilizers recording increased quality and nutrient uptakly of chilly. The highest dry weight is found in T5, which had the combined effect of vermicompost and AbdAgold. The application of amirthakaraisal alone records the second highest root length in *C. annum* and the least in the control. Sumabai [13] reported dry matter production comparatively being higher in all the pots with respect to control. Vermicompost could have stimulated the activity of humic acid enzyme. This is turn could have accelerated the protein content resulting in increased dry matter production. Amirthakaraisal and AbdAgold mixed treatment recorded the highest chlorophyll content in *C. annum*. This may be due to the presence of micronutrients which enhanced the chlorophyll content in *C. annum*.

The nutrients triggered the growth through enzymes and growth promoters. The combination of all manures similarly increased the chlorophyll content 45 DAS. The protein content was higher in the treatment of amirthakaraisal (T4). Protein is one of the essential food constituents taken by up plants for the growth of their seedlings. The highest protein content was recorded in amirthakaraisal treatment pot. The lower value was in the AbdA gold treatment (T3). Thus, the organic manures like vermicompost, amirthakaraisal and AbdAgold when used as components in various strategies, showed promising results in *Capsicum annum*. It has also been found that vermicompost treatment gives enhanced growth in combination with amirthakaraisal and AbdAgold.

5. Conclusion

Application of vermicompost and Amirthakaraisal in the field enhances germination percentage in *C. annum.* Vermicompost, and Amirthakaraisal enhanced the root length, shoot length, and wet weight in *C. annum.* Application of amirthakaraisal has a very good effect on the chlorophyll content leading to enhanced photosynthesis and protein content in *C. annum*. This study shows that vermicompost and Amirthakaraisal are sustainably productive, economically cheap, environmentally safe and ecologically acceptable manures.

Table-1. Treatment types and details

Treatment	Details
T1	Vermicompost
T2	Amirthakaraisal
T3	AbdA gold
T4	Vermicompost + Amirthakaraisal
T5	Vermicompost + AbdA gold
T6	Amirthakaraisal + AbdA gold
T7	Vermicompost +Amirthakaraisal+ AbdA gold
T8	Control

Table-2. Chemical characteristic of soil used in the study

Parameter (unit)	value	Interpretation
Moisture content (%)	1.35	-
pH	5.57	Acidic
Electrical conductivity (ds/m)	0.30	Harmless
Nitrogen (mg/kg)	476	High
Phosphorus (mg/kg)	50	High
Potassium (mg/kg)	518	High
Organic Carbon (g/kg)	5.14	Medium
Exchangeable Calcium (meq/100g)	3.50	-
Exchangeable Magnesium (meq/100g)	1.50	-
Exchangeable Sodium (meq/100g)	1.25	-
Exchangeable Potassium (meq/100g)	0.81	-

Table-3. Chemical characteristics of Vermicompost

Parameter (unit)	Value
pH	7- 8.2
Organic carbon (%)	17.98
Nitrogen (%)	1.50
Phosphorus (%)	0.30
Potassium (%)	0.56
Sodium (%)	0.30
Calcium and magnesium (meq/100mg)	22.67
Copper (mg/kg)	9.50
Iron (mg/kg)	9.30
Zinc (mg/kg)	5.70
Sulphur (mg/kg)	128

Table-4. Chemical characteristics of Amirthakaraisal

Parameter (unit)	Value
Total Nitrogen (mg /kg)	273
Total Phosphorus (mg /kg)	281
Total Potassium (mg /kg)	317
Total sugars (mg /kg)	195
Sodium (mg /kg)	75
Calcium (mg /kg)	27
Total organic carbon (%)	0.68
Indole Acetic Acid (mg/ kg)	9.56
Gallic acid(mg/ kg)	4.0
Phenols (µg/ml)	0.71
pH	5.6
Electrical Conductivity (ds/m)	10.30

Table-5. Chemical characteristic of AbdA gold

Parameters (unit)	Value
Protein (%)	30
Fat (%)	2
Carbohydrate (%)	75
Calcium (ppm)	7896
Iron (ppm)	332
Iodine (ppm)	532
Magnesium (%)	0.5
Manganese (ppm)	155
Sodium (%)	4
Zinc (ppm)	2
Phosphorus (%)	0.9
Sulphur (%)	0.43

Table-6. Two way analysis of variance (ANOVA): Variation due to treatment types and treatment period for the various factors of *Capsicum annum*

S. no	Factor	Source of variation	SS	df	MSS	Calculated F value	Table F value at 5% level	Level of significance
1.	Germination percentage	Treatment type	794.0196	7	113.4314	2.142137	2.764199	NS
		Treatment period	255.3325	3	127.6663	2.410961	3.738892	NS
2.	Root length	Treatment type	11.24219	7	1.606027	25.56859	2.487578	S
		Treatment period	85.26844	3	28.42281	452.5025	3.072467	S
3.	Shoot length	Treatment type	68.87875	7	9.839821	7.474296	2.487578	S
		Treatment period	2621.454	3	873.8179	663.7492	3.072467	S
4.	Wet weight	Treatment type	5.25	7	0.75	5.343511	2.487578	S
		Treatment period	631.8625	3	210.6208	1500.606	3.072467	S
5.	Dry weight	Treatment type	0.028047	7	0.004007	1.320047	2.487578	NS
		Treatment period	18.29078	3	6.096928	2008.695	3.072467	S
6.	Chlorophyll A	Treatment type	0.881088	7	0.12587	2.365045	2.487578	NS
		Treatment period	8.428063	3	2.809354	52.78674	3.072467	S
7.	Chlorophyll B	Treatment type	0.428222	7	0.061175	1.149907	2.487578	NS
		Treatment period	0.554934	3	0.184978	3.477062	3.072467	S
8.	Total chlorophyll	Treatment type	342.4887	7	48.92696	2.466286	2.487578	NS
		Treatment period	3473.171	3	1157.724	58.35797	3.072467	S

S-significant, NS-Not significant

Fig-1. Effect of various treatments on the seed germination (%) of *Capsicum annum*

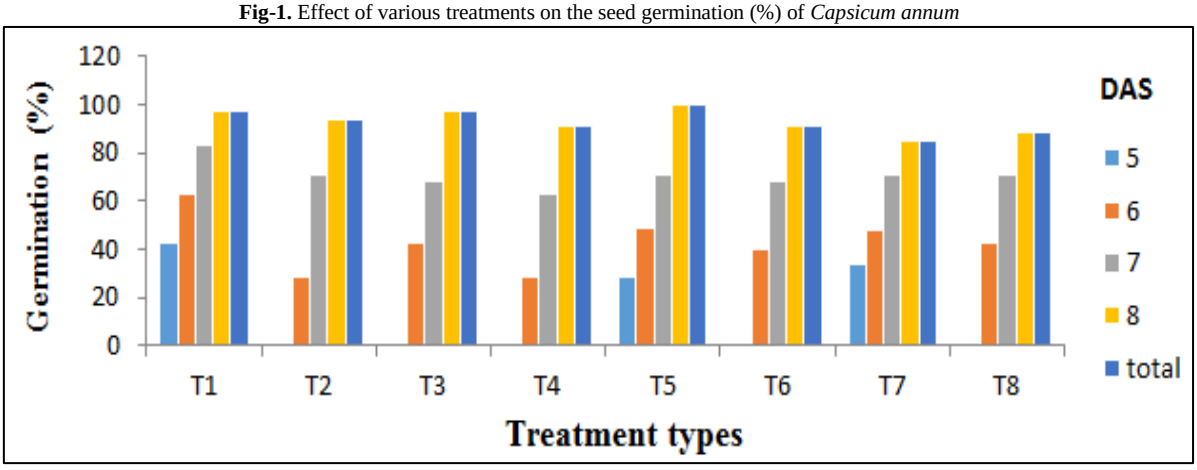


Fig-2. Effect of various treatments on the root length of *Capsicum annum*

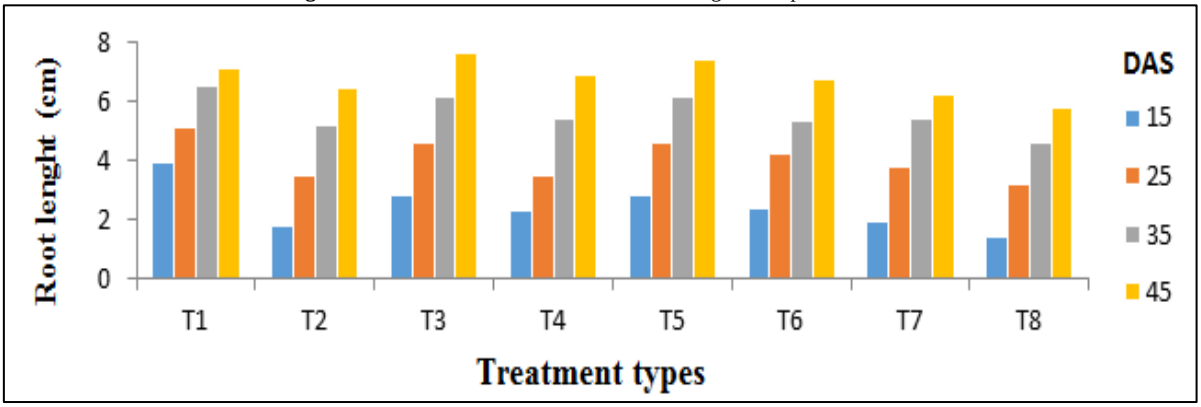


Fig-3. Effect of various treatments on the shoot length of *Capsicum annum*

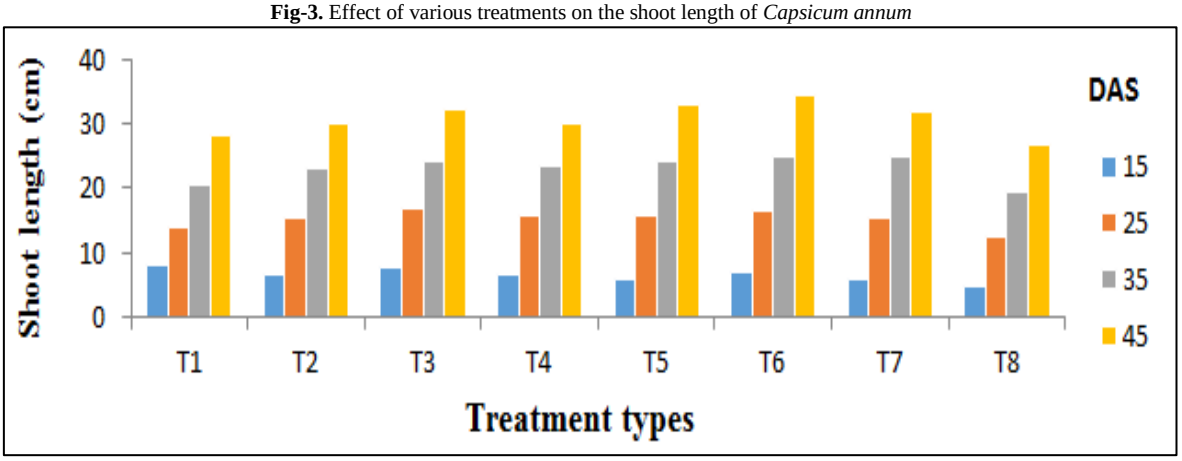


Fig-4. Effect of various treatments on the wet weight of *Capsicum annum*

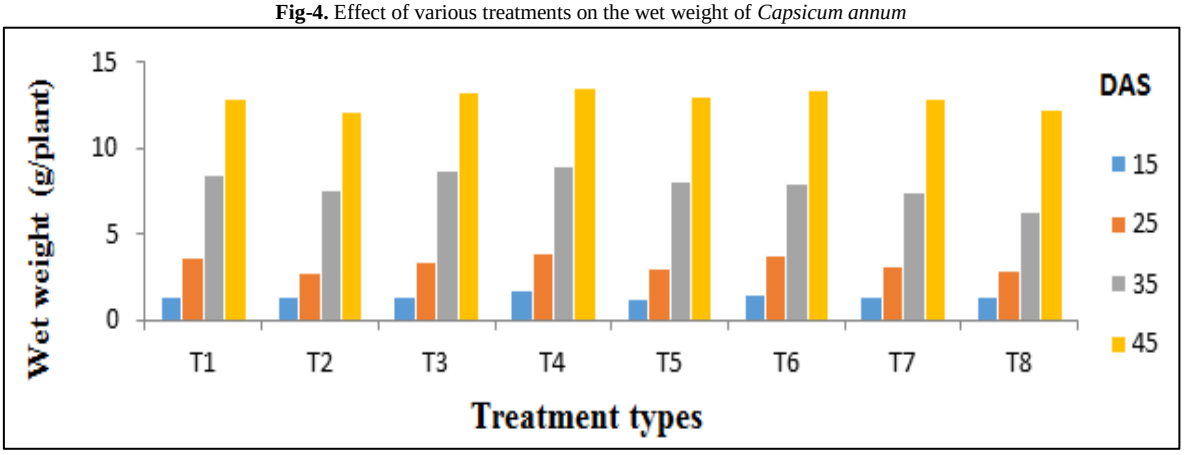


Fig-5. Effect of various treatments on the dry weight of *Capsicum annum*

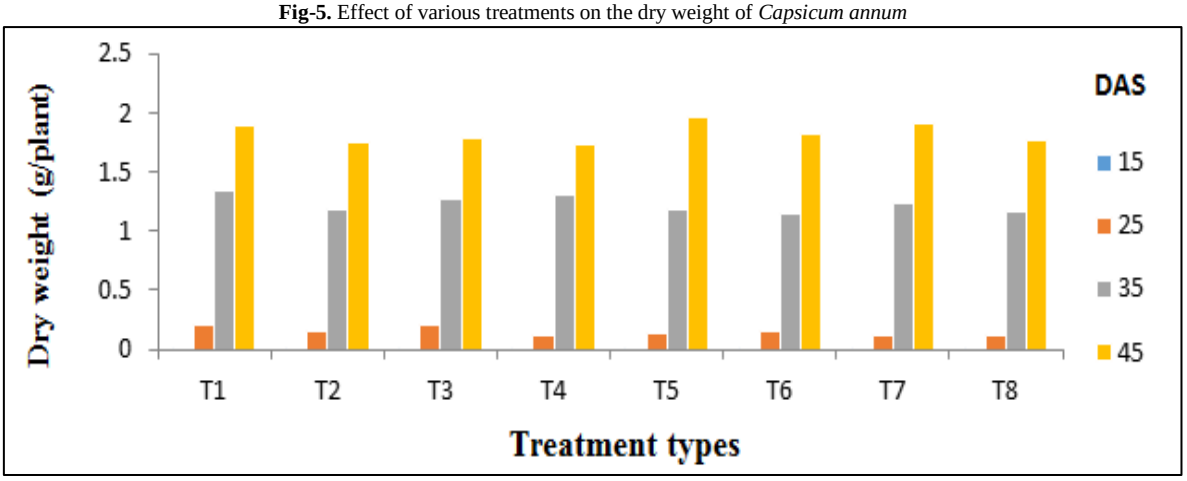


Fig-6. Effect of various treatments on the chlorophyll A content of the leaves of *Capsicum annum*

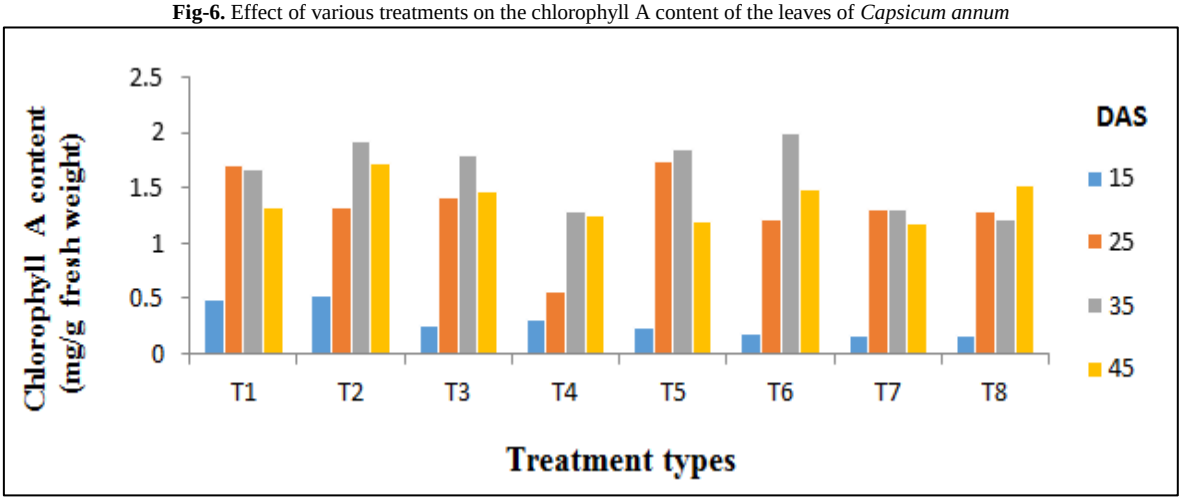


Fig-7. Effect of various treatments on the chlorophyll B content of the leaves of *Capsicum annum*

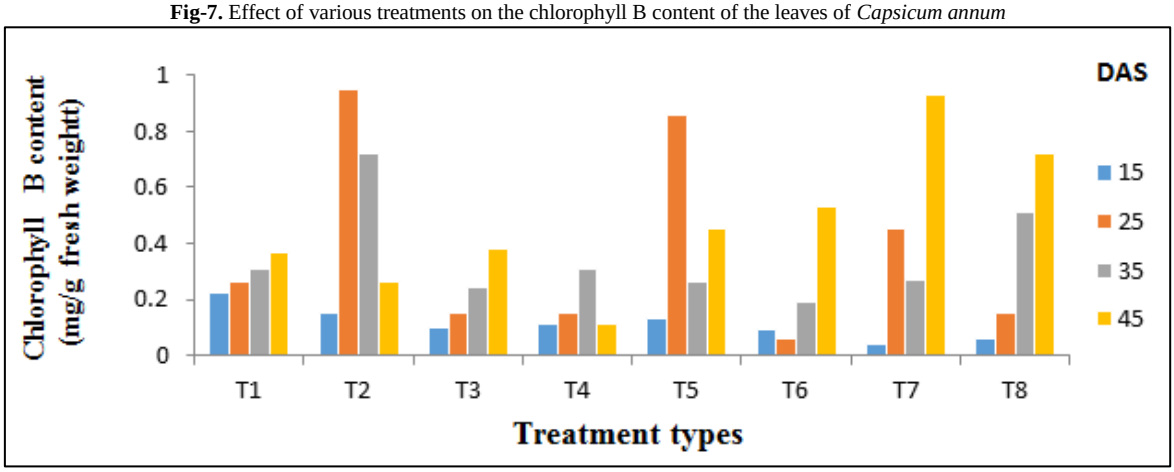


Fig-8. Effect of various treatments on the total chlorophyll content of the leaves of *Capsicum annum*

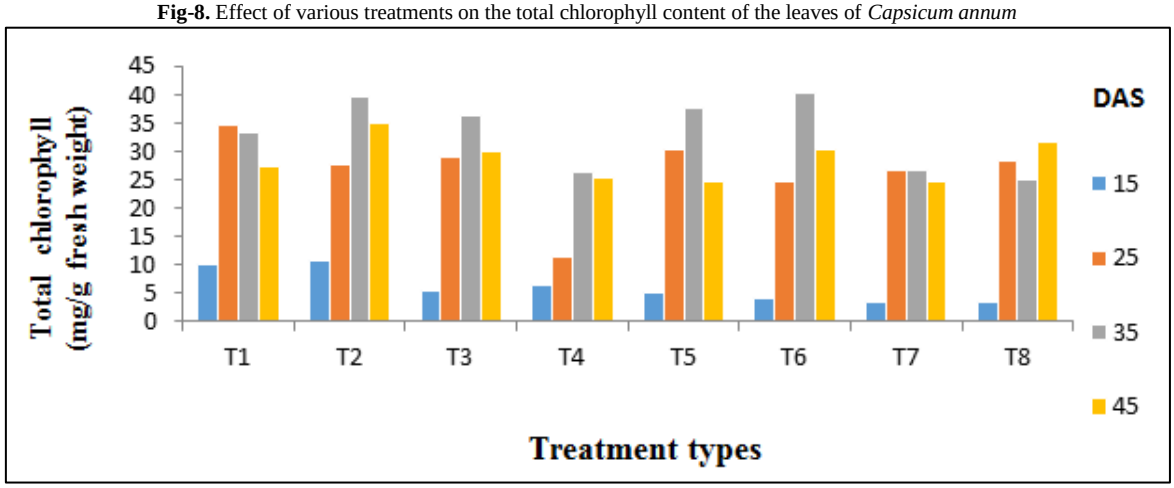
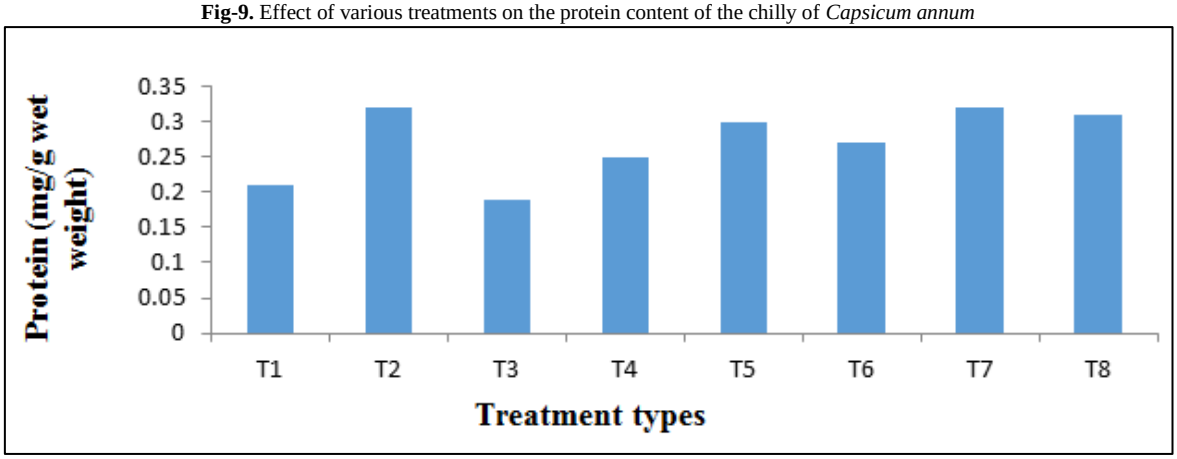


Fig-9. Effect of various treatments on the protein content of the chilly of *Capsicum annum*



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