

ORIGINAL ARTICLE

Expression of Growth, Yield, Quality and Economic traits in Radish (*Raphanus sativus* L.) Grown through Organic Fertilizer Intervention in Dehradun Valley of Uttarakhand

Deepanshi Singh<sup>1\*</sup>, Suneeta Singh<sup>2</sup> and Anil Kumar Saxena<sup>3</sup>

<sup>1\*</sup>Research scholar, Department of Horticulture, School of Agricultural Sciences, SGRR University, Dehradun- 248001, Uttarakhand, INDIA

<sup>2</sup>Associate Professor & Head, Department of Horticulture, School of Agricultural Sciences, SGRR University, Dehradun- 248001, Uttarakhand, INDIA

<sup>3</sup>Associate Professor & Head, Department of soil Science, School of Agricultural Sciences, SGRR University, Dehradun- 248001, Uttarakhand, INDIA

\*Email of corresponding author: deepanshisingshsln145@gmail.com

ABSTRACT

The investigation was conducted during rabi season of 2021-22 at Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand. To find out the "Expression of Growth, Yield, Quality and Economic Traits in Radish (*Raphanus sativus* L.) Grown through Organic Fertilizer Intervention in Dehradun Valley of Uttarakhand". The experiment was laid out in randomized block design with three replications and nine treatments. The treatments comprised following levels of different organic manures with different concentrations viz. T1 (Control), T2 (FYM @10 t/ha), T3 (Vermicompost @5 t/ha), T4 (Vermiwash@50%), T5 (cow urine@50%), T6 (Rhizobium @500ml/ha), T7 (FYM@5t/ha + VC@2.5t/ha), T8(FYM @5t/ha +VC @2.5t/ha +Vermiwash @25%) T9 (FYM @5t/ha + VC @2.5t/ha +Vermiwash@25%+ Cow urine@25%) and T10 (FYM@5t/ha + VC @2.5t/ha +Vermiwash@25%+ Cow urine@25% +Rhizobium @250 ml/ha). The sowing of crop variety F1 hybrid Korean Cross, was done on November 15, 2021. Observations on various growth, yield and quality traits were recorded at 30, 60 DAS and at final harvest stage. The result revealed that treatment T10 recorded the maximum plant height (45.56 cm), number of leaves/plants (22.01 cm), leaf length (26.82 cm), root length (35.48 cm), root diameter (7.86 cm), total dry weight of the plant (6.77 g), total fresh weight of leaves (54.49 g), total dry weight of leaves (6.77 g), root weight (132.67 g), root yield (1.95 Kg/plot) and root yield (195.33q/ha). Whereas, treatment T9 (FYM @5t/ha + VC @2.5t/ha +Vermiwash @25%+ Cow urine @25%) recorded maximum total fresh weight of the plant (123.82 g) and T4 (Vermiwash@50%) recorded maximum (9.45cm). The TSS was recorded highest (4.74 °Brix) in T2 (FYM @10 t/ha). However maximum net return (Rs. 4,75,218) and B:C ratio (1:17.44) were recorded in T6 (Rhizobium @500ml/ha).

**Keyword:** Organic manure, cow urine, vermicompost, Rhizobium, FYM, TSS, net return

Received 24.09.2023

Revised 01.10.2023

Accepted 11.12.2023

**How to cite this article:**

Deepanshi S, Suneeta S and Anil K S. Expression of Growth, Yield, Quality and Economic traits in Radish (*Raphanus sativus* L.) Grown through Organic Fertilizer Intervention in Dehradun Valley of Uttarakhand. Adv. Biores., Vol 15 (1) January 2024: 193-206.

**INTRODUCTION**

Radish (*Raphanus sativus* L.) is an annual vegetable plant. The name of radish taken from the Latin word, radix that means "root" and specially radish root. It has somatic chromosome number is  $2n=2x=18$ . And the genus name, *Raphanus*, is a Latinized form of a Greek expression raphanos which means "easily reared". The characteristics pungent flavour of radish due to the presence of volatile isothiocyanates, and red colour is due to *anthocyanin* pigment. India, Central China, and Central Asia appear to have been secondary centres where differing forms were developed Greek and. The radish was one of the first European crops introduced to the Americas. In India radish is grow in all states. In India the highest production of radish; Haryana, West Bengal, Punjab, Assam, Chhattisgarh, Bihar Madhya Pradesh, Uttar Pradesh, Orissa, Tamil Nadu [1]. The growth and yield of radish depend on the soil and climatic

conditions. India is a wide country with diverse agro- climatic regions, e.g., temperate, tropical, subtropical, and coastal tropical, humid regions, a single variety may not be suitable for all the agro- climatic regions. Use of such organic materials, which are being wasted in large amounts without proper use can help in reducing cost of cultivation, increasing productivity and improving soil as well as human and livestock health. The edible portion of radish root develops from both primary root and the hypocotyl [2]. In Ayurveda and traditional Chinese medicine, Application of FYM into soil increases organic carbon stock. Soil Organic Matter (SOM) has a large number of exchange sites that ultimately result in higher cation exchange capacity. Vermicompost contains plant growth regulators and other plant growth influencing materials created by microorganisms as well as humates, cytokinin's and auxins. The physico-chemical and biological property of soil of compost improves soil physical properties by declining bulk density and increasing the soil water holding capacity [3]. Vermiwash is an organic drainage obtained from units of vermicompost. The water that passes through the vermiculture, resulting in washing of the live and dead earthworm, soil microorganisms and decomposed organic matter, carries all the dissolved substances. Vermiwash and vermicompost in the hydroponic system had higher productivity than the one produced by commercial hydroponic solution [4]. Use of fermented cow urine enhances the soil fertility and it can also be turned into liquid fertilizer as pesticide for crops. Liquid manure from cow urine is easy to make and is good for Plants in comparison to artificial fertilizer [5]. Rhizobium (Bio fertilizers) are the products with living cells containing distinct microorganisms in it which applied to the seeds, soil, interior of the plant and further help to promote the growth of the plant by converting nutritionally important elements such as nitrogen and phosphorus from unavailable to available form with help of process called as nitrogen fixation. Bio fertilizers are a great alternative which are based on organic fertilizers [6]. Therefore, this study was aimed to show the expression of growth, yield, quality and economics of radish grown through organic fertilizer intervention in Dehradun Valley of Uttarakhand.

## MATERIAL AND METHODS

The experiment was conducted at Horticulture Research Block, School of Agricultural Sciences, Shri Guru Ram Rai University, Pathri Bagh, Dehradun, Uttarakhand during the rabi season of 2021-2022. The experiment was laid out in Randomized Block Design with three replications. Each replication consisted of nine treatments. All the treatment were randomized separately in each other replication. T1 (Control), T2 (FYM @10 t/ha), T3 (Vermicompost @5 t/ha), T4 (Vermiwash@50%), T5 (cow urine@50%), T6 (Rhizobium @500ml/ha), T7 (FYM@5t/ha + VC@2.5t/ha), T8(FYM @5t/ha +VC @2.5t/ha +Vermiwash @25%) T9 (FYM @5t/ha + VC @2.5t/ha +Vermiwash@25%+ Cow urine@25%) and T10 (FYM@5t/ha + VC @2.5t/ha +Vermiwash@25%+ Cow urine@25% +Rhizobium @250 ml/ha). The radish cultivar Korean Cross was taken for research purpose. The sowing was done on 15<sup>th</sup> November 2021 in plot size of 1m<sup>2</sup>. All the organic fertilizers i.e., FYM, vermicompost, Vermiwash, Rhizobium and cow urine were prepared and applied to the research plots according to the treatments. All the cultural practices were done at regular intervals as per the requirement of crop during the period of experiment. During the research trial, from each replication, randomly selected four plants were used for recording various observations on growth, and yield parameters during whole of the cropping period at 30, 60 days after sowing and at Final harvest stage. The economics of radish crop was calculated as per the fundamental market prices of the input and produced during the *rabi* season 2021. The obtained data were subjected to the statistical analysis by adopting analysis of variance technique as described by [7] for the Randomized Block Design (RBD).

**Table: 1 Treatment Details**

Treatment	Combinations
T1	Control (Soil)
T2	Vermicompost @5t/ha
T3	FYM@10t/ha
T4	Vermiwash@50%
T5	Cow urine@50%
T6	Rhizobium@500ml/ha
T7	VC @2.5t/ha + FYM @ 5t/ha
T8	VC @2.5t/ha +FYM @ 5t/ha + Vermiwash @25%
T9	VC @ 2.5t/ha +FYM @ 5t/ha +Vermiwash @25% +Cow urine @25%
T10	VC @2.5t/ha +FYM @ 5t/ha + Vermiwash @25% + Cow urine @25% + Rhizobium @250ml/ha

## RESULT AND DISCUSSION

The findings of the experiment regarding growth, yield, quality as well as economics have been categorically represented in Table 2,3,4,5 and 6 and are thoroughly discussed below:

### GROWTH PARAMETERS

#### Plant Height (cm)

Data pertaining to plant height was recorded at 30 DAS, 60 DAS and at final harvest stage were statistically analyzed and presented in table 2 and depicted in Fig.1. The observation of plants height was recorded at 30, 60 days after sowing and at final harvest and the results were significantly differs among the treatments. At 30 DAS, the plant height (15.78 cm) was recorded maximum in T<sub>10</sub>, which was at par with T<sub>9</sub> (14.41 cm). The treatments T<sub>1</sub> (11.21 cm), T<sub>5</sub> (11.61cm) and T<sub>4</sub>(11.86 cm) were also at par with each other. Whereas, the minimum plant height was recorded in T<sub>3</sub> (9.59 cm). At 60 DAS, the plant height (34.99 cm) was recorded maximum in T<sub>5</sub>, which was at par with each treatment T<sub>6</sub> (34.14 cm), T<sub>7</sub> (34.02 cm) and T<sub>10</sub> (34.13 cm). Whereas, the minimum plant height was recorded in T<sub>2</sub> (28.3 cm). At final harvest, the maximum plant height was recorded in T<sub>4</sub> (45.93 cm) which was at par with T<sub>6</sub> (45.68 cm). However significant difference was observed with treatments T<sub>10</sub> (45.56 cm), T<sub>3</sub> (42.88 cm), T<sub>9</sub> (43.66 cm), T<sub>8</sub> (35.92 cm) and T<sub>2</sub> (37.79 cm). While, the minimum plant height was recorded in T<sub>1</sub> (35.74 cm). The significant increase in plant height may be due to application of major and minor nutrients through different organic manure in various levels, which ultimately resulted into improving the plant height [8].

#### Number of Leaves per Plant (cm)

At 30 DAS, the highest value of number of leaves per plant was recorded in treatment T<sub>10</sub> (8.43cm) and the lowest value (5.56cm) in the treatment T<sub>1</sub> i.e. control. At 60 DAS, the maximum number of leaves per plant was recorded in treatments T<sub>9</sub> (22.07cm), which was at par with the treatments T<sub>10</sub> (21.53cm) and T<sub>8</sub> (20.17 cm). The significant difference was observed with treatment T<sub>1</sub> (17.73 cm), T<sub>4</sub> (19.57 cm), T<sub>3</sub> (17.53cm) and T<sub>6</sub> (18.13 cm). However, the minimum number of leaves per plant (16.50) was recorded under the treatment T<sub>2</sub>. Whereas, at final harvest, the number of leaves per plant was recorded maximum in T<sub>10</sub> (22.0 cm) which was at par with T<sub>9</sub> (21.80 cm). However significant difference was observed with treatment T<sub>3</sub>(17.60 cm), T<sub>7</sub>(19.76 cm), T<sub>8</sub>(20.76 cm), T<sub>6</sub>(19.80cm), T<sub>4</sub>(18.85cm) and T<sub>1</sub>(18.03 cm) while minimum number of leaves per plant was recorded in the treatment T<sub>2</sub> (16.13 cm).The probable reasons for greater number of leaves per plant of radish may be due to application of major and minor nutrients, through different organic manures in various levels, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately increases the number of leaves per plant. The findings are also in agreement with the findings of [9].

#### Leaf Length (cm)

At 30 DAS, the maximum leaf length was recorded in the treatment T<sub>10</sub> (8.92 cm) and the minimum (7.1 cm) in treatment T<sub>3</sub>. At 60 DAS, the maximum number of leaf length was recorded in treatment T<sub>4</sub> (23.89 cm). It was also reported that treatment T<sub>5</sub> (21.21 cm), T<sub>6</sub> (21.32 cm), T<sub>7</sub> (21.26 cm), T<sub>8</sub> (21.75 cm) and T<sub>9</sub> (21.53 cm) were at par with each other. However, the minimum leaf length (18.16 cm) was recorded under the treatment T<sub>1</sub>. Whereas, at final harvest, the leaf length was maximum in T<sub>10</sub> (26.82 cm) which was at par with T<sub>4</sub> (26.44 cm), T<sub>6</sub> (25.68 cm), T<sub>3</sub> (25.38 cm) and T<sub>7</sub> (25.13 cm). While minimum leaf length was recorded in the treatment T<sub>2</sub> (19.34 cm).The findings are also in agreement with the findings of [10].

#### Leaf Width (cm)

The leaf width on 30 days after sowing differs significantly and was ranging from 3.7 to 4.85 cm. The maximum leaf width was recorded in T<sub>6</sub> (4.85 cm) which was statistically at par with each other's T<sub>5</sub> (4.66 cm), T<sub>4</sub> (4.53 cm), T<sub>2</sub> (4.01 cm), T<sub>6</sub> (4.85 cm), T<sub>7</sub> (4.37 cm), T<sub>8</sub> (4.3 cm) and T<sub>10</sub> (4.11 cm) and minimum leaf width was recorded in the treatment T<sub>1</sub> (3.9 cm) at #0 DAS. Whereas, at 60 DAS the maximum leaf width was recorded in T<sub>4</sub> (10.81 cm) which was at par with treatment T<sub>6</sub> (10.02 cm) and minimum was recorded in the treatment T<sub>9</sub>(7.71cm). However, at final harvest, the data showed that leaf width of different treatment ranged from 8.7 cm to 13.02 cm. The maximum leaf width was recorded in T<sub>4</sub> (13.02 cm) which was found at par with treatment T<sub>1</sub> (12.3 cm) and minimum leaf width was recorded in the treatment T<sub>9</sub> (8.7 cm). Similar results are also observed by [11].

### YIELD PARAMETERS

#### Root Length (cm)

The maximum root length (35.48 cm) was recorded in treatment T<sub>10</sub> with the application of VC @2.5t/ha +FYM @5t/ha+ Vermiwash @25%+ Cow urine@25% + Rhizobium @250ml/ha. Whereas, minimum root length (28.86cm) was recorded in T<sub>3</sub> with FYM@10t/ha. The significantly highest root length might be due to beneficial effect of organic nutrient sources particularly vermicompost that improves the soil

structure as well as soil quality which might have resulted in increase in root length. The findings are in confirmation with the results of [12].

#### **Root Diameter (cm)**

The widest root diameter (7.86cm) was recorded in T10 with VC@2.5t/ha + FYM @ 5t/ha + Vermiwash @25% + cow urine@25% + Rhizobium @ 250 ml/ha which was significantly superior to all other treatments. Whereas thinnest root diameter was recorded in treatment with FYM @ 10t/ha T3 (5.13 cm). The decrease in bulk density and increase in porosity and water holdings capacity of the soil due to organic nutrient sources might have contributed in increasing root diameter of the plants. The findings are comparable with [13] in radish.

#### **Total Fresh Weight of Plant (cm)**

The highest total fresh weight of plant (267.69 g) was recorded in T7 with VC @ 2.5 t/ha +FYM @5 t/ha which was at par with T10 (262.81g) which was significantly superior to all other treatments. Whereas, the lowest total fresh weight of plant was recorded in Vermiwash @50% i.e.T4 (183.65g). The results show significant differences between the treatments. Similar findings are also reported by [14].

#### **Total Fresh Weight of Leaves per Plant (g)**

The maximum total fresh weight of leaves per plant (54.69 g) was recorded in T10 with VC @2.5t/ha + FYM@5t/ha + Vermiwash @25% + cow urine@ 25% + Rhizobium @250ml/ha which was significantly superior to all other treatments. However, the lowest total fresh weight of leaves (29.87 g) was recorded in VC@50% i.e.T2. This increase in total fresh weight of leaves might be due to the excellence of high level of nutrients in organic manures which was producing good growth of radish plants. The findings are in parallel with [15].

#### **Total Dry Weight of Leaves per Plant (g)**

The highest total dry weight of leaves per plant (6.77 g) was recorded in T10 with VC @2.5t/ha + FYM@5t/ha + Vermiwash @25% + cow urine@ 25% + Rhizobium @250ml/ha which was significantly superior to all other treatments. Whereas, the lowest total dry weight of leaves was recorded in T1(2.47 g). The findings are in similar with [16].

#### **Total Fresh Weight of Root (g)**

Total fresh weight of root (246.4 g) was recorded maximum in T10 (VC @2.5t/ha + FYM@5t/ha + Vermiwash @25% + cow urine@ 25% + Rhizobium @250ml/ha) and lowest total fresh weight of root (167.56 g) was recorded in T4. This might be due to the organic manures which play direct role in plant growth as a source of all necessary macro and micro – nutrients in available forms during root growth also [17].

#### **Total Dry Weight of Root (g)**

The highest total dry weight of root (5.46 g) was recorded in T10 (VC @2.5t/ha + FYM@5t/ha + Vermiwash @25% + cow urine@ 25% + Rhizobium @250ml/ha) which was significantly superior to all other treatments. Whereas, the lowest dry weight of root (3.32 g) was found in T1. The findings are in alike [18].

#### **Root Yield (kg/plot and q/ha)**

The maximum root yield (1.95 kg/plot) was recorded in T10 (VC @2.5t/ha + FYM@5t/ha + Vermiwash @25% + cow urine@ 25% + Rhizobium @250ml/ha) and lowest (0.89 kg/plot) in T1 i.e. control. Whereas, the maximum root yield (195.33 q/ha) was recorded in treatment T10 with VC @ 2.5t/ha + FYM @ 5t/ha +Vermiwash@25% + cow urine@25% + Rhizobium @ 250 ml/ha which was significantly superior to all other treatments. The lowest root yield per hectare was recorded in control T1 i.e. (89.66 q/ha). Similar results were also reported by [19].

### **QUALITY PARAMETER**

#### **Total Soluble Solids (<sup>o</sup>Brix)**

The maximum TSS content of (4.74 <sup>o</sup>Brix) was recorded in treatment T2 which was at par with T6 (4.73) and T4 (4.70) which were significantly superior to all the other treatments. However, the lowest TSS content of (3.51 <sup>o</sup>Brix) was recorded in T10 with + VC @ 2.5t/ha + FYM @ 5t/ha + Vermiwash @25% + cow urine @25% + Rhizobium @250 ml/ha. This might be due to accumulation of more reserve substances in radish. The similar findings have been also reported by [20] in radish.

#### **Economics**

The economics of all the treatments were given in table 4. The net profit per hectare ranges from Rs. 1,34,528 to 4,75,218. The maximum net profit per hectare was recorded under the treatment T<sub>6</sub> (4,75,218). While minimum net profit per hectare was obtained in the treatment T<sub>4</sub> (Rs.1,34,528). The benefit cost ratio ranged from 1:1.58 to 1:17.44 depending on different treatments. It was found to be

highest (1:17.44) under the treatments T<sub>6</sub> Rhizobium@500ml/ha and lowest (1:1.58) under the treatment T<sub>4</sub>(Vermiwash @50%).

**Table.2: Effect of multiple organic manures on growth parameters of radish at different harvesting stages**

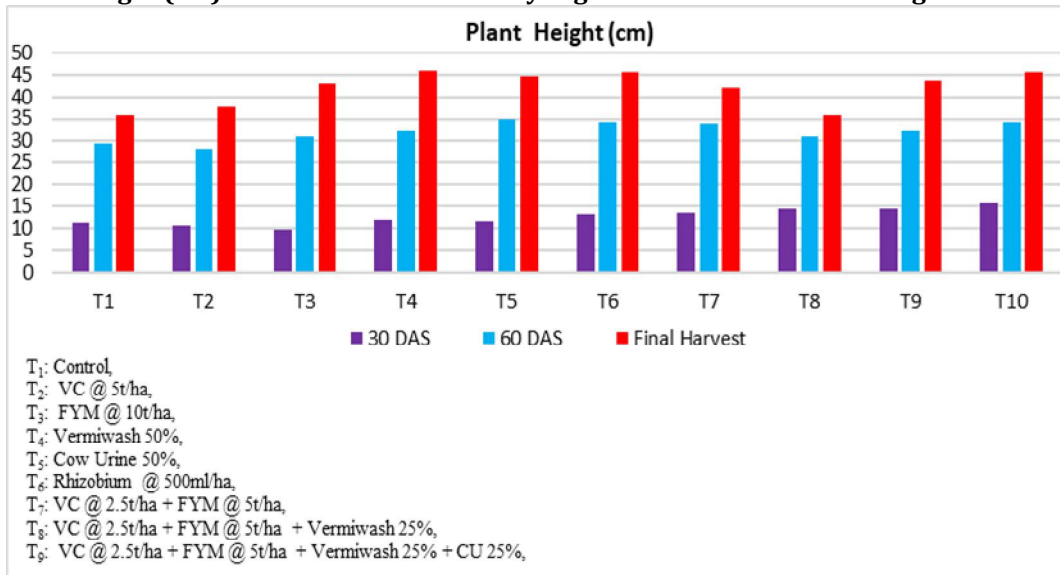
Treatment	Plant height (cm)			Number of leaves			Leaf length (cm)			Leaf width (cm)		
	30 DAS	60 DAS	At Final Harvest	Mean	30 DAS	60 DAS	At Final Harvest	Mean	30 DAS	60 DAS	At Final Harvest	Mean
T <sub>1</sub>	11.21	29.56	35.74	25.50	5.56	17.73	18.03	13.77	7.48	18.16	20.81	15.48
T <sub>2</sub>	10.67	28.3	37.79	25.58	6.00	16.50	16.13	12.87	7.24	18.82	19.34	15.13
T <sub>3</sub>	9.59	31.11	42.88	27.86	6.33	17.53	17.60	13.82	7.1	20.78	25.38	17.75
T <sub>4</sub>	11.86	32.3	45.93	30.03	6.50	19.57	18.85	14.97	8.92	23.89	26.44	19.75
T <sub>5</sub>	11.61	34.99	44.66	30.42	6.80	19.07	18.86	14.90	8.57	21.21	24.5	18.09
T <sub>6</sub>	13.16	34.14	45.68	30.99	6.93	18.13	19.80	14.95	8.34	21.32	25.68	18.44
T <sub>7</sub>	13.51	34.02	41.96	29.83	6.07	19.53	19.76	15.12	7.81	21.26	25.13	18.06
T <sub>8</sub>	14.49	31.01	35.92	27.34	7.00	20.17	20.76	15.97	7.73	21.75	22.46	17.31
T <sub>9</sub>	14.41	32.21	43.66	30.09	7.77	22.07	21.80	17.21	8.00	21.53	24.62	18.05
T <sub>10</sub>	15.78	34.13	45.56	31.82	8.43	21.53	22.0	17.32	8.52	22.45	26.82	19.27

**Table.3: Effect of multiple organic manures on yield and quality parameters of radish at final harvesting stage**

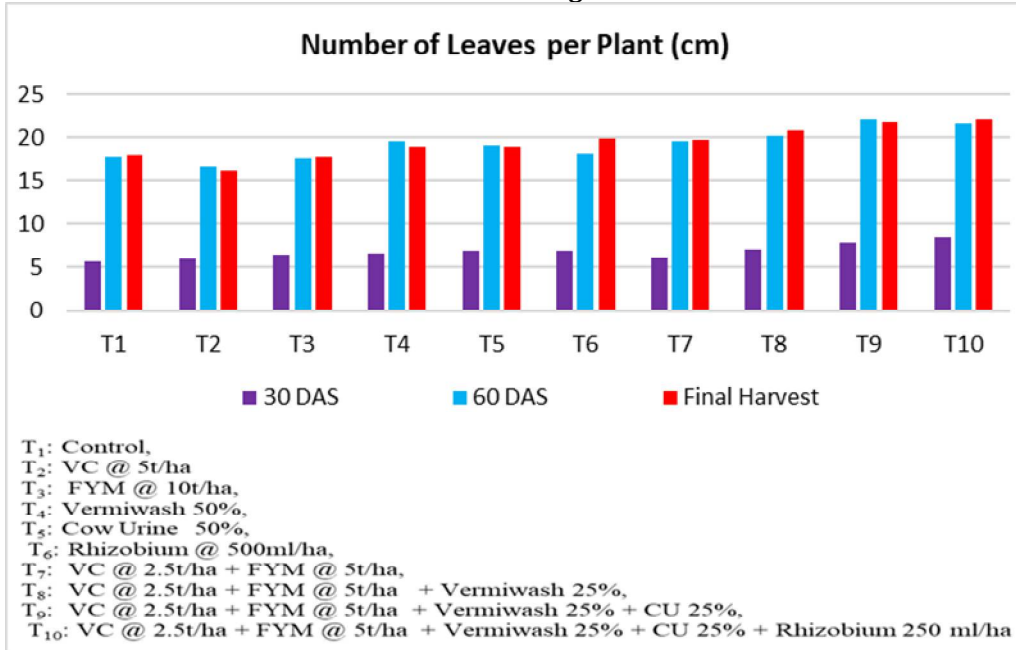
Treatment	Root length (cm)	Root Diameter (cm)	Total fresh weight of plant (g)	Total fresh weight of leaves per plant (g)	Total dry weight of leaves per plant (g)	Total Fresh root weight per plant (g)	Total dry root weight per plant (g)	Root yield (kg/ plot)	Root yield (q/ha)	Total soluble Solid (%Brix)
At Final Harvesting Stage										
T1	31.59	6.20	226.84	30.08	2.47	194.52	3.32	0.89	89.66	3.69
T2	29.47	6.40	196.66	29.87	2.50	198.60	3.43	0.91	91.00	4.74
T3	28.86	5.13	209.72	29.60	2.77	170.64	3.95	0.93	93.67	4.53
T4	33.09	5.69	183.65	33.00	2.75	167.56	4.15	0.95	95.67	4.70
T5	32.93	5.23	209.69	38.77	4.06	176.82	4.25	0.89	89.67	4.68
T6	32.28	5.53	213.66	39.96	5.67	200.82	4.70	1.32	132.67	4.73
T7	31.14	6.05	267.69	44.10	6.06	246.46	4.98	1.22	122.67	4.63
T8	31.19	5.90	229.86	46.33	5.41	192.89	4.36	1.09	109.33	4.67
T9	34.43	6.26	258.99	45.65	4.96	211.22	4.36	1.55	155.00	4.63
T10	35.48	7.86	262.81	54.49	6.77	235.85	5.46	1.95	195.33	3.51
C.D(5%)	1.81	0.78	38.05	3.50	0.36	26.39	0.27	0.20	20.13	N/A
SE(d)	0.60	0.26	12.71	1.17	0.12	8.81	0.09	0.09	9.51	0.09
SE(m)	0.85	0.37	17.91	1.65	0.17	12.46	0.13	0.06	6.72	0.12
C.V.	3.27	7.49	9.74	5.17	4.86	7.65	3.71	9.91	9.91	3.34

**Table.4: Effect of multiple organic manures on economics of radish**

Treatments	Net return (Rs/ha)	B:C ratio
T <sub>1</sub>	3,12,353	1:12.01
T <sub>2</sub>	2,90,695	1:6.27
T <sub>3</sub>	3,25,818	1:11.82
T <sub>4</sub>	1,34,528	1:1.58
T <sub>5</sub>	2,58,853	1:4.16
T <sub>6</sub>	4,75,218	1:17.44
T <sub>7</sub>	4,22,773	1:10.75
T <sub>8</sub>	1,71,494	1:1.70
T <sub>9</sub>	3,18,290	1:2.17
T <sub>10</sub>	4,71,277	1:2.73

**Fig.1: Plant height (cm) of radish as influenced by organic manure at various stages of harvesting**

**Fig.2: Number of leaves per plant of radish as influenced by organic manure at various stages of harvesting**



**Fig.3: Leaf Length (cm) of radish as influenced by organic manure at various stages of harvesting**

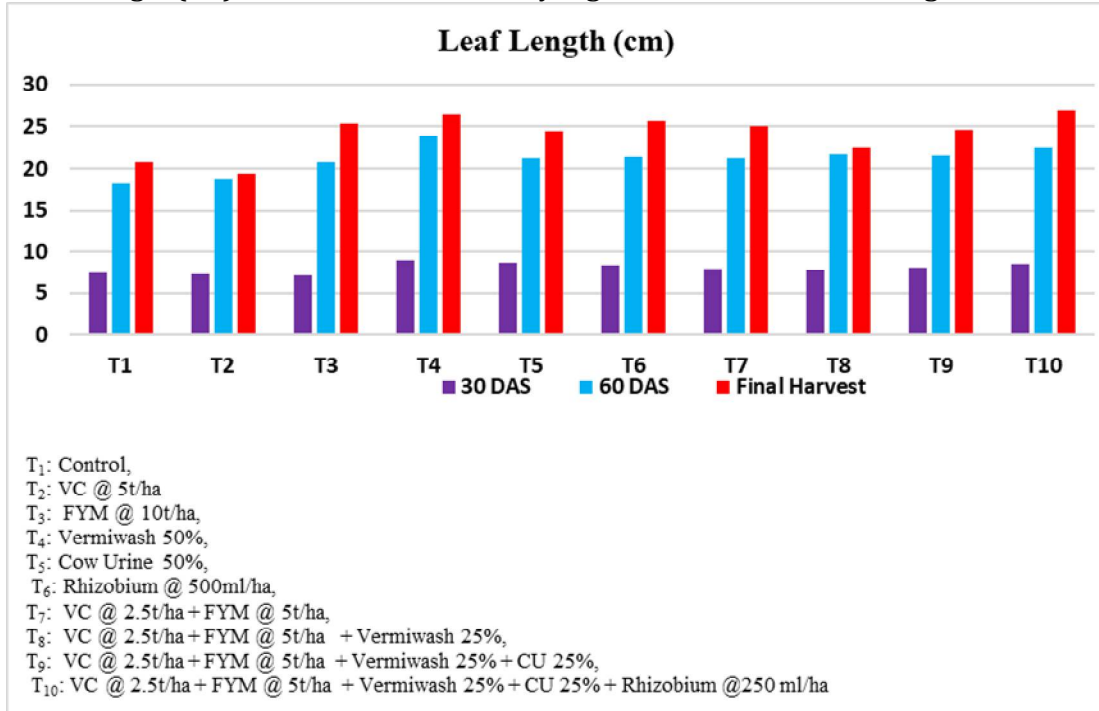


Fig: 4: Leaf Width (cm) of radish as influenced by organic manure at various stages of harvesting

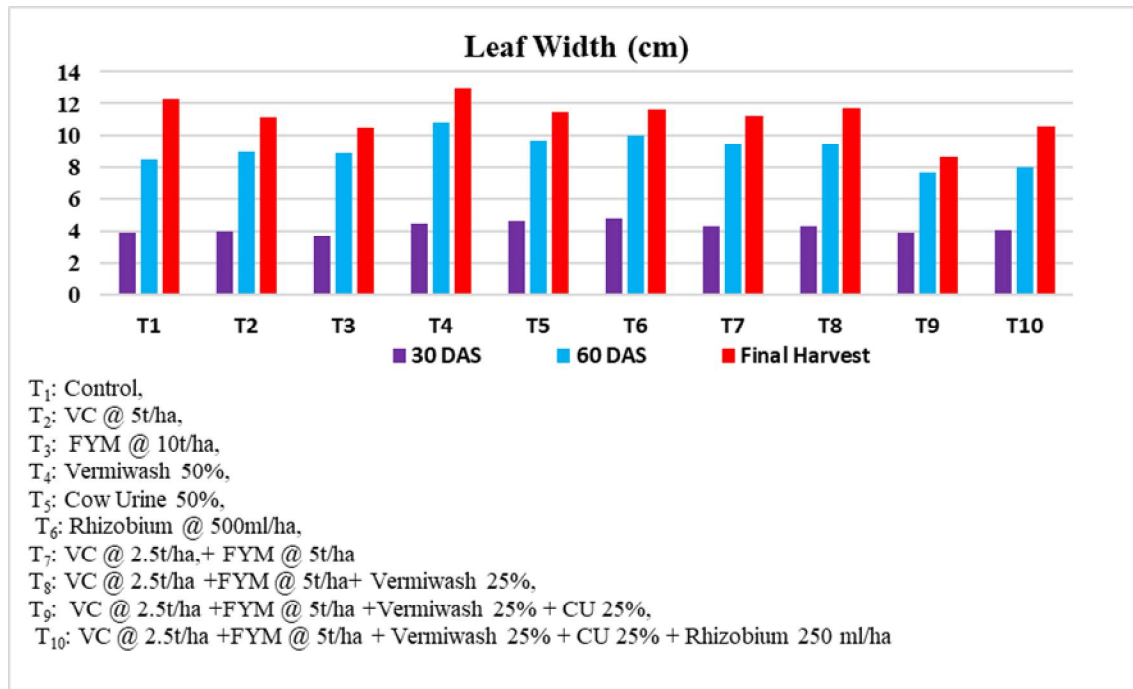
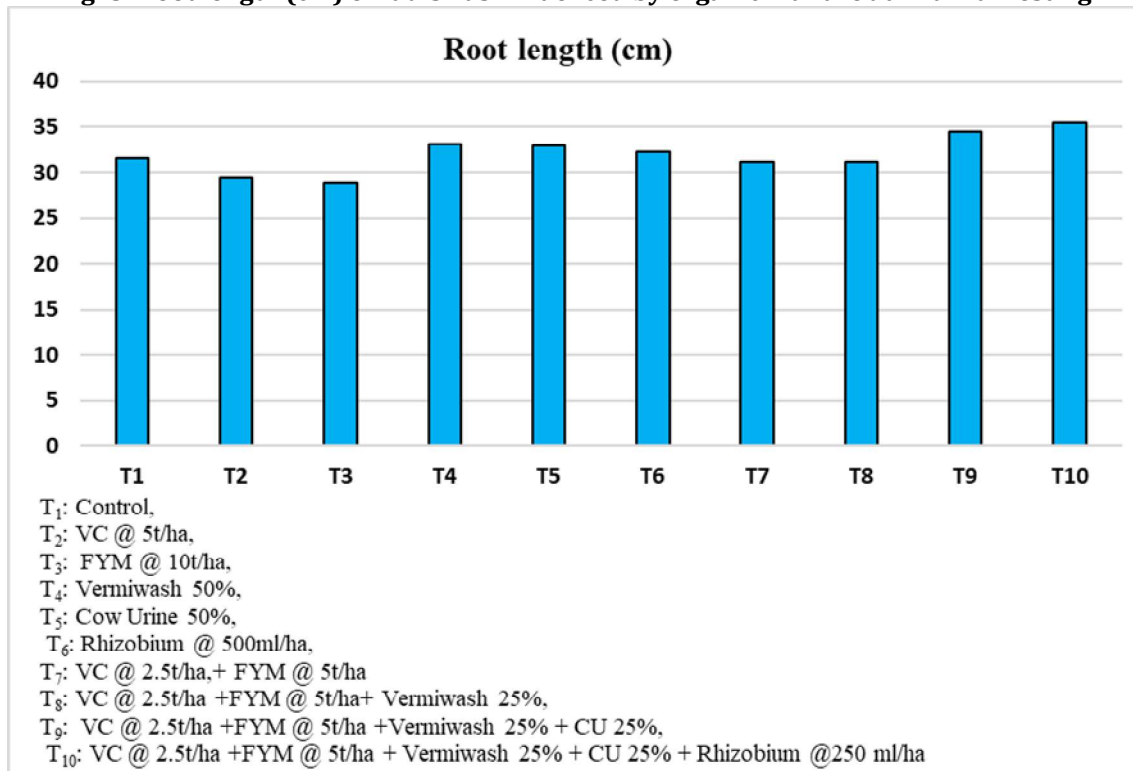
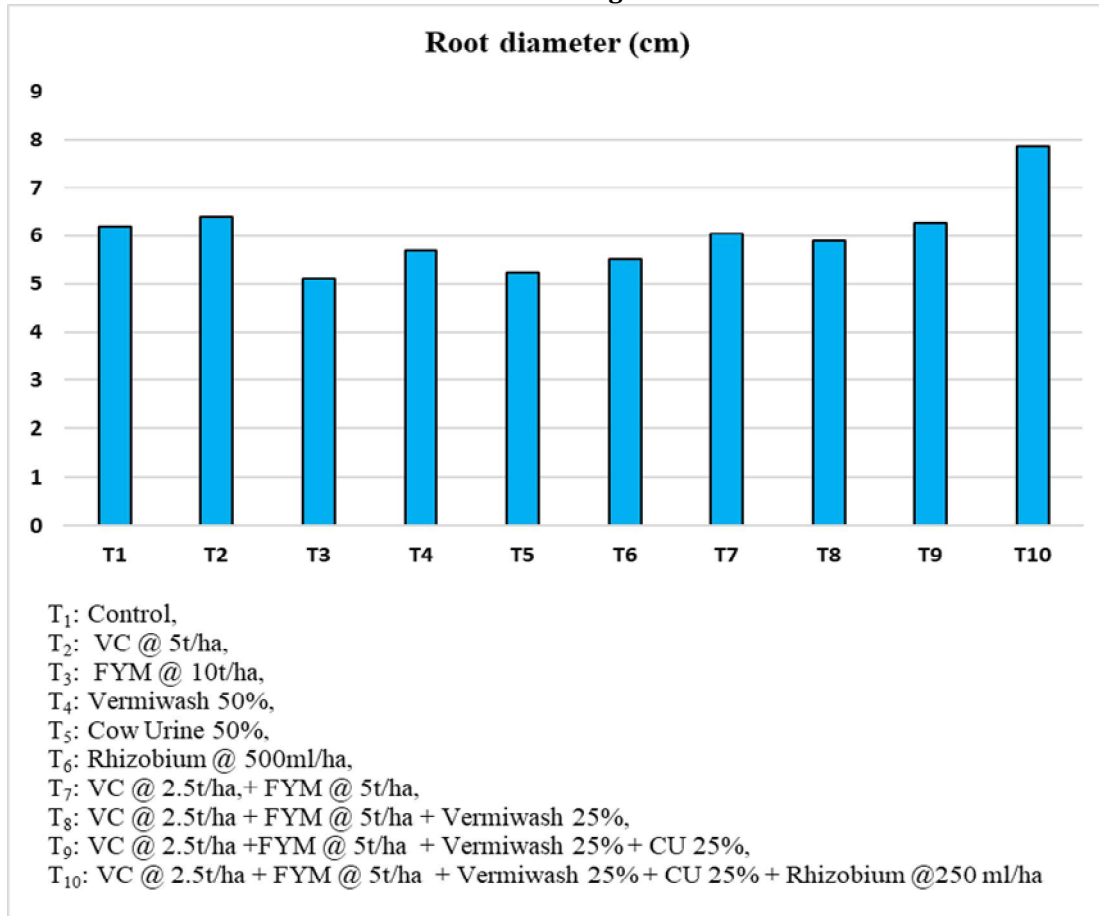


Fig: 5: Root length (cm) of radish as influenced by organic manure at final harvesting

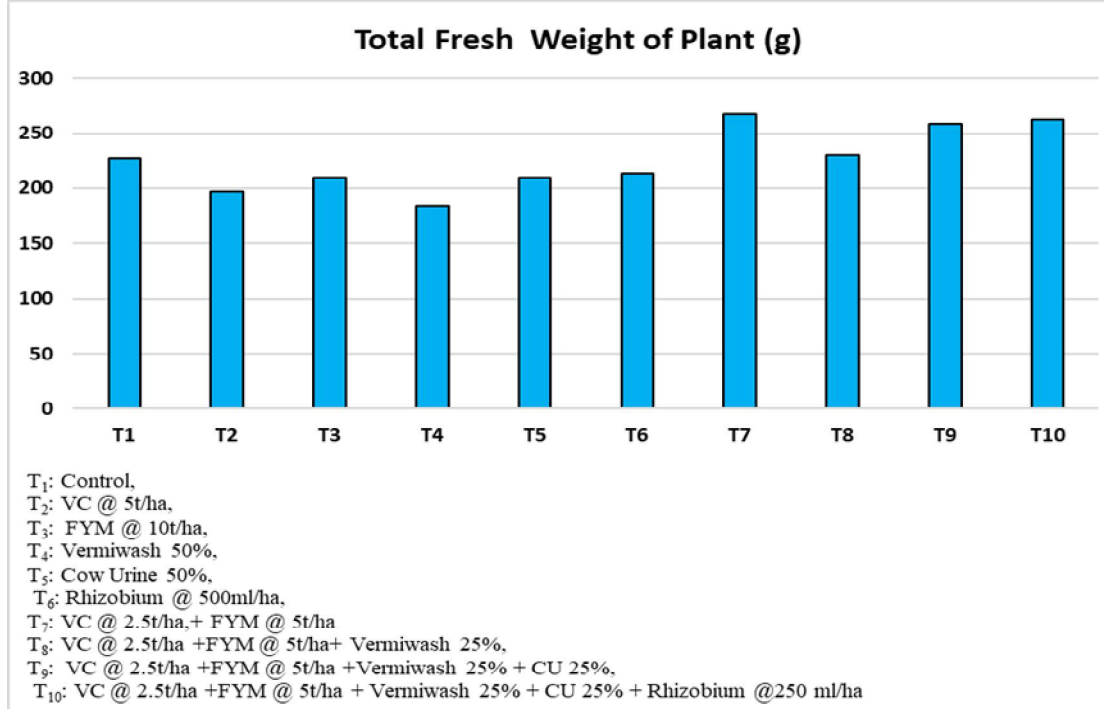




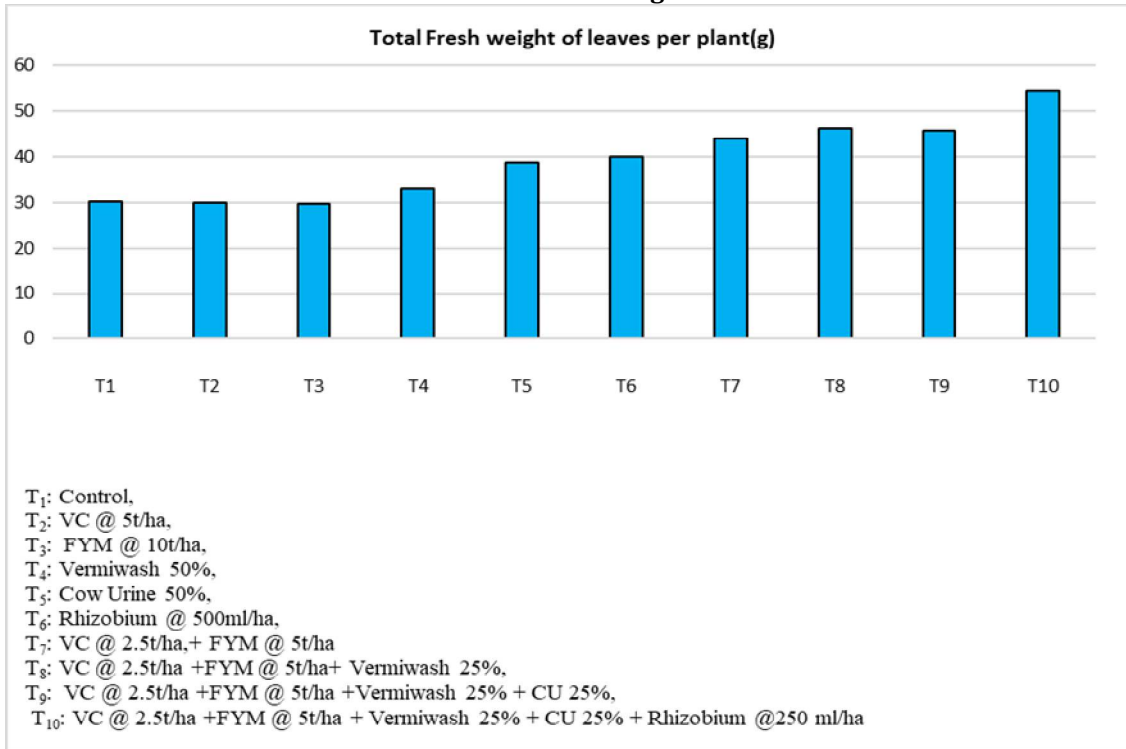
**Fig:6: Root diameter (cm) of radish as influenced by organic manures at final harvesting**



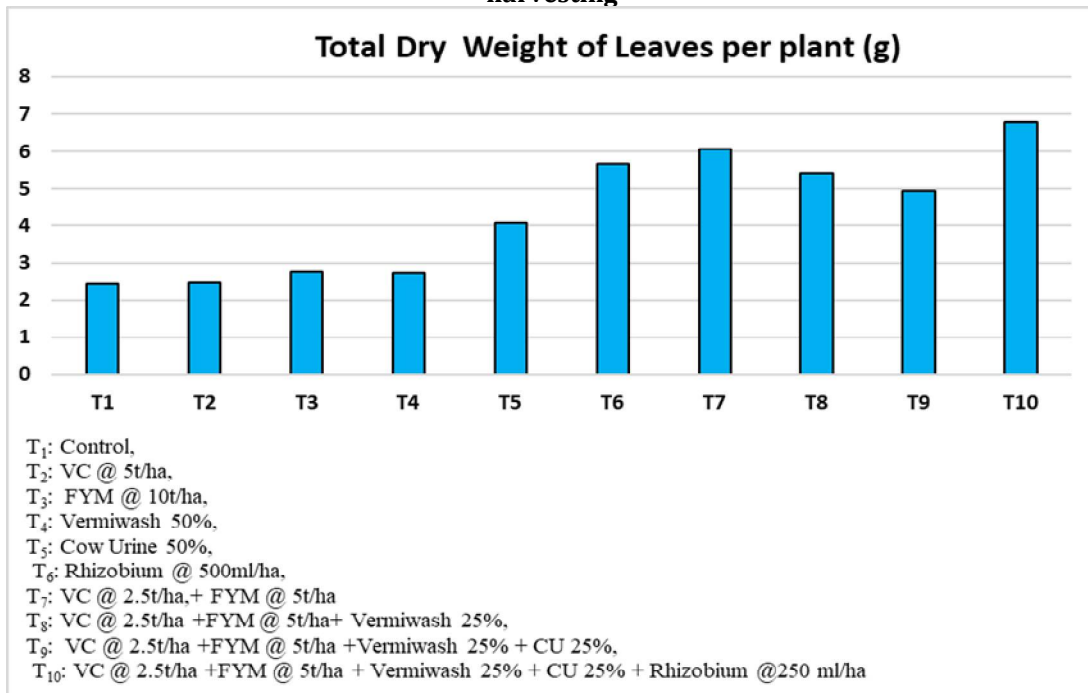
**Fig: 7: Total weight of Plant (g) of radish as influenced by organic manures at final harvesting**



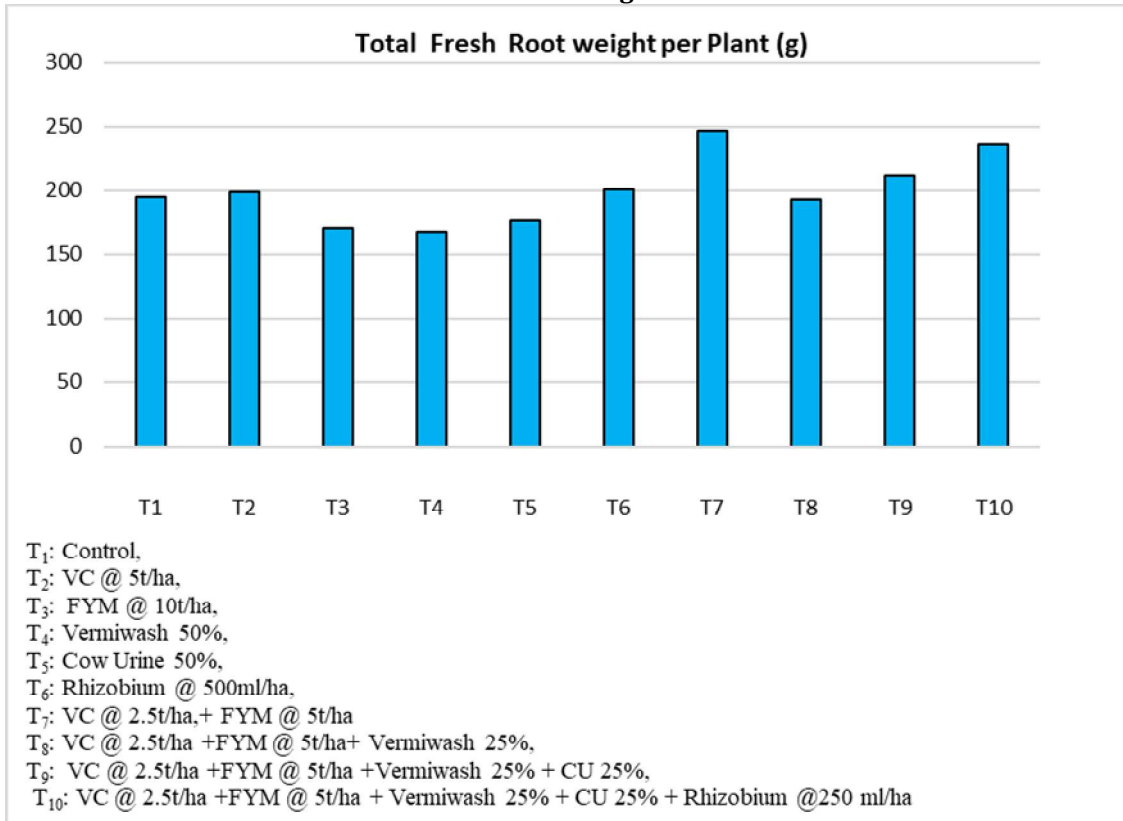
**Fig:8. Total Fresh Weight of Leaves per Plant (g) of radish as influenced by organic manures at final harvesting**



**Fig: 9: Total Dry Weight of leaves per plant (g) of radish as influenced by organic manures at final harvesting**



**Fig:10: Effect of organic manures on total fresh root weight per plant (g) of radish at final harvesting**



**Fig: 11: Effect of organic manures on total dry root weight per plant (g) of radish at final harvesting**

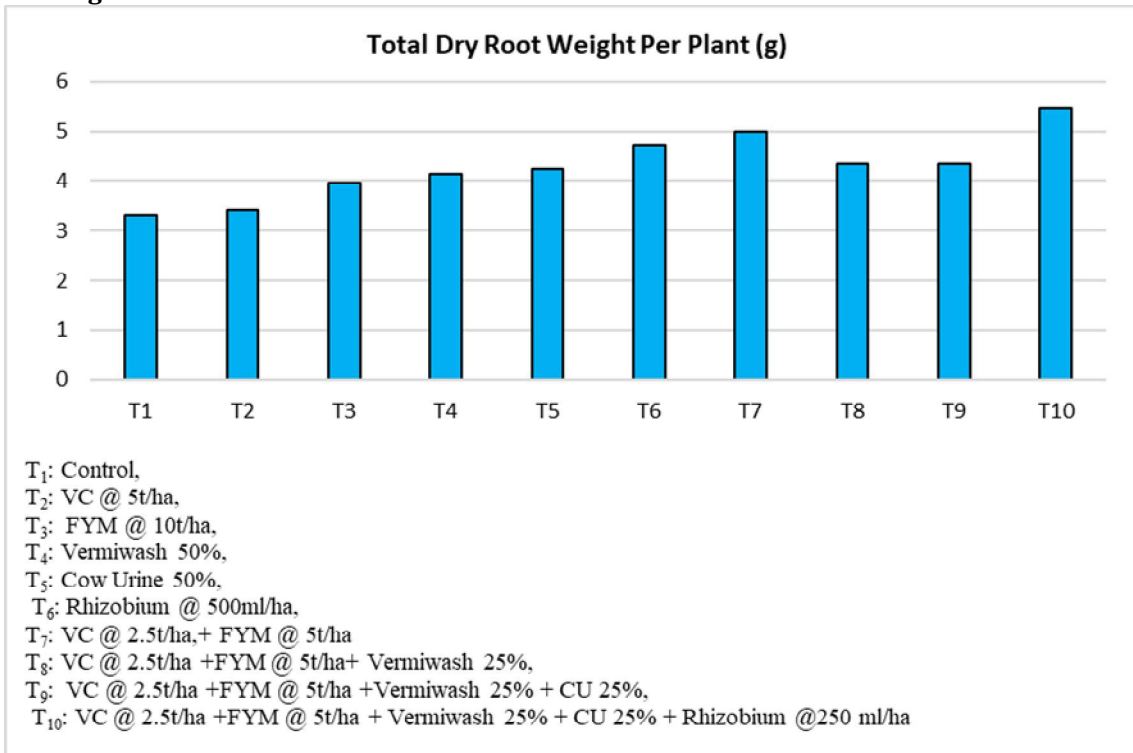


Fig: 12: Effect of different organic manures on root yield (kg/plot) of radish at final harvesting

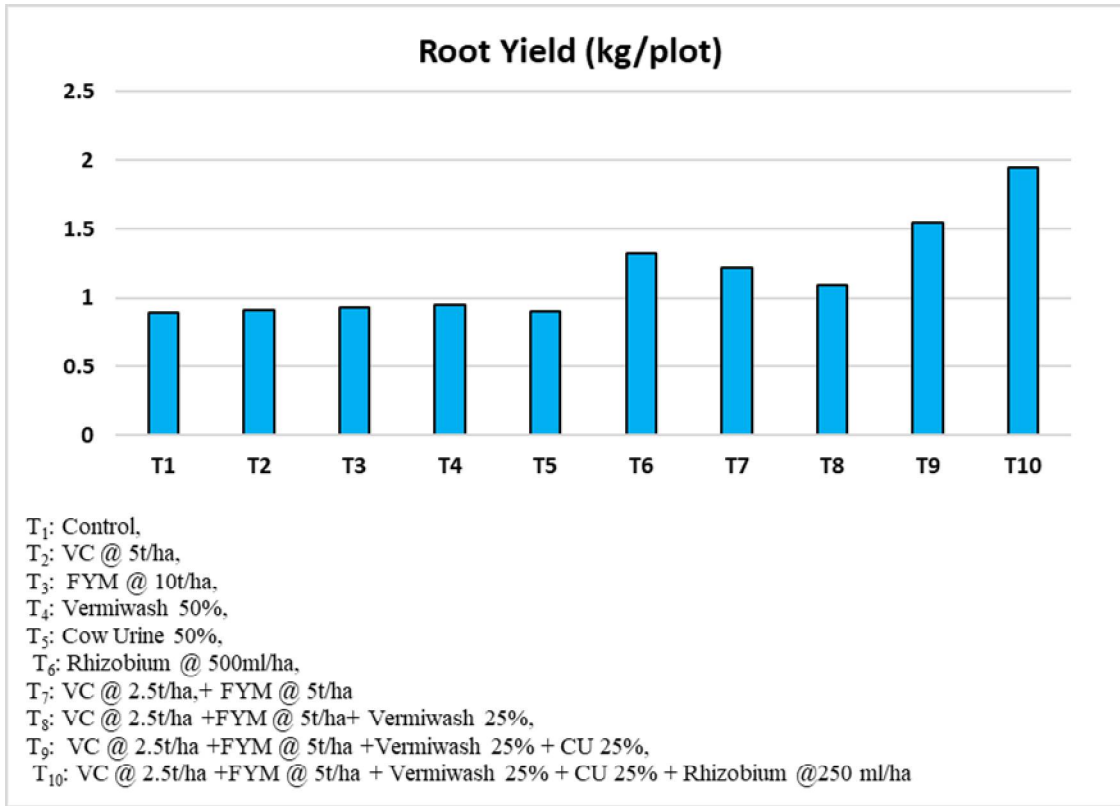
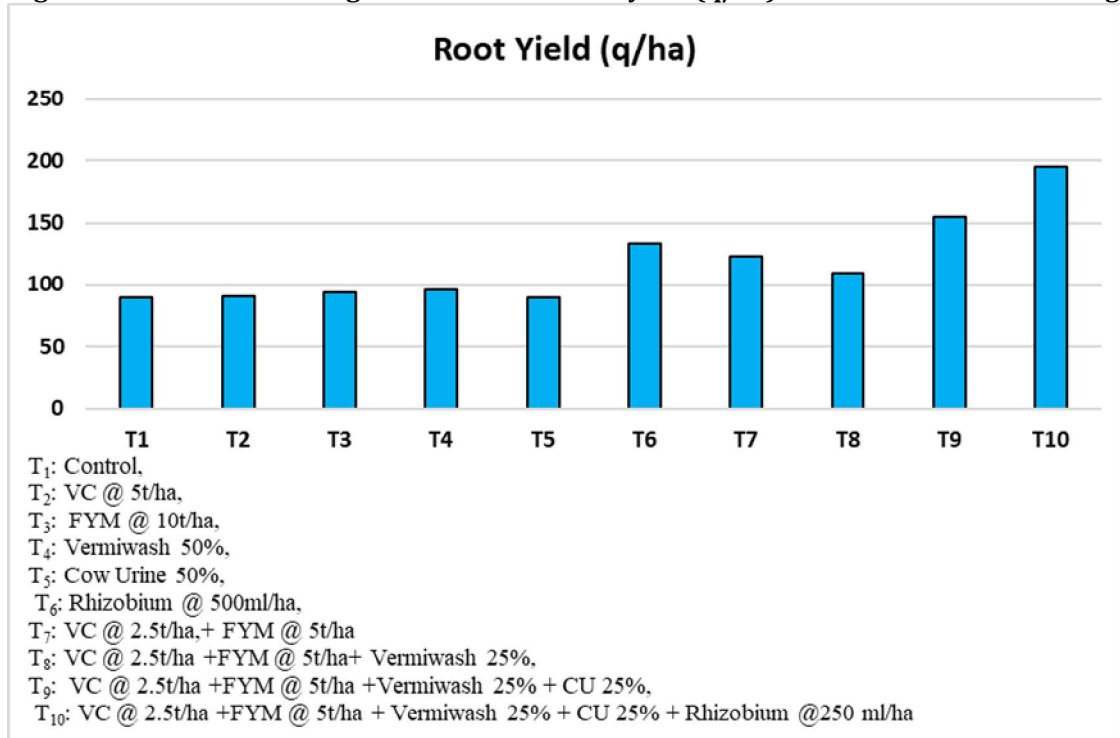
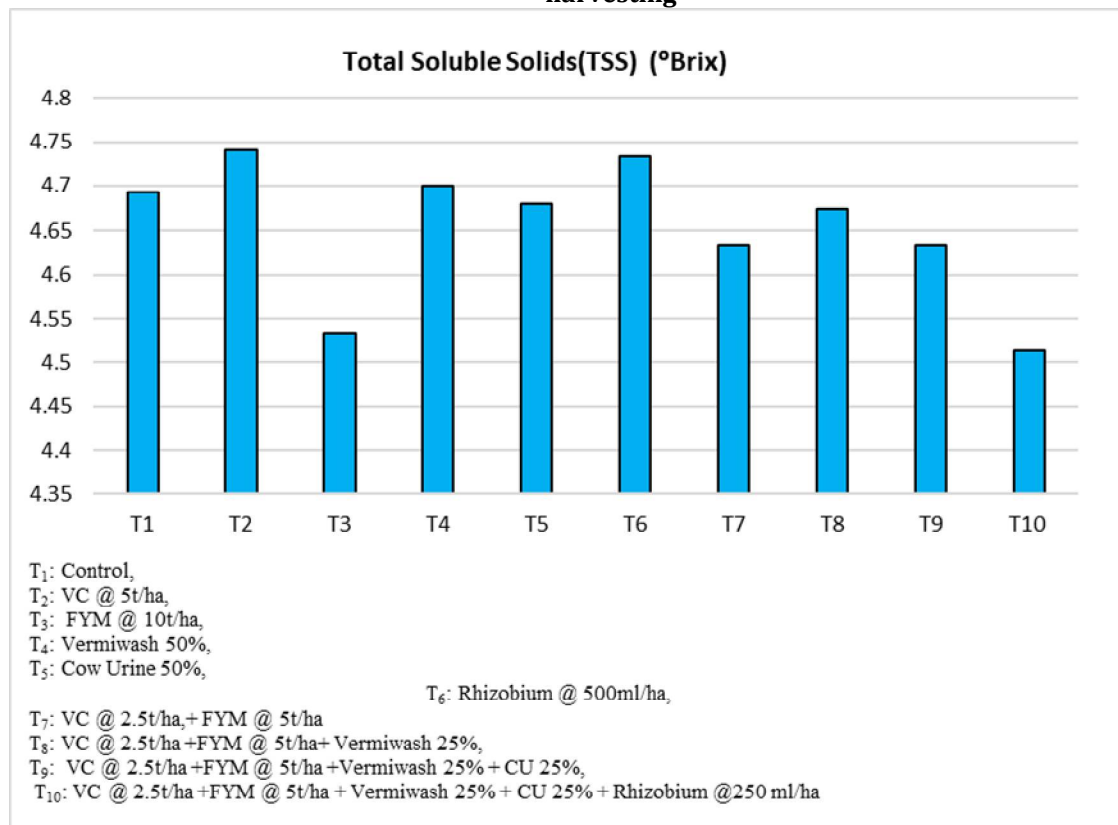


Fig:13: Effect of different organic manures on root yield (q/ha) of radish at final harvesting



**Fig. 14: Effect of different organic manures on Total Soluble Solids (°Brix) of radish root at final harvesting****CONCLUSION**

On the basis of present study on “Expression of Growth, Yield, Quality and Economic Traits in Radish (*Raphanus sativus* L.) Grown through Organic Fertilizer Intervention in Dehradun Valley of Uttarakhand” it can be concluded that among different organic manures, the combination of VC@2.5t/ha+ FYM @5t/ha +Vermiwash @25% + Cow urine@25% + Rhizobium @250ml/ha i.e. treatment T10 was found to be the most effective treatment for increasing plant height, leaf length, root length, root diameter, total fresh weight of leaves, total dry weight of leaves, total fresh weight of root, total dry weight of root, root yield (kg/plot) and root yield (q/ha). Whereas, leaf width and total fresh weight of plant was recorded maximum in T9(VC@2.5t/ha+FYM @5t/ha+Vermiwash@25%+ cow urine@25%). While in treatment T2 (VC @5t/ha) TSS was found maximum. However maximum net return (Rs 4,75,218) and B:C ratio (1:17.44) was recorded in T6 (Rhizobium@500ml/ha). In the present investigation, supplementation of Rhizobium @500ml/ha, improved soil fertility status which resulted in higher yield performance and economics. Therefore, it could be recommended under present agro- climatic conditions in order to obtain sustainably higher yield and quality of radish in addition to increase in soil fertility status.

**REFERENCES**

1. National Horticulture Board, Data base. 2021-2022.
2. Salaria,S.A. and Salaria, S.B. 2022. Vegetables, Spices and Condiments. Vol. (2) pp.168-169.
3. Ravimycin T. 2016. Effects of Vermicompost (VC) and Farmyard Manure (FYM) on the germination percentage growth biochemical and nutrient content of Coriander (*Coriandrum sativum* L.)Int. J. Adv. Res. Biol. Sci. 3(6): 91-98.
4. Jaikishun, S., Hoosein, A. and Ansari, A.A., 2018. The effects of vermicompost and vermiwash from the medicinal plants, neem (*Azadirachta indica*) and lime (*Citrus aurantifolia*), on the growth parameters of lettuce in a hydroponic system. *Nusantara Bioscience*, 10(2), pp.91-95.
5. Naresh, R.K., Shukla, A.K., Kumar, M., Kumar, A., Gupta, R.K., Singh, S.P., Singh, P.K., Kumar, Y., Tomar, S.S., Singh, V. and Rathi, R.C., 2018. Cowpathy and VedicKrishi to empower food and nutritional security and improve soil health: a review. *Journal of Pharmacognosy and Phytochemistry*, 7(1), pp.560-575.

6. Bhardwaj, D., Ansari, M. W., Sahoo, R. K., & Tuteja, N. 2014. Biofertilizers function as key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity. *Microbial cell factories*, 13(1), 1-10.
7. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. ICAR Publication, New Delhi. 1978, 359.
8. Joshi, R., Singh, J. and Vig, A.P., 2015. Vermicompost as an effective organic fertilizer and biocontrol agent: effect on growth, yield and quality of plants. *Reviews in Environmental Science and Bio/Technology*, 14, pp.137-159.
9. Kumar S., Maji S., Kumar S., Singh H.D. 2014. Efficacy of organic manures on growth and yield of radish (*Raphanus sativus* L.) cv. Japanese White. *International Journal of Plant Sciences (Muzaffarnagar)* 9 (1), 57-60
10. Verma, U.K., Kumar, R., Kumar, A., Kumar, S. and Prajapati, M.K., 2017. Integrated effect of organic manures and inorganic fertilizers on growth, yield and yield attributes of Radish cv. Kalyanpur Safed. *Journal of Pharmacognosy and Phytochemistry*, 6(6), pp.826-828.
11. Subedi, S., Srivastava, A., Sharma, M.D. and Shah, S.C., 2018. Effect of organic and inorganic nutrient sources on growth, yield and quality of radish (*Raphanus sativus* L.) varieties in Chitwan, Nepal. *SAARC Journal of Agriculture*, 16(1), pp.61-69.
12. Jajveer S., Navdeep G., Karampal S., Diksha T. And Sukhdeep S. 2019. Effect of the organic manure, inorganic fertilizers and their combination on growth, yield and quality of radish (*Raphanus sativus* L.) cv. R33. *Journal of Pharmacognosy and Phytochemistry* SP4: 57-59.
13. Gayam S, B. Lalitha D, G. Priyanka, K., Kumar S. and P. Vanaja Sri. 2020. Studies on Effect of Different Organic Manures on Growth and Yield of Radish (*Raphanus sativus* L.) *Int. J. Curr. Microbiol. App. Sci.* 9(5): 1936-1944.
14. Lanna, N.B., Silva, P.N.L., Columbaria, L.F., Corrêa, C.V. and Cardoso, A.I.I., 2018. Residual effect of organic fertilization on radish production. *Horticulture Brasileira*, 36, pp.47-53.
15. Rawat, S. and Pant, S.C., 2021. Effect of Organic Manures, Inorganic Fertilizers and their Combinations on Yield of Radish (*Raphanus sativus* L.) CV. Japanese White. *International Journal of Recent Advances in Multidisciplinary Topics*, 2(2), pp.13-15.
16. Singh V., Naseeruddin K. H. and Rana D.K. 2016. Effect of organic manures on growth, yield and quality of radish (*raphanus sativus* L.) cv. Pusa Desi. Vol. 5, issue 2; 129-133.
17. Kumar, S., Datt, N., Sandal, S.K. and Sharma, S.K., 2017. Effect of cow urine and Bio-Fertilizers based fertigation schedule at varying levels of drip Irrigation on yield, growth, quality parameters and economics of cucumber under protected condition.
18. Poudel P. R.; Gyewali, B.; Maharjan, B.; Rana,G.; Pandey R. and Pathak R. 2020. Effect of different organic manures on growth, yield, and quality of radish (*Raphanus sativus*) *SAARC J. Agric.*, 18(2): 101-114.
19. Khalid, M., Yadav, B.K. and Yadav, M.P., 2015. Studies on the effect of integrated nutrient management on growth and yield attributes of radish (*Raphanus sativus* L.). *Annals of horticulture*, 8(1), pp.81-83.
20. Kushwah L., (2016). Effect of organic manures, inorganic fertilizers and their combination on growth, yield and quality of radish (*Raphanus sativus* L.) M.Sc. (Horti.) Thesis (pub), RVSKVV, Gwailor (M.P)

**Copyright:** © 2024 Author. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.