Growth and yield performance of radish in protected cultivation under Rain hose and Drip tape irrigation system

C.Aparna[1*], J. Ravi Kumar[2], M. Hema Latha[3], Dr. G. Muralee Krishna[4]

1*. Post Graduate student, Dr. NTR College of Agricultural Engineering, Bapatla

Corresponding Email Id: aparnacherukuthotapalli@gmail.com

2. Market Development Executive, Ashirvad pipes Pvt Ltd, Bangalore

3. Under Graduate student, College of Agricultural Engineering, Madakasira

4. Professor, Dept. of Soil and Water Conservation Engineering, College of Agricultural Engineering, Madakasira.

GROWTH AND YIELD PERFORMANCE OF RADISH IN PROTECTED CULTIVATION UNDER RAIN HOSE AND DRIP TAPE IRRIGATION SYSTEM

Abstract

Land and water are two input precious natural resources which need to be conserved for sustainable agricultural production. Water conservation plays a vital role in dry land farming. Agriculture in India has facing number of problems which include increasing in population, depletion of water availability, runoff and cultivated land. Increasing in population and depletion of groundwater resources is the major problems for food security and stability. Irrigation lands now produce 4% of the food supply which doesn't meet the required supply. To avoid all the problems, a new sustainable land and water management technique and new irrigation method is introduced which is called Rain hose and Drip tape irrigation system. An experiment was conducted on the performance evaluation of radish crop with rain hose and drip tape irrigation systems under polyhouse.

The results revealed that the uniformity co-efficient was found to be higher by 3.55% in T_1 treatment (Drip tape with 20 mm dia) as compared to T_2 (Rain hose with 40 mm dia). The growth parameters were observed, the maximum mean number of leaves and leaf area of Radish was recorded in T_1 (Drip tape irrigation system) with 22 No and 172 cm^2 and minimum number of leaves and leaf area was recorded in T_2 (Rain hose irrigation system) with 20 No and 129.34 cm^2. From the yield parameters it was observed that tha maximum mean root length, root diameter and root weight of radish is recorded in T_1 (Drip tape irrigation system) with 30.4 cm, 3.165 cm, and 0.259 kg and minimum root length, root diameter and root weight was recorded in T_2 (Rain hose irrigation system) with 29.27 cm, 3.122 cm and 0.242 kg. The yield of radish was found to be 39.88 t/ha in T_1 and 38.45 t/ha in T_2.

Key words: Water management, Growth parameter, Yield parameter, Rain hose irrigation and Drip tape irrigation

1. Introduction

Radish is farmed for its young, sensitive, tuberous roots, which are eaten either cooked or raw. It is a good source of calcium, potassium, and phosphorus as well as vitamin C (ascorbic acid). Radish is primarily a cool-season vegetable crop. Radish growth and yield are highly influenced by soil and climate factors. Although almost any type of soil can be used to grow radishes, light friable loam soil with lots of humus yields the greatest results. Heavy soils result in irregular, misshapen roots with numerous tiny fibrous laterals, and they should be avoided.

Micro-irrigation is a technique where water is dispersed under low pressure through a piped network in a predetermined pattern and applied as a small discharge to each plant or the area around it. It is also known as localised irrigation, low volume irrigation or trickle irrigation. Trickle irrigation, commonly referred to as drip (or micro) irrigation, does what its name implies. Drop by drop, water enters this system right at the roots. Drop by drop water is given to the rootzone of plants or close by. If runoff and evaporation are controlled appropriately, this type of irrigation may be the most water-efficient one. When handled properly, drip irrigation typically has a field water efficiency of between 80 and 90 percent.

The experiment was conducted to determine the manufacturer's coefficient of variation (CV), cost economics and emission uniformity (EU) of a gravity fed drip irrigation system with a field size of 10 m × 5 m under a cucumber crop (Changade et al. 2009). In the study's field experiment, it was seen how different independent characteristics, including vegetative growth, hydraulic performance, crop water requirements, water use efficiency, and cost economics, affected many tomato-related features (Sah et al. 2010). evaluated 14 radish cultivars for root production, top and fresh weight, root width, leaf number, length, and germination percentage (Nautiyal et al. 1977).

Study area

The current research is carried out within the left side of the polyhouse situated at the College of Agricultural Engineering in Madakasira, Anantapur district of Andhra Pradesh and falls within an arid ecological zone, commonly referred to as a rain shadow region. Geographically, it is positioned at a latitude of 13°56'N, a longitude of 77°18'E and an elevation of 676 meters above sea level. Madakasira experiences an annual rainfall of 532 mm and is known for its susceptibility to drought. The predominant soil type in this area is red loam soil.

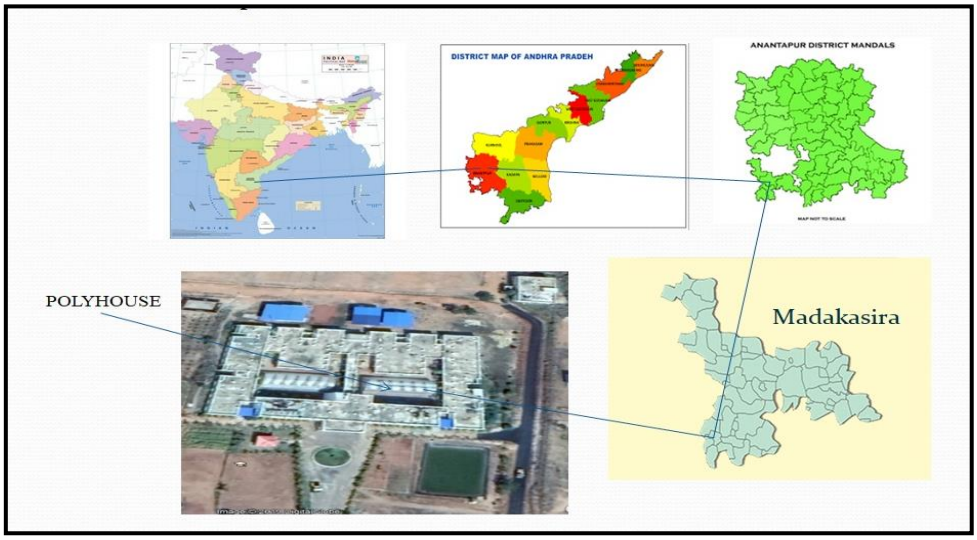

Fig. 1. Study area map (CAE, Madakasira)

Experimental design

An experimental plan was devised and executed within a poly house. The experimentation took place in a designated field with a total area of 154 m^2. This area was subdivided into two treatments: T2 for Rain hose irrigation and T1 for Drip tape irrigation. Each treatment comprised an area of 77 m^2 (11*7). Likewise, the remaining treatment area of 77 m^2 (11*7) was also chosen for the experiment.

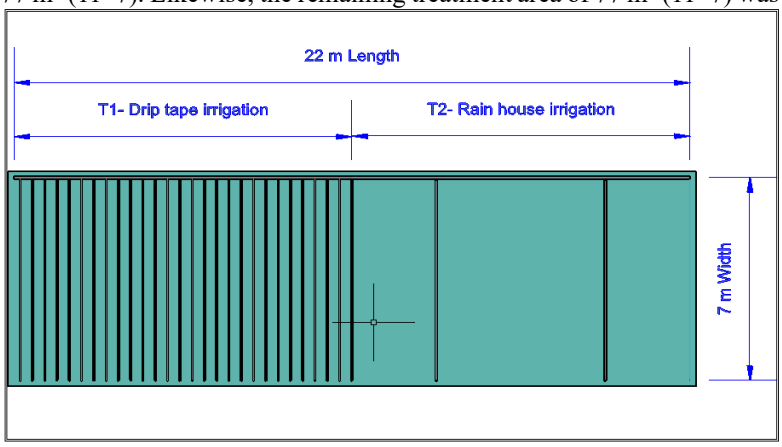

Fig. 2. Experimental design

2. Materials and Methods

2.1 Land Preparation

Well decomposed organic manure (Farm yard manure) at 20-25kg per m is mixed with soil. Farm yard manure contains all the macro and micronutrients required for plant growth. The field was primarily tilled with a mini tractor drawn cultivator followed by a power weeder and then the field was levelled manually. The field was thoroughly tilled to achieve the ideal soil texture. This tilling process involved loosening the soil, breaking up clumps, eliminating weeds and making use of the soil's micro-nutrients to promote crop growth. Subsequently, the field was evenly divided into two sections using precise measuring instruments.

Fig. 3. Primary tillage

Fig. 4. Secondary tillage

2.2 Preparation of beds

Preparation of bed according to the season and type of crop. Rainy season raised beds are prepared but, in the winter and summer season flat beds must be prepared. Uniform and high percentage of germination, this soil should be fine and moist enough. In our poly house flatbed is prepared with the help of hand leveller and the side of the bed are prepared with the help of spade.

2.3 Installation of Rain hose and Drip tape irrigation system

In T_1 and T_2 treatments installation of rain hose spray pipes and drip tapes are done. In T_1 two of rows Rain hose pipes with 40mm diameter and 7 m length are installed. In T_2 twenty-six rows of drip tape with 16 mm diameter and 7 m length are installed.

2.4 Application of fertilizer

Fertilizer are the chemical substances supplied to the crops to increases the productivity and increasing the yield. Fertilizer contains the essential nutrients required by the plants, including nitrogen, potassium, and phosphorus. For 154 m^2 area the recommended fertilizer calculated according to Nitrogen, Phosphorus and Potassium. These fertilizers are broadcasted manually by basal application.

2.5 Sowing

Radish seeds are sown manually in both treatments. The row to row spacing is 20 cm, seed to seed spacing is 10 cm and depth of sowing is 1.15 cm.

2.6 Irrigation in poly house

Irrigation is provided with Rain hose and Drip tape. Rain hose laterals 2@ 40mm and drip tape laterals of 26@16mm diameter are used for irrigating field. Run the rain hose and drip system to check each emitting point for uniform discharge. As per the crop water requirement total 7 number intervals of irrigation were given.

2.7 Thinning and weeding

Thinning is the main thing should be carried in radish field. As it is important to thin the seedlings before the roots get fleshy, often before the plants get their second set of leaves. If radishes are not thinned the roots grow too close together, the plants can become stunted and the roots will be small and distorted. Thinning will be done after 10 days of sowing.

Weeding is the removal of unnecessary plants in the field. If the weeds are not removed in time, a great loss would occur in terms of growth and productivity of crop. Regular weeding in radish farming is necessary to see the growth of the weeds. In this both treatments, two weeding's will be done to keep the growth of weeds under control. One earthing up and one weeding during the early stages (10 to 15 days) radish growth are necessary for developing the roots and another weeding is done of the tuber forming stage (25 to 30 days).

Fig. 5. Thinning

Fig. 6. Weeding

2.8 Growth Parameters of Radish

2.8.1 Number of leaves per plant

The fully developed leaf from each treatment and replications was measured and the average number of leaves per plant was recorded. Number of leaves per plant was recorded at 10, 20, 30 and 40 days.

2.8.2 Leaf area (cm^2)

The area of the leaf from was measured with the help of graph from selected observational plants by measuring the no of squares and the observations was recorded in cm^2. Leaf area per plant was recorded at 10, 20, 30 and 40 days.

2.9 Yield parameters of Radish

2.9.1 Root length (cm)

Root length of all the three randomly selected and labelled plants was recorded by scale ruler to measure the distance between collar and root end and mean values were computed. Root length was recorded at 10, 20, 30 and 40 days.

2.9.2 Root diameter (cm)

Diameters of root of all the three randomly selected and labelled plants were recorded by using vernier callipers and the mean values were computed. Root diameter was recorded at 10, 20, 30 and 40 days.

2.9.3 Root weight (kg)

Fresh weight of Root per plant were recorded from the five randomly selected and labelled plants by using weight balance to determine the weight of radish root in kilogram (kg) and mean values were computed. Root weight was recorded after harvesting.

2.10 Harvesting

In radish farming, harvesting time **i**s an important factor in growing radish. If you leave the radishes in the ground for too long then it became inedible. The crop should irrigate for 10 to 15 minutes before the pulling out of the roots as it facilitates easy uprooting of the roots. Harvesting will be done after 40 days.

2.11 Uniform coefficient

The depth of water collected in each catch-can placed in four quadrants was measured for determination of coefficient of uniformity. The coefficient of uniformity of the rain hose and drip tape system was determined using the relationship developed by Christiansen (1942).

$$Cu = (1 - \sum X/mn) \times 100 \qquad \text{....(2.1)}$$

Where,

Cu = Coefficient of uniformity, %

M = average of all observations,

X = absolute numerical deviation of individual observation from the average application

n = total number of observations

3. Results and Discussion

3.1 Growth parameters of Radish

Number of leaves and leaf area progressively increased with age of radish up to harvest in all the treatments evaluated.

3.1.1 Number of leaves per plant.

The fully developed leaf from each treatment and replications was measured and the average number of leaves per plant was recorded. Number of leaves per plant was recorded at 10, 20, 30 and 40 days. From Fig.7 it was observed that the maximum mean number of leaves of Radish is recorded in T_1- Drip tape irrigation system with 22 No. and minimum mean number of leaves is recorded in T_2- Rain hose irrigation system with 20 No.

3.1.2 Leaf area (cm^2)

The area of the leaf was measured with the help of graph from selected observational plants by measuring the no of squares and the observations was recorded in cm^2. Leaf area per plant was recorded at 10, 20, 30 and 40 days. From Fig.8, it was observed that

the maximum mean Leaf area of Radish was recorded in T_1- Drip tape irrigation system with 172 cm^2 and minimum mean Leaf area was recorded in T_2- Rain hose irrigation system with 129.34 cm^2.

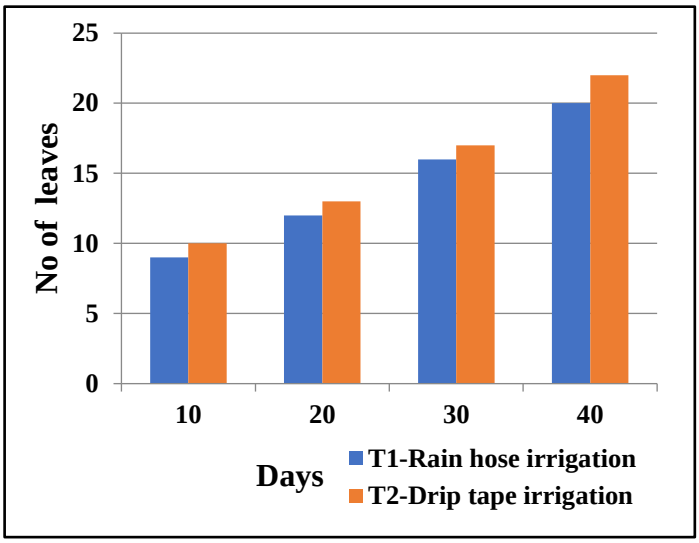

Fig. 7. Number of leaves in T1 and T2

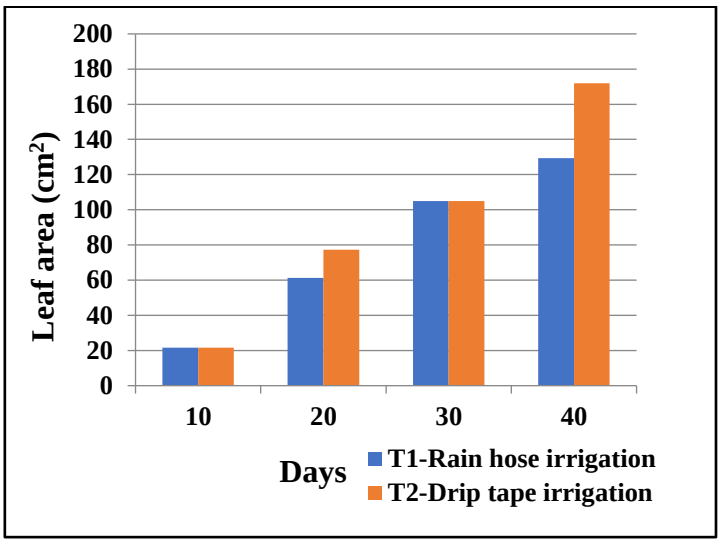

Fig. 8. Leaf area in T1 and T2

3.2 Yield parameter of Radish

Root length, root diameter and root weight progressively increased with age of radish up to harvest in all the treatments evaluated.

3.2.1 Root length (cm)

Root length of all the three randomly selected and labelled plants was recorded by scale ruler to measure the distance between collar and root end and mean values were computed. Root length per plant was recorded at 10, 20, 30 and 40 days. From Fig.9, it is observed that the maximum mean Root length of Radish is recorded in T_1- Drip tape irrigation system with 30.34 cm and minimum mean Root length is recorded in T_2- Rain hose irrigation system with 29.27 cm.

3.2.2 Root diameter

Diameters of root of all the three randomly selected and labelled plants were recorded by using vernier callipers and the mean values were computed. Root diameter per plant was recorded at 10, 20, 30 and 40 days. From Fig. 10, it is observed that the maximum mean Root diameter of Radish is recorded in T_1- Drip tape irrigation system with 3.165 cm and minimum mean Root diameter is recorded in T_2- Rain hose irrigation system with 3.122 cm.

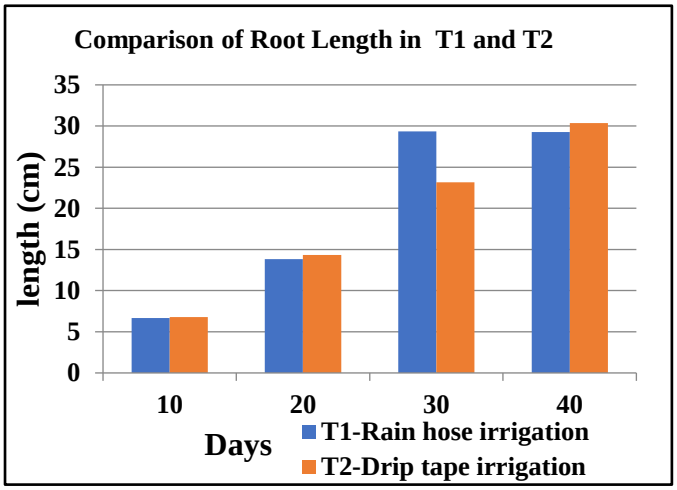

Fig. 9. Root length in T1 and T2

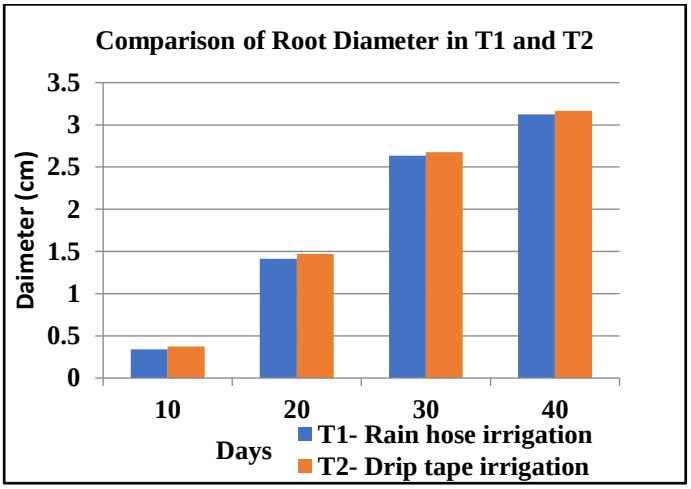

Fig. 10. Root diameter in T1 and T2

3.2.3 Root weight (kg)

Root weight (Tuber) per plant were recorded from the three randomly selected and labelled plants by using weight balance to determine the root weight in kilogram (kg)and mean values were computed. Root weight per plant was recorded at after harvesting. From Fig. 4.11, it was observed that the maximum mean Root weight of Radish is recorded in T_1- Drip tape irrigation system with 0.2326 kg and minimum mean Root weight is recorded in T_2- Rain hose irrigation system with 0.2028 kg.

3.3 Yield of Radish crop

The Radish was harvested manually at the time of harvesting. The root was separated from the leaves of the crop. Yield of Radish crop was noted in both plots differently at the time of harvesting. From fig 4.12, it was observed that the yield of radish was found to be higher in T_1 (398.7013 Quintal/ha), followed by T_2(384.4156 Quintal /ha)

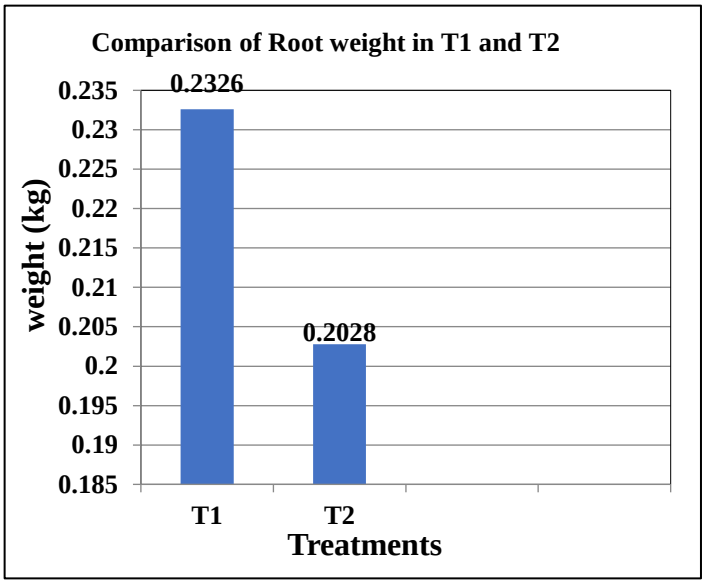

Fig. 11. Root weights in T1 and T2

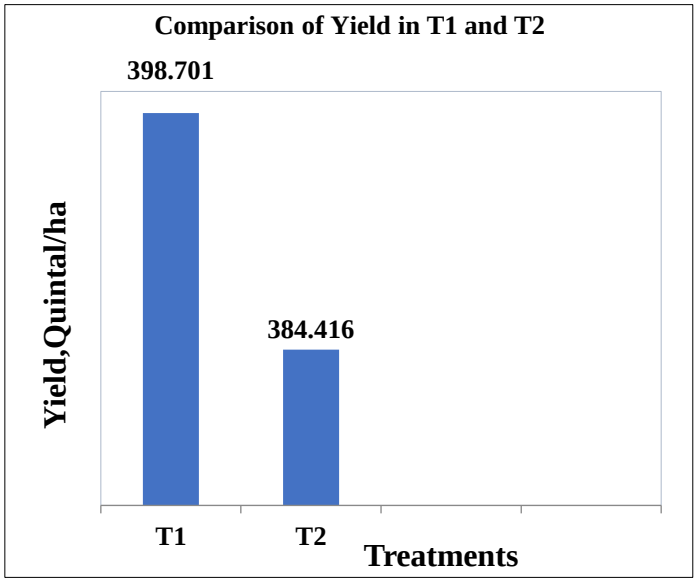

Fig. 12. Comparison of yield in T1 and T2

3.4 Uniformity coefficient:

Uniformity coefficient was estimated by using (equation 2.1) and the results revealed that the uniform coefficient of 40mm rain hose was estimated to be 85.5 % and uniform coefficient of 16 mm drip tape was estimated to be 86.67%. from these results

Conclusion

The growth parameters and yield parameters were more in T_1 (Drip tape irrigation) compared to T_2 (Rain hose irrigation), it may due to uniform distribution of water was more in T_1, so the yield, root weight, root length, root diameter, number of leaves and leaf area were more compare to T_2.

Acknowledgment

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References

Badr M A, Taalab A S. 2007. Effect of drip irrigation and discharge rate on water and solute dynamics in sandy soil and tomato yied.Australian Journal of Basic and Applied Sciences.1: 545-552.

Ghosh, P., P.K. Das,R. Sarker and A. Mannan. 2014. Effect of salinity on germination, growth and yield of radish (Raphanus sativus L.) varieties. *International journal of Biosciences.* 5 (1): 37- 48.

Lavanya, A., Vani, V. S., Reddy, P. S. S. and Sasikala, K., Root yield and quality of radish as affected by sowing dates and spacing. *Vegetable Science*. 39(2): 177- 179 (2012).

Panwar, N. S., Mishra, A. C., Uniyal, S. dates of sowing on yield and quality of radish (Raphanus sativus) cultivars under rain fed mid–hill conditions of Uttarakhand.*Annuals of Agro-Biotech Research.* 18(3): 360-363 (2013).

Priyanka, M., Swarajya Lakshmi, K., Syam Sundar Reddy, P., Srinivasa Reddy, D. and Sri Bala Krishna, M., Yield and Yield Parameters of Radish (Raphanus Sativus L.) Affected by Interaction of Varieties and Dates of Sowing, Int. J. Pure App. *Biosci*. 6(5): 488-491 (2018).