

Studies on Water Requirement and Subsurface Manure Application for Broccoli Cultivation

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Abstract

Broccoli is one of the most nutritious Cole crop and contains vitamin A, Thiamin, Riboflavin, Riadin, vitamin C and minerals like, ca, p, k and fe (Manoj kumar et al. 2013). Land and water are the basic needs of agricultural and economic development of any country and their demands are dramatically increasing day by day. The field experiment was carried out to evaluate the behavior of broccoli crop for water requirement in subsurface point application of manure for flood irrigation and drip irrigation. The Broccoli crop variety Green magic was selected for the experiment as T₁= subsurface application of organic manure with flood irrigation. T₂= subsurface application of organic manure with drip irrigation. From the observation, it was clear that vegetative growth was more or less same in treatment T₁ compared to treatment T₂ but the average width of curds of the treatment T₂ was 19.83 cm which is quite higher compared to T₁ i.e. 18.56 cm. The average weight of curd in treatment T₁ was 338.2 gm and it was higher in treatment T₂ i.e. 403.6 gm respectively. In addition, it was found that the total weight of curds in treatment T₂ was significantly higher i.e. 7533 kg/ha compared to treatment T₁ i.e. 6303 kg/ha. It means that combined point application of water and organic manure responded well compared to other treatment. It is observed that the output cost is more in treatment T₂ compared to treatment T₁ i.e. 7, 53,300 & 6, 30,300 Rs. Respectively. The benefit cost ratio was highest in T₂ i.e. 2.5:1 compared to 1.86:1 in treatment T₁ respectively. From the study, it was revealed that subsurface application of manure in combination with drip irrigation proved the best practice for Broccoli cultivation in open environment.

Key word - Water requirement, Subsurface manure, Broccoli, Cultivation etc.

1. Introduction

India is the second largest producer of vegetable crops in the world. Vegetables of genus Brassica are cultivated and consumed in large quantities in world wide. Broccoli is a plant of the Brassicaceae produced in cool weather country worldwide for its nutritional and therapeutic importance to the human health and is an important cold crop after cabbage and cauliflower (Dewoowoogen P. Baclayon et al, 2009). In recent years, consumers have become increasingly interested in quality and health benefits of foods. It is one of the most nutritious Cole crops and contains vitamin A, Thiamin, riboflavin, ricin, vitamin c and minerals like ca, p, k and fe (Manojkumar et al, 2013). Land and water are the basic needs of agricultural and economic development of any country and their demands are dramatically increasing day by day. Further, the per capita availability of these resources in India is less in comparison with many other countries. Crop water requirements is the water required by the plants for its survival, growth, development and to produce economic parts. This requirement is applied either naturally by precipitation or artificially by irrigation. Appropriate irrigation scheduling is to increase irrigation efficiency by applying the exact amount of water needed to replenish the soil moisture to a desired level, saves water, resources & energy. Therefore, it is important to develop irrigation scheduling techniques under prevailing climatic conditions in order to utilize scarce water resource efficiently for crop production. A drip system produces healthy, fast-growing plants. In fact, improved crop yields were the primary force behind the development of drip irrigation for agriculture. (Urban farmer store drip irrigation handbook).

Organic food consumption is in part, driven by consumer perception that organic foods are more nutritious and simultaneously less potentially harmful to human health. Nutrient concentrations in manure vary widely with the kind of animal. Although the concentration of nutrients is lower in manure than in man-made fertilizers, manure improves soil structure and increases its water holding capacity (Master Gardener Program, Washington state University). The national organic farmers serve reported fertility management as farmers third research priority demands to achieve profitable yields. Soil fertility management is major tool for improving crop yields, especially for crops requiring nitrogen application. Broccoli is a vegetable that requires high N inputs and frequent irrigation to enhance yields. Broccoli has a shallow root system which limits its ability to take up water and nutrients from deeper soil profile.

Keeping these facts in view, a study was undertaken with the following specific objectives:

To estimate water requirement of broccoli crop.
Comparative study on yield of point application of manure for flood irrigation and drip irrigation.

To estimate cost benefit ratio.

2. Materials and Methods

Field experiment was carried out to study yield and cost benefit of broccoli crop for water requirement in point application of manure for flood irrigation and drip irrigation. The experiment was carried out on about total 154 m² area of Pad. Dr. D. Y. Patil College of Agricultural Engineering and Technology farm, Talsande. The size of each plot was 4 m x 1.6 m for flood irrigation & 4m x 2.6m for drip irrigation. Broccoli crop variety of *Green magic* was selected for the experiment & it was planted on the date of 17 October 2014. Two treatments were taken each of five replications as follows:-

T1 = sub- surface application of manure with flood irrigation.

T2 = sub- surface application of manure with drip irrigation.

The experiment was conducted during the year 2014-15 on the central farms of Padmashree Dr. D.Y. Patil college of Agricultural Engineering and Technology, Talsande, Dist. Kolhapur. It is situated at 16° 43'N and 74° 14'E longitude and altitude of 605m. The location of study situated at 32 km north side of Kolhapur.

The climate of Talsande (Kolhapur region) is semi arid sub-tropical with hot dry summer and cold winter. Generally, the monsoon starts in the first week of June. The climatic condition for the site is typically coastal (dry and temperate with average annual rainfall of 1047.57mm). Maximum

temperature occurs during April-May is 25°C to 38°C and minimum temperature in December-January 11.9°C to 21.9°C.

The cow dung was used as organic manure at the time of planting. Cow dung was placed beneath the broccoli plant in the subsurface in treatment T₁ and T₂. The dose of vermicompost was given after 40 days of plantation by side dressing near the plant in subsurface.

Bulk density of the field at the time of planting was measured for two different depths i.e. 0-15 cm and 15- 30 cm and found 1.22 g/cc and 1.36 respectively. Moisture content at the time of planting for 0-15 cm and 15- 30 cm depth was 9.67% and 10.67% respectively. Crop parameter as follows

Table.1. Average height of the plants

Sr. No.	Nos. Days after plantation	Average height of the plants, cm	
		T ₁	T ₂
1	20	25.5	21.56
2	50	35.5	31.56
3	70	53.1	52.06

The broccoli yield data was obtained by harvesting the crop manually from areas which were earmarked for data collection in the test field and then weighted to determine the crop yield in kg/ha.

Randomized block design was used for experimental setup and data for broccoli yield was noted for each plot. Production cost consists of the cost of inputs material as Broccoli plants, manure used on uniform basis in all the treatments of Broccoli crop plus cost of energy consumed in respective operations for the crop. Broccoli is the main outputs. The present market rate of broccoli was taken to calculate the total output cost of cultivation. Net income was calculated on the basis of cost involved in production of broccoli crop and cost of broccoli obtained as output. The difference of cost of the output to the total production cost gave the net income.

RESULT AND DISCUSSION

Table. 2. Physical parameters of broccoli

Sr. No.	Physical Parameters	Treatment (T ₁)	Treatment (T ₂)
1	Height of the plants at the time of harvest, cm	47.8	47.4
2	Number of leaves of each plant	32	38
3	Length of leaves of each plant, cm	35.6	35.2
4	Width of leaves of each plant, cm	13.6	13

5	Stem Diameter of each plant, cm	12.36	12.58
6	Diameter of curd of each Plant, cm	18.56	19.83

Table.3. Yield data of broccoli

Sr. No.	Parameter	Treatment (T ₁)	Treatment (T ₂)
1	Weight of each curd (Kg)	0.3382	0.4042
2	Number of plants per ha	18636	18636
3	Total weight of curds per ha (Kg)	6303	7533
4	Input cost, Rs/ha	76272	80272
5	Total output cost, Rs/ha	630300	753300
6	Net income, Rs/ha	554028	673028
7	Benefit cost ratio	1.86:1	1.2.5:1

(Assuming, cost of the Broccoli/kg = 100 Rs.)

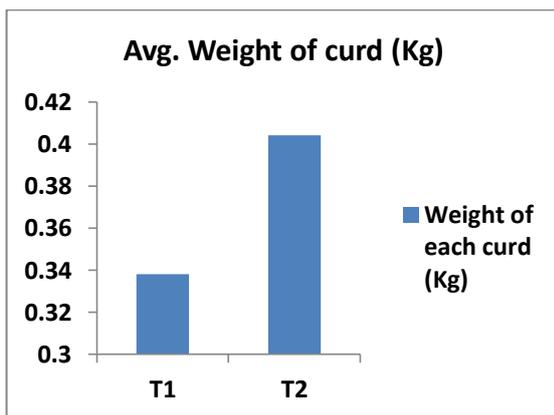


Fig.1. Weight of each curd (Kg)

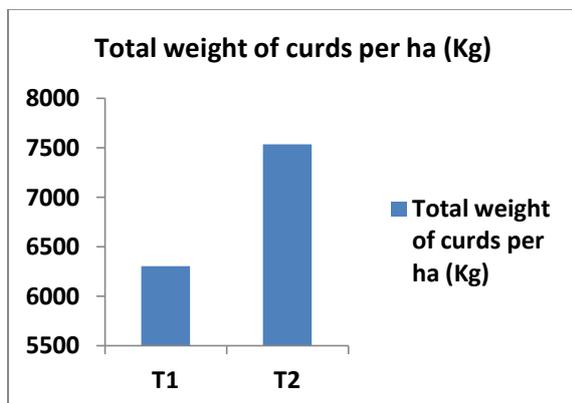


Fig.2. Total weight of curds per ha (Kg)

Table 3 shows that the total weight of curds in treatment T₂ is higher i.e. 7533 kg/ha compared to treatment T₁ i.e. 6303 kg/ha. Also, the output cost is

more in treatment T₂ compared to treatment no. T₁ i.e. 7, 53,300 & 6, 30,300 Rs. Respectively

Conclusion

From the study, it was revealed that vegetative growth was more or less same in treatment T₁ compared to T₂ but the average diameter of curds of treatment T₂ was 19.83 cm which is quite higher compared to T₁ i.e. 18.86. The average weight of curds in treatment T₁ was 338.2 cm and it was higher in treatment T₂ i.e. 403.6 gm respectively. Also, total weight of curds in treatment T₂ per hectare was 7533 kg and it was 6303 kg in treatment T₁ respectively. It indicates that combined point application of water and manure responded well compared to other treatment. The input cost in treatment T₁ was 76272 Rs and it was 80272 Rs for treatment T₂. The output cost was more in treatment T₂ compared to treatment T₁ i.e. 753300 & 630300 Rs. Respectively. Net income was more in treatment T₂ compared to treatment T₁ i.e. 673028 Rs and 554028 Rs respectively. The benefit cost ratio was more in T₂ i.e. 2.5:1 compared to 1.86:1 in treatment T₁ respectively.

Subsurface application of manure in combination with drip irrigation proved best practice for broccoli cultivation in open environment. It saves water and manure to the great extent. Also, as there is plenty of water and manure available in root zone of the plants throughout its growing period causing vigorous growth of the plants which ultimately helped in reducing the intensity of pests and diseases. This technology will help to increase the overall yield of the crop using naturally available resources precisely making it sustainable agriculture for future generations.

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