Determination of Transplanting Time of the Capsicum Seedlings for Yield and Profit Maximization

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ABSTRACT

Capsicum as a high value Vegetable Crop is immensely popular among the farmers of the Birbhum District of the State of West Bengal in India. But the farmers are unable to get maximum yield and profit from this Vegetable as early and late transplanting of the Capsicum seedlings invite viral diseases which cause low production. Hence, standardization of the optimum transplanting time of the Capsicum seedlings is a serious need of the Capsicum farmers.

Hence, the present study aims to focus on determination of optimum time of transplanting of the Capsicum seedlings to maximize the Yield component and Profit component and to minimize the insect-pest at ack.

The present study showed that early as well as delayed transplanting of Capsicum seedlings also faced the problem of rain and associated surge of insect pest infestation in the months of September, October and February as well as increased temperature which reduced Yield.

From the Benefit: Cost ratio analysis of the present study, it may be safely noted that the Capsicum seedlings transplanted in the First Week of November fetched highest Profit. As the time of transplanting become early or delayed the Benefit: cost Ratio get reduced to a significant extent.

Keywords: Capsicum, Transplanting Time, Seedlings.

The genus Capsicum (*Capsicum annuum* L.) belongs to the family Solanaceae. It is grown in several parts of the world and is believed to be the native of Tropical South America (Shoemaker and Teskey, 1995). The domesticated peppers could be broadly classified into sweet and hot types based on their level of pungency. The bell pepper (*Capsicum annuum* L. var. *grossum* Sendt; 2n = 24) is commonly known as sweet pepper, capsicum or green pepper. They differ from common hot peppers in size and shape of the fruits, capsaicin content and usage. Bell pepper is one of the highly remunerative vegetables cultivated in several parts of the world especially in temperate regions of Central and South America and European countries, tropical and subtropical regions of Asian continent.

Access this article online	
Publisher	Website: http://www.renupublishers.com
Rp	DOI: 10.5958/2454-9541.2015.00001.8

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Submission: 11 October, 2014 Revison : 12 Janauary, 2015 Acceptance: 20 July, 2015

In the world, area and production of bell pepper is merged with that of hot pepper (chilli). Hence, the statistics related to pepper/chilli as whole is given. Annual world production of bell pepper in the year 2007 amounted to 27.46 million metric tonnes from an area of 1.72 million hectares. China is the major producer of capsicum and contributes 36 per cent of the total cultivated area of the world with a production of 12.53 million tonnes. India contributes average annual production of 0.9 million tonnes from an area of 0.885 million hectare with a productivity of 1.017 tonnes per ha (Anon., 2007).

The bell pepper in India is under non-traditional category of vegetables (Kalloo and Pandey, 2002).They are mainly cultivated during *rabi* and *kharif* seasons in Karnataka, Maharashtra, Tamil Nadu, Himachal Pradesh, and hilly areas of Uttar Pradesh and during *rabi* season in West Bengal.

Bell pepper has attained a status of high value crop in India in recent years and occupies a pride of place among vegetables in Indian cuisine because of its delicacy and pleasant flavour coupled with rich content of ascorbic acid and other vitamins and minerals. It imparts delicate taste and pleasant flavour to the cuisine. Nutritionally, bell peppers are rich in vitamins particularly vitamin A (180 IU) and vitamin C. Hundred grams of edible portion of capsicum provides 24 Kcal of energy, 1.3g of protein, 4.3 g of carbohydrate and 0.3g of fat (Anon., 2001).

It also finds place in preparations like pizza stuffing's and burger with growing popularity of fast food. The high market price it fetches is attributed to the heavy demand from the urban consumers. There is a good demand for export too. The export market needs fruits with longer shelf life, medium size tetra lobed fruits with attractive colour, mild pungency with good taste. However, the supply is inadequate due to the low productivity of the crop (Muthukrishnan *et al.,* 1986).

Basically bell pepper is a cool season tropical crop and lacks adaptability to varied environmental conditions. Despite its economic importance, growers are not in a position to produce good quality capsicum with high productivity due to various biotic (pest and diseases), abiotic (rainfall, temperature, relative humidity and light intensity) and crop factors (flower and fruit drop). Due to erratic behaviour of weather, the crops grown in open field are often exposed to fluctuating levels of temperature, humidity, wind flow etc. which ultimately affect the crop productivity adversely (Ochigbu and Harris, 1989). Besides this, limited availability of land for cultivation hampers the vegetable production. It is difficult to obtain higher yields of good quality fruits throughout the year under open conditions in most parts of India, as it is delicate crop.

So, Agronomical practices play an important role for obtaining higher yields. Newly evolved and superior type of varieties/hybrids of crops needs to be assessed for their optimum time of planting and other cultural practices to achieve maximum yields both under open and protected structures. In West Bengal, it is to be noted that farmers raised Capsicum seedling in the end of November and transplanted it in the late December or in the first week of the January. Generally, the cropping system in relation to the Capsicum cultivation was Rice-Vegetable-Fallow and Vegetable-Vegetable-Fallow and the farming situation was irrigated medium land. In West Bengal, the production of the Capsicum crop is low in the growing season i.e. the Rabi season. Several earlier studies have shown that the causes of low production of Sweet Pepper Crop were (a) late transplanting of the Capsicum seedlings and (b) heavy infestation of sucking insects (Aphids, Thrips, Jassids, Mite etc.) during late transplanting.

Capsicum as a high value Vegetable Crop is immensely popular among the farmers of the Birbhum District of the State of west Bengal in India. But the farmers are unable to get maximum yield and profit from this Vegetable as early and late transplanting of the Capsicum seedlings invite viral diseases which cause low production. Hence, standardization of the optimum transplanting time of the Capsicum seedlings is a serious need of the Capsicum farmers.

Therefore, there is a need to study the optimum time of transplanting of the seedlings of the Capsicum crop to maximize the potential yield and to minimize the insect-pest attack on the Capsicum crop. Hence, the study on determination of optimum time of transplanting of the Capsicum seedlings was taken up with the following objectives;

1. To determine the optimum time of transplanting

of the Capsicum seedlings to maximize the Yield component and Profit component and to minimize the insect-pest attack.

The literature pertaining to the growth and development of the Capsicum under different temperature condition and regimes are noted down below.

Deli and Tiessen (1969) observed higher number of branches and flowers in low temperature exposed capsicum plants. The flowers and ovaries formed were very small in sweet pepper plants which were exposed to constant temperature of 25°C and were largest when plants exposed to low temperature at four leaves stages.

Rylski (1972) reported that soil temperature below 10°C retarded growth and development of chilli plants, while 17°C was optimum and raising the temperature increased were shoot growth but root growth was retarded above 30°C. Days to flowering were reduced from 87 to 65 under high temperature conditions.

Polowick and Sawahaney (1985) reported that, the low temperatures (18/15°C) had more effect (negative response) on flowers and fruits of capsicum than intermediate (23/18°C) temperatures.

Gosselin and Trudel (1986) observed maximum shoot dry weight and leaf area at root zone temperatures of 24°C and 30°C in pepper. It was noted that maximum fruit weight and number occurred at 30°C root zone temperature. Highest temperature (25°C) range resulted in two week earlier harvest and improved fruit shape and firmness in fruit than at lowest constant temperature (Buitelaar and Janse, 1987).

Bakker *et al*. (1988) reported that yield of total and Class-1 fruits (kg/m^2) in sweet pepper were greatest at daily mean temperature of 21-21.3°C.

Bhatt and Rao (1993) noticed higher net photosynthetic rate, growth rate and number of flowers in bell pepper at higher night temperatures. They further reported that at intermediate temperature, the number of four lobed fruits significantly increased and at low temperature the fruits obtained were short, blunt and unmarketable.

Chen *et al*. (1994) showed that sweet pepper (Capsicum frutescens) fruits exposed to chilling stress (0.1°C) showed increased respiration rates and ethylene production. The relative conductivity of the pulp and membrane permeability increased with chilling duration. These metabolic changes occurred before visible signs of chilling injury became apparent. However, an altering temperature treatment counteracted these changes and reduced the accumulation of alcohol, acetaldehyde and acetone, increased peroxidase and catalase activities, inhibited phenylalanine ammonia-lyase activity and reduced electrolyte leakage. The alternating temperature treatment was effective in reducing chilling injury in cold-stored sweet peppers.

Leonardi (1994) reported that maintaining temperature just above the minimum required for plant growth (about 160 C until the end of vegetative growth and about 130 C during flowering) increased yield and advanced the harvesting time of peppers.

MATERIALS AND METHODS

The present investigation was carried out to study the performance of Capsicum Hybrid (Capsicum annuum L.) Bharat under different transplanting times of the Capsicum crop. The experiment was carried out at the Three Villages namely Kankutia, Kartickdanga and Senkapur in the Community Development Block of Bolpur-Sriniketan in the District of Birbhum, West Bengal, India during the period of April, 2007 to March, 2008.

The material used and the methodology adopted are furnished here under.

Geographical Location

Birbhum being the northern most district of the Burdwan division lies between the latitude 23°32/ and 24°35/ in the northern hemisphere and 80°01/ 40//and 87° 05/25//longitude. On the map the district (Birbhum) looks like an isosceles triangle. The apex is situated at the northern extremely not far south of the point where the Ganges and the hills of Santhal Parganas of Jharkhand beginning to diverge while the river Ajoy forms the base of the triangle. Birbhum is bounded on the north and west by the Santhal Parganas, by the districts Murshidabad and Burdwan on the east, and on the south by Burdwan. The Birbhum is separated from the Burdwan district by the river

Ajoy. The district comprises three sub-divisions namely- Bolpur, Rampurhat and Suri. Suri is the head quarter of the district and of the Suri (Sadar) Sub-Division as well.

Experimental Details

The study was conducted by laying a single experiment as detailed below.

Area of Study: Three Villages namely Kankutia, Kartickdanga and Senkapur in the Community Development Block of Bolpur-Sriniketan in the District of Birbhum.

Crop: Capsicum

Hybrids: Bharat

Cropping Sequence:

1. Paddy – Vegetable – Fallow

2. Vegetable – Vegetable – Fallow

Micro-Farming Situation

The farmers cultivated Capsicum in irrigated medium land in the Rabi Season.

Number of treatments: Four (04)

Type of treatments: T_1 = Transplanting of the Capsicum Seedling at the First Week of October (Exact Date of transplanting - 03.10.2007)

T_2 = Transplanting of the Capsicum Seedling at the First Week of November (Exact Date of Transplanting – 02.11.2007.)

T_3 = Transplanting of the Capsicum Seedling at the First Week of December (Exact Date of Transplanting – 03.12.2007.)

T_4 = Transplanting of the Capsicum Seedling at the First Week of January (Exact Date of Transplanting – 04.01.2008.

Experimental Design: Randomized Block Design

Number of Replications: Fifteen (15)

Plot Size/Replication: 0.006 ha

Total Area required: 0.36 ha.

Supply of Critical Inputs: Krishi Vigyan Kendra Share: Seed, Polythene Tube, Plant Protection Chemicals. Farmers' Shares: Land, Labour, Manures, Fertilizers, Irrigation.

Monitoring Indicators: (a) Growth of the Capsicum Plant and (b) Yield of the Capsicum Crop.

Experimental Procedure

The crop was grown in different plots by adopting the recommended package of practices according to the different time of transplanting of the seedlings of the Capsicum.

Characters of the capsicum hybrids

Bharat hybrids were developed by Indo-American Hybrid Seeds Private Limited Company. These hybrids were said to have early fruit bearing character, with highest yield during initial 2 to 3 pickings.

Preparation of Land

Land area was thoroughly dug to a depth of 20 to 25 cm. One month prior to planting weeds and stubbles were removed completely and the soil was brought to a fine tilth. The beds of convenient size (length 31.5 m, width 1m and height 15 cm were prepared out of mixture of red soil + farmyard manure + coco peat + sand + paddy husk in 1:1:1:1 proportion + vermin-compost (1 kg/m2) and neem cake (200 g/m2). Soil was disinfected with Formalin (2%) to overcome the problem of soil borne diseases. Immediately after treating the soil with Formalin the area was covered with black polythene sheet for 3-4 days, there after the polythene sheet was removed and irrigated twice to remove chemical residues if any in the soil. Raised beds of 30 cm height, 35 m length and 30 meter width were prepared leaving 50 cm between the beds to enable easy cultural operations like weeding, spraying and harvesting etc.

Mulching

To conserve the soil moisture and prevent weed growth, beds were covered with silver coloured mulch having 30 micron thickness.

Transplanting

The Capsicum seedlings were transplanted according to the treatment transplanting time period. The holes

were made on each mark by using PVC pipe. Before transplanting, the seedlings were dipped in 0.2% bavistin and 2% superphosphate solution for two minutes and were transplanted.

Fertilizer Application

Fertilizers were provided with manual labour.

Initial 1 and 1/2 month: 1:2:5 N: P: K was applied.

Next onwards: 2:1:3 N: P: K was applied on alternate days.

Weekly foliar application of micronutrients was provided.

Weeding and plant protection measures

Mulching was done to reduce weed problem in the beds. Only the space between the beds was kept free by manual weeding.

Table 1. Plant Protection Measures Adopted regarding Insect Pests

Sl. No.	Insect Pest	Scientific Name of the Insect Pests	Trade Name of the Pesticides	Brand Name of the Pesticides
01.	Thrips	Scirtothrips dorsalis	Imidacloprid 17.8 SC	Confidor 0.05 %
02.	Mites	Polyphago-tarsonemus latus	Abamectin 1.9 EC	Vertimec 0.03 %
03.	Fruit Borers	Spodoptera litura	Methomyl 40 SP	Lannate 0.2 %

Table 2. Plant Protection Measures Adopted regarding Disease Pests

Sl. No.	Disease Pest	Trade Name of the Pesticides	Brand Name of the Pesticides
01.	Dieback	Propiconazole 25EC	Tilt 0. 1 %
02.	Fruit Rot	Penconazole 10EC	Topaz 0.05%
03.	Powdery Mildew	Metalaxyl + Mancozeb72 WP	
(8%) (64%)	Ridomyl MZ 0.2%		
04.	Sclelrotium Rot	Carboxin 75 WP	Vitavax 0.2 %

Irrigation

The plants were irrigated one hour daily with drip irrigation system. Plants were watered before 12 noon or late evening.

Harvesting

Fully mature fruits at 10-20 % colour break stage were harvested periodically with the help of secateurs. Cleaning, sorting and grading operations were carried out and then packed in corrugated card board boxes before sending to market.

OBSERVATIONS

Vegetative parameters

Plant height (cm)

Five plants were tagged at random in each treatment for recording the plant height at an interval of 30 days starting from the date of transplanting. The plant height was measured from the ground level to the growing tip of the main stem at 30, 60, 90 and 120 days after transplanting (DAP). The average height was calculated and expressed in centimetres.

Number of branches per plant

Well developed branches were counted at 30, 60, 90 and 120 days after planting from all the plants tagged for recording observations and the mean of number of leaves per plant was worked out.

Reproductive parameters

Number of fruits per plant

The number of mature fruits that were harvested from the tagged plants in each picking was recorded till the final harvest.

Individual fruit weight (gms.)

The fresh capsicum fruits harvested from the labelled plants from each treatment were weighed and recorded in grams.

Yield parameters

Fruit Yield Per Plant (Kgs.)

The weight of mature fruits harvested from each picking was recorded till final harvest and total yield of fruits per plant was recorded in kilograms.

Environmental parameters

Following environmental parameters were recorded from the time of transplanting to that of last picking of fruits.

Temperature (°C)

Air temperature in the Capsicum field was recorded by using Thermo hygrometer at weekly interval, and expressed as mean monthly data.

Rainfall (mm)

The average rainfall during the period of Capsicum cultivation was recorded by using the Rain gauge at daily interval, and expressed as mean monthly data.

Benefit-Cost Economics

Economics of capsicum production under different protected structures was worked out by considering the present price of inputs and produce.

Net returns ($Rs.ha^{-1}$) = Gross returns ($Rs.ha^{-1}$) - Cost of cultivation ($Rs.ha^{-1}$)

$$\text{Benefit: Cost ratio} = \frac{\text{Net returns } (Rs.ha^{-1})}{\text{Cost of cultivation } (Rs.ha^{-1})}$$

Statistical analysis

The data pertaining to vegetative and reproductive characters were tabulated treatment and replication wise. The data was statistically analyzed by software MSTAT–C. Fisher and Yates tables (1957) were referred for knowing the tabulated values at five per cent level of significance at corresponding degree of freedom. Inferences were drawn as revealed by the analysis of tables.

EXPERIMENTAL RESULTS

The experimental results obtained from the present study are furnished here, under the following sub-headings.

Vegetative characters

Plant height (cm)

The data on plant height at different stages of crop growth as influenced by time of transplanting are presented in Table 3.

The plant height of capsicum differed significantly due to the time of transplanting. In the Table 3 we could find out that the Average Plant Height was highest in the Capsicum Crops which were transplanted at the First Week of November and that Average Height was 47.58 cm. As the time of transplanting was early or delayed the Average Plant Height were decreased. The Average Plant Height was lowest in the Capsicum Crops transplanted at the First Week of January and that was 21.67 cm.

Number of Branches per plant

The data on number of Branches per plant at different Transplanting Time of the Capsicum seedlings are presented in Table 4.

Table 3. Average Plant Height (cms.) Per Plant

Sl. No.	Treat-ment	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	Total	Average
01.	T_1	26.0	28.0	23.0	25.0	23.0	25.0	26.0	20.0	22.0	24.0	26.0	25.0	20.0	30.0	28.0	371.0	24.73
02.	T_2	47.2	48.5	44.0	50.0	46.0	45.0	40.0	46.5	49.0	52.0	42.5	47.5	48.5	52.0	55.0	713.7	47.58
03.	T_3	44.0	41.0	40.0	38.0	42.0	39.5	34.0	38.0	42.0	44.0	36.0	40.0	38.5	42.0	35.0	594.0	39.60
04.	T_4	23.0	21.0	22.0	18.0	20.0	21.0	22.0	20.0	25.0	25.0	22.0	26.0	20.0	22.0	18.0	325.0	21.67

CD at 5 Percent Level of Significance was 8.34.
S.Em. 02.70

Table 4. Average Number of Branches Per Plant

Sl. No.	Treat-ment	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	Total	Average
01.	T_1	28.0	22.0	25.0	20.0	20.0	24.0	21.0	19.0	10.0	25.0	28.0	20.0	22.0	25.0	20.0	329.0	21.93
02.	T_2	53.0	55.0	53.0	62.0	60.5	52.0	57.0	53.0	58.0	70.0	68.5	62.0	58.0	65.0	62.0	889.0	59.27
03.	T_3	48.0	47.0	50.0	45.0	53.0	33.0	28.0	30.0	48.0	52.0	42.0	38.0	32.0	48.0	42.0	636.0	42.40
04.	T_4	25.0	22.0	18.0	15.0	16.0	18.0	15.0	12.0	16.0	20.0	20.0	22.0	18.0	18.0	16.0	271.0	18.07

CD at 5 Percent Level of Significance was 14.20.

S.Em. 04.64

Table 5. Average Number of Fruits per Plant

Sl. No.	Treat-ment	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	Total	Average
01.	T_1	16.0	14.0	14.5	13.0	12.0	15.0	17.0	16.0	12.0	18.0	20.0	22.0	16.0	17.0	18.0	240.5	16.03
02.	T_2	22.0	21.5	18.5	24.0	26.0	33.0	28.0	29.0	27.5	32.0	38.0	40.0	32.0	38.0	40.0	449.5	29.97
03.	T_3	19.0	18.0	17.0	20.0	22.0	24.0	18.0	20.0	18.0	25.0	28.0	33.0	28.0	30.0	35.0	355.0	23.67
04.	T_4	12.0	13.0	11.0	12.0	10.0	13.0	12.0	10.0	13.0	16.0	15.0	18.0	15.0	16.0	12.0	198.0	13.20

CD at 5 Percent Level of Significance was 6.53.
S.Em. 2.17.

The Average Number of Branches per Plant of capsicum differed significantly due to the time of transplanting. In the Table 4 we could find out that the Average Number of Branches per Plant was highest in the Capsicum Crops which were transplanted at the First Week of November and that Average Number of Branches per Plant was 59.27. As the time of transplanting was early or delayed the Average Number of Fruits per Plant were decreased. The Average Number of Branches per Plant was lowest in the Capsicum Crops transplanted at the First Week of January and that was 18.07.

Yield Characters

Average Number of Fruits per Plant

The Data on Average Number of Fruits per Plant are presented in the Table 5.

The Average Number of Fruits per Plant of Capsicum differed significantly due to the time of transplanting. In the Table 5 we could find out that the Average Number of Fruits per Plant was highest in the Capsicum Crops which were transplanted at the First Week of November and that Average Number of Fruits Per Plant was 29.97. As the time of transplanting was early or delayed the Average Number of Fruits Per Plant were decreased. The Average Number of Fruits per Plant was lowest in the Capsicum Crops transplanted at the First Week of January and that was 13.20.

Average Fruit Weight in Each Plant

The Data on Average Fruit Weight (Gms.) in each Plant are presented in the Table 6.

The Average Fruit Weight in each Plant of Capsicum differed significantly due to the time of transplanting. In the Table 6 we could find out that the Average Fruit Weight in each Plant was highest in the Capsicum Crops which were transplanted at the First Week of November and that Average Fruit Weight in each Plant was 146.93 Gms. As the time of transplanting was early or delayed the Average Fruit Weight in each Plant were decreased. The Average Fruit Weight in each Plant was lowest in the Capsicum Crops transplanted at the first Week of January and that was 51.53 Gms.

Table 6. Average Fruit Weight (Gms.) in Each Type of Capsicum Plant

Treat-ment	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	Total	Average
T_1	112.0	100.0	118.0	90.0	80.0	77.0	75.0	70.0	63.0	60.0	78.0	72.0	80.0	90.0	85.0	1250.0	83.33
T_2	162.0	145.0	130.0	151.0	138.0	143.0	144.5	142.0	138.5	160.0	149.0	140.0	136.0	170.0	155.0	2204.0	146.93
T_3	138.0	122.0	120.0	130.0	128.0	118.0	127.5	129.0	132.0	135.0	115.0	125.0	128.0	130.0	124.0	1901.5	126.77
T_4	40.0	35.0	45.0	60.0	56.0	61.0	56.0	58.0	45.0	65.0	50.0	55.0	50.0	52.0	45.0	773.0	51.53

CD at 5 Percent Level of Significance was 38.99.
S.Em. 12.91

Table 7. Average Fruit Yield Per Plant in Kgs.

Sl. No.	Treat-ment	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}	Total	Average
1.	T_1	1.79	1.40	1.71	1.17	0.96	1.16	1.28	1.12	0.76	1.08	1.56	1.59	1.28	1.53	1.53	19.92	1.33
2.	T_2	3.57	3.12	2.41	3.63	3.59	4.72	4.05	4.12	3.81	5.12	5.66	5.60	4.35	6.46	6.20	66.41	4.43
3.	T_3	2.62	2.20	2.04	2.60	2.82	2.83	2.30	2.58	2.38	3.38	3.22	4.13	3.59	3.90	4.34	44.93	3.00
4.	T_4	0.48	0.46	0.50	0.72	0.56	0.79	0.67	0.58	0.59	1.04	0.75	0.99	0.75	0.83	0.54	10.25	0.68

Average Fruit Yield per Plant (kgs.)

The Data on Fruit Yield per Plant in kilograms are presented in the Table 7.

The Average Fruit Yield per Plant of capsicum differed significantly due to the time of transplanting. In the Table 7 we could find out that the Average Fruit Yield per Plant was highest in the Capsicum Crops which were transplanted at the First Week of November and that Average Yield per Plant was 4.43 Kilo Grams. As the time of transplanting delayed the Average Fruit Yield per Plant were decreased. The Average Fruit Yield per Plant was lowest in the Capsicum Crops transplanted at the First week of January and that was 0.68 Kilo Grams.

Benefit-Cost economics

The data of benefit-cost economics was presented in the Table 8.

The Fifteen Numbers of T2 Treatment plots gave the maximum yield of 73.97 tons per Hectare followed by T3 plots which gave a Yield of 50.41 tons per Hectare. T4 Plots gave a poor Yield of 11.43 Tons per Hectare.

Table 8 clearly showed us that the cost of cultivation was highest in the T2 Plots which were Rs. 2.80 lakhs per Hectare. This was because higher amount production needed to be harvested and that required higher labour cost for plucking the capsicum fruits. The cost of cultivation was lowest in the T1 and T4 Plots which were Rs. 2.10 lakhs per Hectare.

Table 8 pointed out that the Gross Income from the T2 Plots was highest and that was Rs. 10.19 Lakhs per Hectare followed by T3 Plots where the Gross Income was Rs. 7.49 Lakhs. The per hectare Gross Income was lowest in the T4 Plots where it was only Rs. 3.24 Lakhs.

Table 8 also revealed that Net Profit per Hectare was highest in the T2 Plots which were Rs. 7.39 Lakhs followed by the T3 Plots which was Rs. 5.04 Lakhs. The per Hectare Net Profit was lowest in the T4 Plots which were only Rs. 1.14 Lakhs.

From the Benefit: Cost (B: C) Ratio Analysis, we found out that the B: C Ration was highest in the T2 Plots where it was 3.64 followed by the T3 Plots where it was 3.06. The Benefit: Cost Ratio was lowest in the T4 Plots.

Table 8. The Benefit-Cost Economics of Capsicum Cultivation

Sl. No.	Treatment type	Yield (Tons/ Hectare)	Cost of Cultivation (Rs. / Hectare)	Gross Income (Rs. / Hectare)	Net Profit (Rs. / Hectare)	Benefit: Cost (B:C) Ratio
01.	T_1	22.44	2.24 Lakhs	4.34 Lakhs	2.24 Lakhs	2.07
02.	T_2	73.97	2.80 lakhs	10.19 Lakhs	7.39 Lakhs	3.64
03.	T_3	50.41	2.45 Lakhs	7.49 Lakhs	5.04 Lakhs	3.06
04.	T_4	11.43	2.10 Lakhs	3.24 Lakhs	1.14 Lakhs	1.54

Environmental Situations

Average Maximum and Minimum Atmospheric Temperature (o Centigrade)

The Data on Average Maximum and Minimum Atmospheric Temperature in Degree Centigrade in the Cropping Season of the Capsicum Crop were recorded in the Table 9.

The Average Maximum Atmospheric Temperature was highest i.e. 32.1° Centigrade in the Month of September and it was lowest i.e. 24.8° Centigrade in the Month of January. The Average Minimum Atmospheric Temperature was highest i.e. 24.9° Centigrade in the Month of September and it was lowest i.e. 11.2° Centigrade in the Month of December and January. The Month of November which was very important for being the optimum time of transplanting of the Capsicum seedling saw an Average Maximum Temperature of 29.1° Centigrade and an Average Minimum Temperature of 17.8° Centigrade.

Table 9. Average Maximum and Minimum Atmospheric Temperature during the Cropping Season of the Capsicum

Sl. No.	Month and Year	Average Maximum Atmospheric Temperature (°Centigrade)	Average Minimum Atmospheric Temperature (°Centigrade)
01.	September, 2007	32.1	24.9
02.	October, 2007	31.7	23.0
03.	November, 2007	29.1	17.8
04.	December, 2007	25.8	11.2
05.	January, 2008	24.8	11.2
06.	February, 2008	25.7	12.6

Rainfall during the Cropping Season of Capsicum

The Data on Rainfall (mm) during the Cropping Season of the Capsicum Crop were recorded in the Table 10.

During the Cropping Season of the Capsicum Crop, rainfall occurred in the Months of September, October, November, January and February, only in the Month of December there was no rainfall. The Total rainfall recorded during the Cropping Season of Capsicum was 640.7 mm. The highest rainfall of 549.6 mm was recorded in the Month of September, 2007 and the lowest rainfall of 13.6 mm was recorded in the Month of February, 2008.

Table 10. Rainfall during the Cropping Season of Capsicum

Sl. No.	Month and Year	Amount of Rainfall (mm)
01.	September, 2007	549.6
02.	October, 2007	48.8
03.	November, 2007	7.5
04.	December, 2007	-
05.	January, 2008	21.2
06.	February, 2008	13.6

Pest Disease Infestation Profile

Heavy infestation of pest and diseases were observed in the T_1 and T_4 treatment Plots. The observation in this regard was as follows:

1. Heavy infestation of the insects Aphids were observed.
2. Secondary Virus infection was caused by the attack of the Aphids insects.
3. Infestation of Fruit Borer was low.

CONCLUSION

Environment is the aggregate of all external conditions which influences the growth and development of crop, that which plays dominant role in crop production. Each crop has

its own set of environmental conditions under which it grows best. Generally, crops are not profitable unless they are adapted to the region in which they are produced. Raising a crop successfully means the crop must be productive and economical to grow under prevailing conditions.

Among the environmental factors, the temperature, relative humidity, light intensity and rainfall are the factors which mainly influence the crop growth and development considerably. Solar radiation consists of different wave lengths of light, in which only the visible portion is useful for crop growth, while ultraviolet and infrared radiations are not beneficial for the crop growth, as they bring changes at molecular level that leads to cellular disorganization of the crops grown under open environment.

Temperature is the major regulator of the crop development process. It influences the flower and fruit development. From the present study, it may be safely concluded that atmospheric temperature was optimum in the first Week of November for transplanting of the Capsicum seedlings to get maximum Yield. The effect of temperature on net photosynthesis is of vital concern in crop production. The higher temperatures have more adverse influence on net photosynthesis than lower temperature leading to decreased production of photosynthates above a certain temperature (Bhatt and Rao, 1993). Early as well as delayed transplanting of Capsicum seedlings also faced the problem of rain and associated surge of insect pest infestation in the months of September, October and February as well as increased temperature which reduced Yield.

From the Benefit: Cost ratio analysis, it may be safely concluded that the Capsicum seedlings transplanted in the First Week of November fetched highest Profit. As the time of transplanting become early or delayed the Benefit: cost Ration get reduced to a significant extent.

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