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Research Article

EFFECT OF TRANSPLANTING DATE AND MICRONUTRIENT FOR QUALITY AND SUSTAINABLE PRODUCTION OF CAPSICUM VARIETIES UNDER PROTECTED CONDITION

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Abstract- The present experiment was carried out at the field of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (West Bengal) during the year 2013-14 and 2014-15 to study the effect of transplanting dates and micronutrient complex application on yield and quality of capsicum varieties under protected condition. The experiment was laid out in Three Factor Complete Randomized Design with three replications. The highest fruit yield was obtained from transplanting on 17th November for variety Arya with micronutrient application (134.64 t/ha) and it was lowest for variety Ayesha with transplanting on 7th December without micronutrient application (79.19 t/ha) for both the year. Whereas, significantly higher total soluble solid content was obtained with 27th October transplanting of variety Arya with micronutrient application (5.230Brix) and highest β-carotene content (371.17 mg/100 g) of fruit was recorded for variety Ayesha for the same transplanting date and micronutrient complex application.

Keywords- Capsicum, Transplanting Date, Micronutrient, Protected Condition and Quality.

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Introduction

Capsicum (*Capsicum annuum* L.Grossum), also known as sweet pepper, bell pepper or Shimla Mirch is one of the popular vegetables grown throughout India. It is the second most important crop among the solanaceous fruits. It is now intensively grown in Himachal Pradesh, hills of Utter Pradesh and Darjeeling district of West Bengal during summer months and as autumn crops up to winter months in plains of Maharashtra, Karnataka, Tamil Nadu, Bihar, West Bengal, Madhya Pradesh and Utter Pradesh.

Production of vegetables under protected cultivation system results in effective use of the land resources, besides being able to increase the production of quality vegetables both for the export and domestic markets by offsetting biotic and abiotic stresses to a great extent that otherwise is prevalent in open cultivation. Vegetable productions under protective structures ensure year-round supply of vegetables and helps to stabilize market price. Nowadays green house is the most relevant method for fulfilling the essence of protected cultivation. Greenhouse is the most practical method of accomplishing the objectives of protected cultivation [1]. Tomato, Capsicum and Cucumber are the most extensively grown vegetables under green houses and give higher returns [2]. Greenhouses are rapidly gaining favour from growers in many regions of the India because these structures extend the growing season and increase quality of high value Horticultural crops. There is a need to replace traditional crops and adopt high value export oriented crops cultivation in a scientific method to achieve a global share in the export.

Micronutrient fertilizers are one of the outstanding sources of nutrient that effect on growth and development of sweet pepper. Use the low value for medium responsive crops and the high rate for high responsive crops. Because of the narrow range between deficiency and toxicity levels in crop plants, micronutrient fertilization should not be used on a large scale or become a common practice. Though, the micro-nutrients are required in the minute quantities by the plants, but each of these play a specific role in the physiology of the plants. Therefore, it is essential to adopt a strategy of nutrients management in vegetable production by using judicious combination of macro and micro-nutrients. Information available on the use of micronutrients on bell pepper production is scanty, therefore, the present investigation have been planned to assess the effect of foliar sprays of micronutrients in combination with soil application on bell pepper under protected cultivation.

Materials and Methods

The field experiment was conducted during the year 2013-14 and 2014-15 at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (West Bengal), India situated at 23.50N latitude and 800 E. Longitude with average altitude of 9.75m above the mean sea levels (MSL). The soil is sandy loam and slightly acidic. Topographic situation of the experimental site was under Gangetic new alluvial plains of West Bengal. The average minimum and maximum temperature inside the polyhouse during the study period were 17° C and 40°C respectively and the relative humidity recorded was 53 to 94 percent. The experiment was laid in three factor Factorial Complete randomized Design, replicated thrice. Vermicompost @ 3 tonnes/ha and N: P: K @125:80:60 kg/ha were applied at the time of sowing. The main factor was three transplanting date 27th October (D1),17th November (D2) and 7th December (D3) , sub factor was two varieties Arya (V1), Ayesha ((V2)), sub-sub factor was application of micronutrient complex (C1) boron 1%, copper 2.4% EDTA, Zinc 5.3% EDTA , Manganese 5% EDTA, Molybdenum 0.1% and control (C0) without micronutrient.

Results and Discussion

Effect of transplanting date, variety and micronutrient on different yield attributing characters of Capsicum.

Days to first flowering in Capsicum

[Table-1] indicated that days of transplanting and application of micronutrient showed significant effect on days to first flowering of capsicum in case of single effect. Minimum days of 56.37, 54.79 days has been showed from V1 (Arya) and C1 (with Micronutrient) respectively, whereas the effect was insignificant in case of transplanting.

The possible reason might be due to the fact that Boron is an essential element found in the meristematic regions of plants such as root tips, emerging leaves and buds. Flowering of the plant is the reproductive phase of the plant life. Health of plant is affected by the availability of nutrients to the plant. Similar finding was reported by [3].

Table-1 *Effect of transplanting date, variety and micronutrient on different yield attributing characters of Capsicum*

Treatment	Days to first flowering	Percentage of fruit setting	Number of fruits per plant	Individual fruit weight (g)	Pericarp thickness (mm)	Yield (ton) per ha
Planting Dates						
D1	61.89	48.87	16.82	174.42	6.10	119.71
D2	56.59	52.35	18.23	163.48	5.43	121.92
D3	51.7	55.22	16.33	146.21	6.26	97.64
S. Em (±)	0.36	0.38	0.11	1.44	0.07	1.13
CD (5%)	1.44	1.5	0.47	5.73	0.30	4.51
Variety						
V1	56.36	52.2	16.85	169.83	5.57	117.08
V2	57.09	52	17.40	152.90	6.30	109.10
S. Em (±)	0.29	0.31	0.09	1.18	0.06	0.93
CD (5%)	NS	NS	0.38	4.68	0.25	3.68
Micronutrient						
C0	58.67	48.9	16.38	155.14	5.78	103.84
C1	54.79	55.3	17.87	167.59	6.08	122.34
S. Em (±)	0.29	0.31	0.09	1.18	0.06	0.93
CD (5%)	1.18	1.2	0.38	4.68	0.25	3.68

Percentage of fruit set in capsicum

Data presented on the [Table-1] revealed that a significant effect of individual and interaction effects among the factors in most other cases, highest fruit setting of 55.22 % was observed from D3 (December transplanting) and lowest at D1 (0ctober transplanting) 48.57 %.Effect of varieties on percentage of fruit was non-significant. Though 52.22 % showed higher value of fruit setting. (Application of micronutrient) C1 showed a significantly superior over (without application) C0.

Although flower bud number was similar at 33 ºC and many buds reached the mature flower stage fruit set was inhibited completely. While flowers developing at high temperature generally opened fully, the flowers did not shed pollen. Failure of peppers to set fruit at 33 ºC was due to abscission of mature flowers, possibly after a malfunction in flower development, such as incomplete microspore meiosis, resulting in no fertilized flowers. Similar finding was reported by [4].

Number of fruits per plant

It was revealed from the data presented in the [Table-1] on effect of transplanting date, variety and micronutrient that individual as well as combined effect has a significant effect in most of the cases except D×C (Transplanting date and micronutrient) and V×C (Variety and micronutrient).Highest number of fruits were recorded in D2 (November transplanting) 18.23 , 17.40 V2 (Ayesha) and 17.87 C1 (with micronutrient) in case of individual effect of date transplanting, varieties and application of micronutrient.

In the present findings, the middle aged transplants produced more number of fruits than the younger or older transplants. The possible reason seems to be that in case of younger seedlings there was less storage of food needed for vegetative extension, whereas, older transplants were mature enough and limit vegetative extension. Moreover, middle aged seedlings on account of extended lateral branches produced maximum number of fruits per plant than younger or older ones. Maximum number of fruits by middle aged transplants was also reported by [5] in tomato. Contrary to this, [6] reported maximum number of fruits from younger transplants while [7] found more fruits from older transplant

Individual fruit weight (g)

It is clear from the presented data in [Table-1] that the entire factors were statistically significant. Individual fruit weight was higher 174.42g in October transplanting, 169.83g in Ayesha in case of variety and 167.59 g with micronutrient in case of application of micronutrient. The combined effect between the two factors D1V1 (October transplanting of Arya) 179.72 g showed highest fruit weight and that value was statistically similar to D2V2 (November transplanting of Ayesha) 175.93 g and lowest fruit weight was measure in D3V2 (December transplanting of Ayesha) 138.57 g. The combine effect between (date of transplant and micronutrient) D1C1 176.95 g showed superior over the other treatment and combination of (Ayesha with micronutrient) V2C1 142.41g gave the lowest fruits weight whereas 171.80 g micronutrient in Arya was highest one value statistically same with V1C0 (Arya without micronutrient) 167.87 g.

The possible reason for maximum yield using middle aged transplants rather than younger or older transplants seems to be greater number of marketable fruits produced per plant which might have directly contributed towards high fruit yield. Interestingly, the size of the fruits was not affected by of number of fruits. This may be because of higher or enhanced biomass, accumulation of resources and improved water relationship in the plants. In case of younger seedlings there was lesser biomass and less storage of food in terms of solutes needed for cellular elongation and thus less vegetative extension, whereas, older transplants were mature enough, thereby, limiting vegetative extension. Almost identical views have been reported by workers like [5] in tomato who also obtained maximum yield by using middle aged transplants. However, [8] obtained maximum yield by using younger transplants while [9] used older transplants for maximum possible yield.

Individual fruit pericarp thickness (mm)

The data tabulated in regard to pericarp thickness all individual effect was a significant different in different factors. Maximum thickness was observed from 6.26 mm, 6.30 mm and 6.08 mm from December transplanting, Ayesha and with micronutrient as treatment respectively. D3 treatment was statistically same with October transplanting.

Yield (ton) per hectare

Yield of capsicum under polyhouse influenced significantly by the individual factors as presented in the [Table-1]. Maximum yield of 121.92 t/ha was harvested from D2 (November transplanting) lowest value was from D3 (December transplanting) 97.64 t/ha which 27.28 t/ha lower over D2 (November transplanting) statistical significant result was indicated the signify influence of variety and variety V1 Proved the superiorly 117.08 t/ha over DV2 (Transplanting date and Ayesha) 109.10 t/ha. Micronutrient application also influenced on yield of the capsicum 122.34t/ha over without application micronutrient 103.84t/ha.

Total yields were reduced due to late planting. Similar finding were related to [10,11].

Effect of transplanting date, variety and micronutrient on different quality attributing characters of Capsicum

Total chlorophyll (mg/100g) fresh weight

In case of total chlorophyll content maximum chlorophyll content of 22.35 mg/100g was observed D2 (November date of transplanting), 20.32 mg/100g and 21.17mg/100g was noticed from D2 (November date of transplanting) and C1 (micronutrient application) respectively.

Ascorbic acid (mg/100g) fresh weight

Result presented in [Table-2] shown a significant effect on ascorbic acid. All the single and combined factors shown significant effect except V×C (Variety and micronutrient) and D×V×C (transplanting date variety and micronutrient). D1 (October transplanting) 54.67mg/100g, V1 (Arya) 54.65 mg/100g, C1 (Micronutrient application) 54.37 mg/100g were high percent of ascorbic acid in single factor whereas D1V1 (October transplanting of Arya) 56.90 mg/100g, D1C1 (0ctober transplanting with micronutrient) 56.13 mg/100g were high percent of ascorbic acid.

The increase in ascorbic acid content may be due to good growth of plants resulting from higher assimilation of the micronutrients which are made available to the plant due to decompose organic matter. The increased activity of ascorbic acid oxidase enzyme in presence of micronutrients may be concerned to another reason for increase in ascorbic acid content. These findings were found in conformity with those of [12] in brinjal and [13] in capsicum.

Total soluble solid (0 Brix)

Result presented in [Table-2] showed a significant effect on total soluble solid content of fruits and it revealed that all the single and contributed factors showed a significant result statistically except the combination factor V×C (variety and micronutrient), D1 (October transplanting) 4.09 0Brix, V1 (Arya) 4.50 0 Brix, C1 (With micronutrient) 4.33 0 Brix has highly percentage of Total soluble solid in single factors whereas D1V1 (October transplanting of Arya) 4.08 0 Brix, D2C1 (November transplanting with micronutrient) 4.430 Brix were high Total soluble solid. Similar finding was reported [14].

ß carotene (mg/100g) fresh weight

It was noticed from the [Table-2] that a significant effect of all the factors in case of insignificant as well all combined effect in case ß-Carotene content of capsicum fruits. In case of single factor D1 (October transplanting) showed the highest ß-Carotene which was statistically same to D2 (November transplanting) 296.93 mg/100g, V2 (Ayesha) 269.0 mg/100g and C1 (micronutrient application) 298.27 mg/100g was statistically superior on that aspect.

Table-2 *Effect of transplanting date, variety and micronutrient on different quality attributing characters of Capsicum*

Treatment	Total chlorophyll (mg/100g) fresh weight	Ascorbic acid (mg/100g) fresh weight	Total soluble solid (0Brix)	β carotene (mg/100g) fresh weight
Planting Dates				
D1	17.71	54.67	4.09	297.60
D2	22.33	53.32	4.40	296.93
D3	19.78	51.38	4.14	296.65
S. Em (±)	0.18	0.26	0.04	0.15
CD (5%)	0.72	1.07	0.16	0.61
Variety				
V1	19.56	54.65	4.50	225.06
V2	20.32	51.59	3.93	369.06
S. Em (±)	0.14	0.22	0.03	0.12
CD (5%)	0.58	0.87	0.13	0.50
Micronutrient				
C0	18.41	51.87	4.09	295.84
C1	21.47	54.37	4.33	298.27
S. Em (±)	0.14	0.22	0.03	0.12
CD (5%)	0.58	0.87	0.13	0.50

Conclusion

From the present investigation it is concluded that the highest fruit yield was obtained from transplanting on 17th November for variety Arya with micronutrient application (134.64 t/ha). Whereas, significantly higher total soluble solid content was obtained with 27th October transplanting of variety Arya with micronutrient application (5.230Brix) and highest β-carotene content (371.17 mg/100 g) of fruit was recorded for variety Ayesha for the same transplanting date and micronutrient complex application.

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