

## Comparative Studies of Late Planted Capsicum (*Capsicum annum*) for Growth and Yield under Polyhouse and Open Field Condition as Influenced by Different Growth Regulators

S.H. Ansary<sup>1</sup>, N. Mudi<sup>2</sup>, A. K. Chowdhury<sup>3</sup>, N. Gayen<sup>4</sup> and K. Barui<sup>5</sup>

1,2,3,4&5. SMS, Hooghly Krishi Vigyan Kendra, BCKV, ICAR, Chinsurah, Hooghly, West Bengal, India

Corresponding author e-mail: samsulhaqueansary@gmail.com

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### ABSTRACT

A study was conducted on late planted capsicum at instructional farm of Hooghly KVK, W.B. during the period of January-April in the year 2017- 2018 to evaluate the growth and yield performance as influenced by different hormones under polyhouse and open environment. The experiment consisted of two production system, i.e polyhouse and open environment condition with three different hormonal treatments along with a control. The treatments were application of triacontanol @ 0.5 ml/ litre at full bloom stage, application of planofix (4.5%NAA) @ 0.25 ml/ litre at full bloom stage, application of Ethrel @ 0.3 ml/ litre at full bloom stage and control (No use of hormone). All the treatments were laid out following RBD with five replications. The results showed that growth and yield of capsicum were significantly influenced by different hormones under both conditions. All hormonal treatments increased yield in capsicum under both polyhouse and open field condition as compared to non treated plants. Among the hormones, planofix had best effect to increase fruit-set, number of marketable fruits per plant, fruit size and yield. Highest fruit weight (122.2g and 97.4g), number of marketable fruits per plant (5.6 and 4.2) and yield (39.4 t/ha and 28.2 t/ha) were recorded in polyhouse and open field condition respectively under planofix treatment. Whereas, ethrel treatment resulted highest number of total fruits (8.2 and 7.2) in polyhouse and open field condition respectively. Again polyhouse was more effective to increase yield of quality fruits in capsicum than open environment condition. About 40% yield increment was recorded under planofix treatment in polyhouse than open field.

**Key words:** Capsicum; Hormone; Polyhouse; Open field;

**C**apsicum (*Capsicum annum* L.) also known as sweet pepper, bell pepper or Shimla Mirch belongs to the family Solanaceae is one of the most popular vegetables grown throughout India. It is rich in Vitamin A, Vitamin C and minerals like Calcium, Magnesium, Phosphorus, Potassium, etc. Greenhouses may increase crop yields by as much as two to three times as plants grown under open field conditions. The quality of the product is normally higher than open field and the dependency on chemicals is drastically reduced. The quality of fruits particularly flavour, appearance and texture (firmness) may be influenced by the system of production since crops are exposed to varied external environmental conditions (Dull, 1986). Chandra *et al.*, (2000) and Singh *et al.*, (2010) indicated that

polyhouses, poly-tunnels and plastic-mulching are most suitable solutions for yield increase of sweet pepper. Protected structures act as physical barrier and play a key role in integrated pest management by preventing spreading of insects, pests and viruses causing severe damage to the crop (Singh *et al.*, 2003). The use of polyhouse and black plastic mulch, when combined with appropriate planting date, improves early and total yields of bell pepper in areas where the production is constrained by sub-optimal temperature conditions (Dhaliwal *et al.*, 2017). The objective of the study was to identify better growth hormone for increasing fruit-set of late planted capsicum and to compare growth and yield of capsicum as influenced by greenhouse and open field production system.

## METHODOLOGY

The experiment was conducted during 2017-18 (December to April) at Instructional Farm of Krishi Vigyan Kendra, Hooghly, West Bengal. The experimental site comes under subtropical humid region. The average temperature ranges from 15-20°C during December-January and 25-30°C during march-April. The soil of the experimental field was clay loam having high water holding capacity with pH around 6.6. The Capsicum variety taken was 'Delisha' which is a promising high yielding variety having ability to produce fruits under slightly higher temperature. The experiment consisted of two production system, i.e polyhouse and open environment condition with three different hormonal treatments along with a control. The treatments were T-1: application of triacontanol @ 0.5 ml/ litre at full bloom stage, T-2: application of planofix (4.5% NAA) @ 0.25 ml/ litre at full bloom stage, T-3: application of Ethrel @ 0.3 ml/ litre at full bloom stage and T-4: control (No use of hormone).

The experiment was laid out in a Randomized Block Design with five replications. Seedlings of 30 days old were transplanted during second week of December in double row bed system with spacing of 60cm in between rows and 45cm in between plants in both polyhouse and open field condition. Irrigation channels are laid out in between two crop rows. Both organic and inorganic fertilizers were applied as per recommended dose. After application of all basal fertilizers, poly mulch was placed and then planting was done at specified distance. Later foliar spray of water soluble fertilizers like 19:19:19 (N:P:K) was done @ 5g/L at 30 DAT (days after transplanting) and 50 DAT. Micronutrient mixture (comprising Zn, B, Mo, Cu) was sprayed twice @ 2g/L at 40 DAT and 60 DAT. All other general agronomic practices were followed time to time. Harvesting of the crop was started at 70 days after planting. The different observations viz. plant height (cm) at 90 DAT, primary branches per plant, fruit diameter (cm), Average fruit weight (g), Number of marketable and total fruits per plant and Yield (t/ha) were recorded accordingly and the data of different parameters were statistically analyzed.

## RESULTS AND DISCUSSION

*Vegetative growth characters:* Vegetative growth of capsicum was highly influenced under different

production system and application of plant growth hormone further influenced its development.

*Plant height :* Plant height was influenced significantly by different hormonal treatments over control as shown in Table 1. It was noticed that in polyhouse condition all hormonal treatments resulted to keep plant height shorter than control and highest plant height (62.8 cm) was observed in control followed by planofix treatment (57.2 cm). But in open condition highest plant height (41.2 cm) was observed in planofix treatment followed by triacontanol (39.4 cm) whereas ethrel treatment recorded lowest plant height (37.6 cm). In control climate of polyhouse hormones might affected plant height but in open condition it was not happened. Again it was clear that overall plant height was increased under polyhouse than open field. This may be attributed to the enhanced plant metabolic activities like photosynthesis and respiration due to favourable microclimatic condition under polyhouse. Higher plant height of capsicum under polyhouse was also reported by *Ngullie and Biswas (2016)* and *Nkansah et al. (2017)*.

*Number of primary branches per plant :* Number of primary branches per plant was not so much influenced by the treatments and similar branching habit was found in both polyhouse and open condition indicating it is purely varietal character. Although highest number of primary branches per plant was recorded by ethrel treatment under both growing conditions (5.2 and 4.8 in polyhouse and open field respectively) as mentioned in Table 1.

*Fruit characters :* Physical appearance like shape, size and colour of fruits were much influenced by growing environment and more attractive size and colour of fruits were obtained under polyhouse condition than open field. Good quality of capsicum fruits was due to growing of fruits under proper climatic condition. In polyhouse filtered sunlight might result dark green colour of fruits. Increase fruit size was due to proper utilization of nutrients and freshness of fruits was due to protection against insect-diseases and all abiotic stress.

*Fruit diameter and fruit weight:* Fruit diameter and fruit weight were significantly varied by different treatments both under polyhouse and open field condition as in Table 2. Hormonal treatments increased fruit diameter and fruit weight of capsicum. Highest fruit diameter (7.22 cm and 6.58 cm respectively) and fruit weight (122.2 g and 97.4 g respectively) were recorded under planofix treatment in both polyhouse and open

**Table 1. Effect of growth regulators on vegetative growth of capsicum under polyhouse and open field condition**

Treatments	Plant height (cm) at 90 DAT		Number of primary braches/plant	
	Poly house	Open field	Poly house	Open field
T-1	50.2	39.4	4.0	4.6
T-2	57.2	41.2	4.4	4.4
T-3	56.8	37.6	5.2	4.8
T-4 (Control)	62.8	38.6	4.6	3.8
SEm(±)	2.344	0.733	0.303	0.264
CD (at 5%)	7.22	2.26	0.93	0.82

conditions, whereas ethrel resulted smaller fruits among the hormones. It was obvious that both fruit diameter and fruit weight were increased under polyhouse over open field. Better microclimatic condition might help proper utilization of nutrients which led to larger fruit. *Ngullie and Biswas (2016)* also reported higher fruit diameter and fruit weight of capsicum grown under polyhouse. *Singh et al. (2011)* stated that hybrid sweet pepper 'Tanvi' produced maximum fruit diameter, number of fruits/plant, individual fruit weight and yield in protected cultivation.

**Yield component and Yield characters :** The yield and yield components were significantly influenced by different hormonal treatments and experimental results under Table 3 showed that all hormones had positive effect on fruit setting and yield.

Maximum number of marketable fruits per plant (5.6 and 4.2 respectively) was recorded under planofix treatment in both polyhouse and open field condition but ethrel recorded highest number of total fruits per plant (8.2 and 7.2 respectively) in both conditions. Fruits per plant were increased in polyhouse by all the treatments as compared to open field. Better microclimate under polyhouse led to increase fruit setting ability in capsicum. *Kanwar et al., (2014)* found higher number of fruits per plant in bell pepper under greenhouse growing condition. All the treatments significantly increased yield over control both in polyhouse and open field conditions. Yield increment was due to increase fruit size and fruit number per plant. Highest yield (39.4 t/ha and 28.2 t/ha respectively) was obtained under planofix treatment followed by ethrel in both polyhouse and open field condition. *Das et al. (2015)* opined that application of 4-CPA @ 2000 ppm

**Table 2. Effect of growth regulators on fruit characters of capsicum under polyhouse and open field condition**

Treatments	Fruit Diameter (cm)		Avg. Fruit weight (g)	
	Poly house	Open field	Poly house	Open field
T-1	7.04	6.06	117.8	84.8
T-2	7.22	6.58	122.2	97.4
T-3	6.62	5.92	107.2	85.6
T-4 (Control)	6.58	5.76	102.4	81.2
SEm(±)	0.1007	0.163	1.532	1.278
CD (at 5%)	0.31	0.50	4.72	3.94

increase fruit set and yield by reducing flower and fruit drop in capsicum.

This result is in agreement with the findings of *Hasanuzzaman et al. (2007)* and *Appireddy et al. (2008)* where they reported that, plant growth regulators increase the yield of bell pepper. The higher fruit yield under polyhouse condition may be attributed favourable climatic condition under polyhouse and protective ability against biotic and abiotic stresses (*Singh et al., 2010* and *Ngullie and Biswas, 2016*). Similarly, *Zende (2008)* and *Brar et al. (2005)* also reported higher fruit weight and yield of capsicum under polyhouse. *Dhaliwal et al. (2017)* reported that the use of polyhouse and black plastic mulch, when combined with appropriate planting date, improves early and total yields of bell pepper in areas where the production is constrained by sub-optimal temperature conditions.

## CONCLUSION

Based on the experimental results, it can be concluded that all hormonal treatments increased yield in capsicum under both polyhouse and open field condition. Among the hormones, planofix had best effect to increase fruit-set, number of fruits per plant, fruit

**Table 3. Effect of growth regulators on number of fruits & yield of capsicum under polyhouse and open field condition**

Treatments	No. of marketable		No. of total fruits/plant		Yield (t/ha) fruits/plant	
	PH	OF	PH	OF	PH	OF
T-1	5.2	4.0	7.6	6.2	36.4	23.8
T-2	5.6	4.2	7.8	6.8	39.4	28.2
T-3	5.4	4.0	8.2	7.2	37.4	24.8
T-4 (Control)	4.6	3.6	6.8	5.2	27.6	18.2
SEm(±)	0.265	0.268	0.297	0.339	0.666	0.486
CD (at 5%)	0.82	0.82	0.92	1.04	2.05	1.50

PH=Poly house; OF=Open field

size and yield. Ethrel had some positive effect to increase total fruit number per plant and yield. Again under polyhouse due to better microclimatic situation and protection from biotic & abiotic hazards yield of capsicum was considerably increased as compared to open field. About 40% yield increment was recorded under planofix treatment in polyhouse than open field.

Therefore, cultivation of capsicum with application of hormones particularly planofix can bring ample scope for increasing crop yield in late planted capsicum to fetch more profit for the farmers. Again polyhouse can be effectively utilized for capsicum cultivation with application of planofix to increase more yield of quality fruits for getting better remuneration.

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