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To workout, the effect of plant growth regulators on economics of sweet pepper under naturally ventilated polyhouse

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Abstract
The present investigation entitled "Effect of plant growth regulators on growth, yield and quality parameters in sweet pepper (*Capsicum annum* L.) under naturally ventilated polyhouse" was conducted at Vegetable Research Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during two consecutive Rabi season 2020-21 and 2021-22 to find out the effect of PGRs and their spray schedules on sweet pepper under protected cultivation. The experiment was laid out in Factorial Randomized Block Design with 12 treatment combinations and replicated thrice. The experiment comprised four levels of plant growth regulators *viz*., NAA @ 50 ppm (P1), NAA @ 100 ppm (P2), Triacontanol @ 5 ppm (P3) and Triacontanol @ 10 ppm (P4) and three spray schedules *viz*., spray at 30 & 45 DAT (I1), spray at 30, 45 & 60 DAT (I2) and spray at 30, 45, 60 & 75 DAT (I3). higher monetary benefit (net return of Rs. 200102 and C:B ratio of 1:3.69) were observed with Triacontanol @ 10 ppm and spray schedule at 30, 45, 60 and 75 days after transplanting (DAT).

Keywords: Plant growth regulators, economics, sweet pepper, naturally ventilated polyhouse

Introduction
The genus sweet pepper (*Capsicum annuum* L. var. grossum Sendt; 2n=24) is belongs to the family solanaceae. It is one of the very profitable vegetable, cultivated throughout the world. Now-a-days, it is very valuable vegetable crop of India because of its pleasant flavour, taste and nutrients and coupled with rich content of ascorbic acid and other vitamins and minerals.
Among the various protected structures, polyhouse production had been proven as more profitable protected technique for capsicum cultivation (Aruna and Sudagar, 2010) [2]. Polyhouse/greenhouse production of capsicum emphasizes appropriate planting densities to boost-up the total production per unit area by utilizing the space available and nutrient applied. Now-a-days, decreasing land holding for crop cultivation hinders the availability of land under vegetable crops, further year around availability of good quality capsicum endorses the cultivation of capsicum under protected environmental conditions such as greenhouse or polyhouse.
Auxins are used in commercial farming to control fruit drop and to improve fruit quality (Almeida *et al*., 2004) [6] and it has been reported that polar auxin transport may play a major role in growth, floral, yield and yield related traits. Foliar application of NAA enhances the vegetative growth by way of increasing the stem length and leaf number. Application of NAA in crops like tomato and peppers have resulted in, increased production of flower and fruit set as well as yield. Fruit quality parameters such as fruit size, TSS, ascorbic acid contents in tomato can be increased with the exogenous application of NAA. NAA improves the internal physiology of plants in terms of better supply of water, nutrients and other bio-compounds vital for their proper growth and development. Ample works have been done by several scientists about the effect of plant growth regulators on growth, yield and fruit quality of vegetable crops under open field conditions. Yet there is further need to estimate region specific efficient plant growth regulators, their accurate concentration and time of application (spray schedule) to enhance the yield and quality of sweet pepper under protected conditions

Material and Methods
The present investigation entitled "Effect of Plant Growth Regulators on Growth Parameters of Sweet Pepper under Naturally Ventilated Polyhouse." was conducted during Rabi season of 2020-21 and 2021-22 at Vegetable Research Farm, Department of vegetable science

Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur.

The experiment comprises four levels of plant growth regulator and three levels of spray schedule, thus the total no. of treatment combinations was twelve. NAA @ 50 ppm (P1), NAA @100 ppm (P2), Triacontanol @ 5 ppm (P3) and Triacontanol @10 ppm (P4). The experiment was laid out under naturally ventilated poly house having an area of 200 m2 for raising crop. The irrigation and fertigation were applied through drip system. The experiment was carried out in Factorial Randomized Block Design with three replications. In all, there were twelve treatment combinations and were randomly allotted to different plots/beds with the help of fisher' random number table (Fisher, 1950). The observation to be recorded plant height(cm), number of branches/plant, intermodal length, stem girth (cm), number of flowers per plant, days to 50% flowering and days to first fruit set. In the experiment the cost of input, field preparation and other cost were taken into consideration for cost of cultivation. The gross return was recorded by the sums of all the sales of harvestings of fruits. Net return was calculated by subtracting cost of cultivation from gross return and B:C ratio was calculated by dividing gross return from cost of cultivation. These observations were taken from each treatment.

Result and Discussion

The economics of sweet pepper crop was affected by different treatments of plant growth regulators and spray schedule. The data recorded on economics were statistically analyzed and are presented in Table 4.40. Economic of sweet pepper production was worked out by considering the market price of inputs and produce and computed on an area of 1000 m2. The total cost of NVPH was calculated based on rental value of the structure.

On the basis of mean values of two years study, the cost of cultivation was worked highest (Rs. 74278) with the combination of Triacontanol @ 10 ppm and spray schedule of 30, 45, 60 and 75 days after transplanting (DAT). Similarly, the gross return (Rs. 274380), net return (Rs. 200102) and C:B ratio (1:3.69) were also maximum with the application of Triacontanol @ 10 ppm at 30, 45, 60 and 75 days after transplanting (DAT). It was followed by combination of application of NAA @ 100 ppm and spray schedule of 30, 45, 60 & 75 DAT with gross return of Rs. 267300, net return of Rs. 193028 and C:B ratio of 1:3.59. The lowest return was found with application of NAA @ 50 ppm at 30 and 45 DAT.

Table 1: Economics as influenced by different levels of plant growth regulator and spray schedule of sweet pepper (Mean values of 2020-21 & 2021-22) (Area: 1000 m^2)

Treatment	Cultivation cost	Gross return	Net return	C:B ratio
NAA @ 50 ppm + spray at 30 & 45 DAT	73786	184440	110654	1:2.49
NAA @ 50 ppm + spray at 30, 45 & 60 DAT	74014	212640	138626	1:2.87
NAA @ 50 ppm + Spray at 30, 45, 60 & 75 DAT	74242	225840	151598	1:3.04
NAA @ 100 ppm + spray at 30 & 45 DAT	73816	246660	172844	1:3.34
NAA @ 100 ppm + spray at 30, 45 & 60 DAT	74059	256920	182861	1:3.46
NAA @ 100 ppm + spray at 30, 45, 60 & 75 DAT	74272	267300	193028	1:3.59
Triacontanol @ 5 ppm + spray at 30 & 45 DAT	73780	195000	121220	1:2.64
Triacontanol @ 5 ppm + spray at 30, 45 & 60 DAT	74005	203820	129815	1:2.75
Triacontanol @ 5 ppm + spray at 30, 45, 60 & 75 DAT	74230	216780	142550	1:2.92
Triacontanol @ 10 ppm + spray at 30 & 45 DAT	73804	245820	172016	1:3.33
Triacontanol @ 10 ppm + spray at 30, 45 & 60 DAT	74041	255360	181319	1:3.44
Triacontanol @ 10 ppm spray at 30, 45, 60 & 75 DAT	74278	274380	200102	1:3.69

*Avg. sale rate @ Rs. 60/- per kg

In present investigation, concluded that the maximum monetary benefit was found with the application of Triacontanol @ 10 ppm at 30, 45, 60 and 75 days after transplanting (DAT). This might be due to higher fruit yield of sweet pepper resulted in higher net return by crop.

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