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Effect of gibberellic acid on growth, yield and quality parameters of chilli (*Capsicum annum* L.)

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Abstract
The present investigation was carried out at the experimental field of Faculty of Agriculture, Horticulture Department, A.K.S. University, Satna (M.P.) in the year 2017-18. The experiment include 3 combinations of Gibberellic acid along with control viz. 0 PPM- GA_0, 50 PPM- GA_1,100 PPM- GA_2, and150 PPM- GA_3 replicated 5 times using randomized block design. It was observed in the application of GA3 @ 150 PPM found significantly superior over other treatments in terms of plant height at 30 DAT, 60 DAT and at harvest (76.82 cm, 116.14 cm, 141.58 cm), No of branches/plant at 30 DAT and at harvest (28.37 and 50.73), fruit length (29.74 cm), fresh weight of 10 fruits of chilli (109.85 g), number of fruits/plant (127.91), fruit yield/plant (636.04 g), fruit yield/ha (25.70 t/ha) and vitamin C content (98.49 mg/100 g).

Keywords: GA_3, growth, yield, quality, chilli

Introduction
Chilli (*Capsicum annuum* L.) is an important spice cum-vegetable crop cultivated extensively in India. Chilli (*Capsicum annum* L.) belongs to the family solanaceae, is an important commercial spice cum vegetable crop of India. Chilli forms an essential ingredient of Indian curry. There is no spice probably so popular as chilli and no other spice hasbecome such an indispensable ingredient of the daily food of majority people of the world. Chilli is famous for its pleasant aromatic flavour, pungency and high colouring substance. It is used widely in culinary, pharmaceutical and beverages industries. Hence, chilli finds diverse utility as spice, condiment, culinary supplements, medicine and vegetable, besides it is an important commercial crop.

Chilli occupies an area, production and productivity were estimated to be 9.5 lakh hectare, 10-10.5 lakh tonnes and 8.6 t/ha respectively during 2014-15 However, in Madhya Pradesh chilli is cultivated in 47.091 thousand hectares of area with total annual production of 42.9 thousand tonnes of dry chilli (Anonymous, 2014-15). India is the world largest producer, consumer and exporter of chilli. Guntur in Andhra Pradesh is produces 30% of chilli particularly in India. Even though chilli is ahigh values commodity, which has the potential for improving the income and the livelihood of thousands of small holder farmers.

Gibberellic acid (GA_3) is a phytohormone that is needed in small quantities at low concentration to accelerate plant growth and development. GA_3also increases the plant height, weight of shoot and root of the plant. Chemically speaking, gibberellins are actually acids. They are produced in the plant cell's plastids or the double membrane-bound organelles responsible for making food and are eventually transferred to the endoplasmic reticulum of the cell, where they are modified and prepared for use. Gibberellins are often used for promotion of fruit set in some fruit vegetable production including tomatoes and yields can increase dramatically to four times Abdulla *et al*. (1978).

Material and Methods
The present investigation was conducted to explore the production potential of chilli. The experiment was conducted at the experimental field of Faculty of Agriculture, Horticulture Department, A.K.S. University, Satna (M.P.) in the year 2017-18. The topography of the experimental field was uniform with adequate irrigation and drainage facilities. The experiment include 3 combinations of Gibberellic acid along with control viz. 0 PPM- GA_0, 50 PPM- GA_1,100 PPM- GA_2, and150 PPM- GA_3 replicated 5 times using randomized block design. The data collected for all the characters involved under study were subjected to the statistical scrutiny (analysis) for proper interpretation. The standard method of analysis of variance technique appropriate to the Randomized Block Design as described by Panse and Sukhatme (1967) was used.

The treatment differences were tested by employing 'F' test at five per cent level of significance on the basis of null hypothesis. The appropriate standard errors (S.Em.±) were calculated in each case and the Critical Difference (C.D.) at five per cent level of probability was worked out to compare the two treatment means, where the treatment effects were found significant under 'F' test. The percentage co-efficient of variation (C.V. %) was also worked out for all the cases.

Results and Discussion

The data pertaining to plant height at 30, 60 DAT and at harvest as influenced by different concentrations of Gibberellic acid. The result shows that plant height at 30DAT was influenced significantly due to different concentrations of Gibberellic acid. The plant height in general increasedy multifold between 30 DAT and up to the harvest stage. At 30 DAT stage, it rangedfrom 60.49 to 76.82cm. The data presented in Table 1 revealed that maximum plant height (76.82cm) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 75.76cm with GA3 @ 100 PPM. Whereas minimum plant height (60.49cm) was noted in (Control, 0 PPMGA3) at 30 DAT.

The result showed that plant height at 60DAT significantly higher plant height (116.14cm) was recorded in the application of GA3 @ 150 PPM followed by plant height (113.48cm and 107.55cm) in the application of GA3 @ 100 PPM and 50 PPM, respectively and least plant height (85.57cm) was recorded in (Control, GA3 @ 0 PPM).

At the harvesting stage plant height ranged from 104.22 to 141.58cm. The maximum plant height (141.58cm) was observed in the GA_3 @ 150 PPM found significantly superior over other treatments and closely followed by 138.82cm with GA3 @ 100 PPM. Whereas minimum plant height (104.22 cm) was noted in (Control, 0 PPM GA3) at harvest.

The result shows that number of branches per plant at 30 DAT was influenced significantly due to different concentrations of growth regulator of Gibberellic acid. The number of branches per plant in general increased by multifold between 30 DAT and up to the harvest stage. Maximum number of branches per plant (28.37) at 30 DAT was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 27.87 with GA3 @ 100 PPM, Whereas minimum number of branches per plant (25.73) was noted in (Control, 0 PPM GA3) at 30 DAT.

The maximum number of branches per plant (50.73) was observed in the GA_3 @ 150 PPM found significantly superior over as treatments and closely followed by 48.65with GA3 @ 100 PPM. Whereas minimum number of branches per plant (45.57) was noted in (Control, 0 PPM GA3) at harvest.

The data pertaining to fruit length (cm) as influenced by different growth regulators was statistically analyzed and presented in Table 1. Result revealed that maximum fruits length (29.74 cm) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 29.27 cm with GA3 @ 100 PPM. Whereas minimum fruits length (23.78 cm) was noted in (Control, 0 PPM GA3).

The data pertaining to fruits width (cm) revealed that maximum fruits width (5.76 cm) was observed in the GA3 @ 100 PPM found significantly superior over other treatments and closely followed by 5.34 cm with GA3 @ 50 PPM. Whereas minimum fruits width (4.72 cm) was noted in (Control, 0 PPM GA3).

The data pertaining to fresh weight of 10 fruits (g) revealed that maximum fresh weight of fruits (109.85 g) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 105.65 g with GA3 @ 100 PPM. Whereas minimum fresh weight of fruits (69.88 g) was noted in (Control, 0 PPM GA3).

The data pertaining to number of fruits per plant revealed that maximum number of fruits/ plant (127.91) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 118.64with GA3 @ 100 PPM. Whereas, minimum number of fruits/ plant (78.12) was noted in (Control, 0 PPM GA3).

The maximum fruit yield/ plant (636.04g) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 610.83 g with GA3 @ 100 PPM. Whereas, minimum fruit yield/ plant (447.47 g) was notedin (Control, 0 PPM GA3).

The maximum fruit yield/ ha (25.70 t) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 24.57 t with GA3 @ 100 PPM. Whereas, minimum fruit yield/ ha (18.62 t) was noted in (Control, 0 PPM GA3).

Result revealed that maximum Vit- C content (98.49mg) was observed in the GA3 @ 150 PPM found significantly superior over other treatments and closely followed by 98.46 mg with GA3 @ 100 PPM. Whereas, minimum Vit- C content (96.66mg) was noted in (Control, 0 PPM GA3).

Maximum plant height (76.82, 116.14and 141.58cm), maximum number of branches/plant (28.37 at 30 DAT and 50.73 cm at harvest) and maximum number of leaves/ plant (165.66, 209.79and 274.47) are obtained at 30, 60 DAT and at harvest as with the application with the GA_3 @ 150 PPM which was followed by GA_3 @ 100 PPM concentration of growth regulator in chilli.

These results are agreement with that reported by Natesh *et al*. (2005) [7], Kalshyam *et al*. (2011) [5], Vaishnav *et al*. (2012) [12], Shahid *et al*., Vandana *et al*. (2014) [13], and Patel *et al*. (2016) [9].

It was observed that there was sizeable improvement in all yield parameters with GA_3. GA_3 @ 150 PPMbeing significantly superior over the other treatments. Thus, it is clear that yield of chilli in was maximum (25.70t/ha) at GA_3 @ 150 PPM which closely followed by GA_3 @ 100 PPM.

These results are supported by the findings of Joshi and Singh 2001) [4], Sultana etal. (2006) [11], Sridhar *et al*. (2009) [10], Athaneria *et al*. (2011) [1], Vaishnav *et al*. (2012) [12], Kiranmayi *et al*. (2014) [6], Vandna *et al*. (2014) [14].

The application of higher concentration of GA_3 with proper age of seedling, besides increasing the yield and quality it also helps in enhancing ascorbicacid content in the fruits of chilli. These results are in accordance with the findings of Chavan *et al*. (1997) [2] in chilli.

Table 1: Effect gibberellic acid on growth, yield and quality parameters of chilli

Treatment	Plant height (cm) of chilli at			Number of branches/ plant at		Fruit Length (cm)	Fruit Width (Cm)
	30 DAT	60 DAT	Harvest	30 DAT	Harvest		
GA_0	60.49	85.57	104.22	25.73	45.57	23.78	4.72
GA_1	74.24	107.55	131.96	27.40	47.33	28.51	5.34
GA_2	75.76	113.48	138.82	27.87	48.65	29.27	5.76
GA_3	76.82	116.14	141.58	28.37	50.73	29.74	5.02
SEm±	0.29	0.29	0.58	0.05	0.13	0.11	0.05
CD(P=0.05)	0.98	0.97	1.92	0.16	0.42	0.35	0.17

Treatment	fresh weight of 10 fruits of chilli (g)	Number of fruits of chilli/plant	fruit yield/ plant of chilli (g)	fruit yield/ ha of chilli (t)	Vitamin-C content of chilli (mg/100g)
GA_0	69.88	78.12	447.47	18.62	96.66
GA_1	99.34	111.97	578.45	23.48	98.03
GA_2	105.65	118.64	610.83	24.57	98.46
GA_3	109.85	127.91	636.04	25.70	98.49
SEm±	0.50	0.55	1.17	0.08	0.10
CD(P=0.05)	1.65	1.85	3.91	0.25	0.30

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