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Combined effect of exogenously applied potassium and gibberellic acid on quality parameters in parthenocarpic cucumber (*Cucumis sativus* L.) cv. Sania (F1) under protected condition

Saurabh Toppo, Annu Verma, Praveen Gupta and Sukwariya Devi

Abstract
A field experiment was conducted to study the combined effect of Potassium and Gibberellic acid on quality parameters in parthenocarpic cucumber (*Cucumis sativus* L.) cv. Sania (F1) under low poly tunnel. This experiment was carried out under low poly tunnel during 2019-20 and 2020-21 at Centre of Excellence on Protected Cultivation and Precision Farming, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experiment was laid out in a Factorial Randomized Block Design replicated thrice with ten treatments i.e. Control (Water spray), G1K1 - (Potassium 1000 g.dm-3+GA3 5 g.dm-3), G1K2 - (Potassium 2500 g.dm-3+ GA35 g.dm-3), G1K3 - (Potassium 5000 g.dm-3+GA35 g.dm-3), G2K1 - (Potassium 1000 g.dm-3+GA3 10 g.dm-3), G2K2 - (Potassium 2500 g.dm-3+GA3 10 g.dm-3), G2K3 - (Potassium 5000 g.dm-3+GA3 10 g.dm-3), G3K1 - (Potassium 1000 g.dm-3+GA3 15 g.dm-3), G3K3- (Potassium 2500 g.dm-3+GA3 15 g.dm-3), G3K3 - (Potassium 5000 g.dm-3+GA3 15 g.dm-3). The result shows that maximum moisture content (94.71% and 94.34%) in and dry matter content (5.16% and 5.31%) was recorded G2K2 (10 ppm + 5000 ppm), maximum starch content (6.18% and 6.13%) was recorded in G2K3 (10 ppm + 5000 ppm) and maximum total soluble solids (3.38% and 4.00%) was recorded in G3K3 (15 ppm + 5000 ppm) during the year 2019-20 and 2020-21, respectively.

Keywords: Potassium, gibberellic acid, starch etc.

Introduction
Cucumber (*Cucumis sativus*), an annual trailing vine vegetable belonging to Cucurbitaceae family, is the most widely grown vegetable of the family after watermelon. The demand and supply for cucumber has been expeditiously increased in the last few years and now it is grown throughout the world using fields or greenhouse culture. It has a diploid chromosome number of 14, 2n= 14 (Kadi *et al*., 2018) [2]. Although it is very watery, with little flavor and not very nutritious, it is a common ingredient of salads and pickles, being valued primarily for its crisp texture and juiciness. The fruits are extremely nutritive and con-sist of 95% water, extremely small calories (about 15 calories per cup) reported by Mukherjee *et al*. (2013) [4]. The fruit also consists of calcium (20mg/100g), iron (0.7mg/100g), thiamin (0.3mg/100g), niacin (0.01mg/100gm) and some natural antioxidants that reduce chronic diseases (Trichopoulou *et al*., 2000; Mia *et al*., 2014) [9, 3]. It is very rich in antioxidants and vitamin K and C (Jyoti *et al*., 2016) [1]. The major problem is maleness in cucumber which greatly decrease the fruit yield (Singh *et al*., 2015) [8]. The cucumber grows best in a semitropical climate. It flourishes well under environment of high temperature, humidity, and light intensity and with an uninterrupted irrigations and appropriate nutrients supply. Under favourable and suitable climatic and nutritional conditions and when pests are under control, the plants grow fast and yield heavily. Under excellent environments, more fruit may initially develop, so fruit may need thinning. Plants allowed to bear too much fruit become exhausted, abort fruit, and fluctuate widely in productivity over time. On the other hand, cucumbers are very sensitive to unfavourable environments, and the slightest stress has negative impacts on their growth and fruit yield. When cucumber could not meet the criteria of these environmental requirements, the effects are seen in the growth pattern, fruiting, flowering, and fruit yield and hence the need of application of PGRs will emerge whose applications shape the growth and development of the plants in right way. PGRs such as gibberellin include many aspects of plant growth and development. They are organic substances that are used in low concentration to change the plant growth usually by stimulating part of the natural growth regulatory system.

Due to the importance of plant growth regulators has been classified and inadequate data on the effect of PGRs on growth and yield in cucumber was observed. Therefore, an experiment was laid out to find out their impact on quality parameters of cucumber.

Materials and Methods

The proposed experiment was conducted under low poly tunnel during 2019-20 and 2020-21 at Centre of Excellence on Protected Cultivation and Precision Farming, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The experimental material consisted of Sania (F1) cultivar of cucumber, Potassium and gibberellic acid. Experiment was laid out in Factorial Randomized Block Design with additional treatment as control versus others having three replications. Foliar spray of three concentration of potassium (K1 - 1000 g.dm-3, K2 - 2500 g.dm-3, K3 - 5000 g.dm-3) and gibberellic acid (G1 - 5 g.dm-3, G2 - 10 g.dm-3, G3 - 15 g.dm-3) each were performed in cucumber plant. Spraying of K was performed twice a week, 1st after 20 days of sowing. Spraying of GA3 was performed twice. 1st on the 30th day after sowing and then on the 60th day. Cucumber was transplanted at a spacing of 1 m x 0.50 m. Data were recorded on four important characters related to quality characters i.e. moisture content, dry matter content, starch content and total soluble solids during the course of investigation which were subjected to statistical analysis of two years and pooled mean data using suitable techniques of different characters.

Results and Discussion

Moisture content (%): Moisture content was not significantly affected due to treatment with potassium, gibberellic acid and combination of potassium and gibberellic acid treatment during the year 2019-20 and 2020-21. Among potassium treatments, maximum moisture content was recorded (92.93% and 92.85) in K1 – 5000 ppm followed by K2 – 2500 ppm (92.57% and 92.45%), K3 – 1000 ppm (92.12% and 91.01%) during 2019-20 and 2020-21, respectively.

Among gibberellic acid treatments, maximum moisture content was recorded (93.08% and 93.18%) in G2 – 10 ppm followed by G1 – 5 ppm (92.39% and 92.10%), G3 – 15 ppm (92.15% and 92.04%) during 2019-20 and 2020-21, respectively.

Among different combinations of potassium and gibberellic acid, maximum moisture content was recorded (94.71% and 94.34%) in G K – 10 ppm + 5000 ppm followed by G K 2(94.67% and 93.58%), G K (93.33% and 92.94%) and G K (92.26% and 92.55%) in year 2019-20 and 2020-21, respectively. Under these combinations, minimum moisture content was recorded (90.78% and 90.55%) in G1K3 during 2019-20 and 2020-21, respectively. Minimum moisture content (90.03% and 90.08%) was recorded in water sprayed (control) as compared to other treatments during 2019-20 and 2020-21.

Dry matter content (%): Dry matter content was not significantly affected due to treatment with potassium, gibberellic acid and combination of potassium and gibberellic acid treatment during the year 2019-20 and 2020-21.

Among potassium treatments, maximum dry matter content was recorded (4.65% and 4.84%) in K1 – 5000 ppm followed by K2 – 2500 ppm (4.43% and 4.69%), K3 – 1000 ppm (4.28% and 4.61%) during 2019-20 and 2020-21, respectively.

Among gibberellic acid treatments, maximum dry matter content was recorded (4.70% and 5.00%) in G2 – 10 ppm followed by G1 – 5 ppm (4.37% and 4.61%), G3 – 15 ppm (4.29% and 4.52%) during 2019-20 and 2020-21, respectively.

Among different combinations of potassium and gibberellic acid, maximum dry matter content was recorded (5.16% and 5.31%) in G2K2 – 10 ppm + 5000 ppm followed by G1K1 (5.11% and 5.29%), G3K3 (4.68% and 5.02%) and G2K (4.64% and 4.91%) in year 2019-20 and 2020-21, respectively. Under these combinations, minimum dry matter content was recorded (3.86% and 4.01%) in G1K3 during 2019-20 and 2020-21, respectively. Minimum dry matter content (3.81% and 3.86%) was recorded in water sprayed (control) as compared to other treatments during 2019-20 and 2020-21. Similar opinion was reported by Pal *et al*., 2016 [6] in cucumber.

Starch content (%): Starch content was not significantly affected due to treatment with potassium and gibberellic acid, combination of potassium and gibberellic acid treatment during the year 2019-20 and 2020-21.

Among potassium treatments, maximum starch content was recorded (6.00% and 5.99%) in K3 – 5000 ppm followed by K2 – 2500 ppm (5.66% and 5.71%), K1 – 1000 ppm (5.37% and 5.39%) during 2019-20 and 2020-21, respectively.

Among gibberellic acid treatments, maximum starch content was recorded (5.96% and 5.93%) in G2 – 10 ppm followed by G1 – 5 ppm (5.82% and 5.83%), G3 – 15 ppm (5.25% and 5.33%) during 2019-20 and 2020-21, respectively.

Among different combinations of potassium and gibberellic acid, maximum starch was recorded (6.18% and 6.13%) in G2K3 – 10 ppm + 5000 ppm followed by G1K3 (6.03% and 6.04%), G2K2 (5.99% and 6.03%), G1K2 (5.99% and 5.98%) in year 2019-20 and 2020-21, respectively. Under these combinations, minimum starch content was recorded (4.98% and 5.09%) in G3K1 during 2019-20 and 2020- 21, respectively. Minimum starch content (12.73% and 20.50%) was recorded in water sprayed (control) as compared to other treatments during 2019-20 and 2020-21. Similar opinion was reported by Pal *et al*., 2018 [5] in cucumber.

TSS (%): TSS was not significantly affected due to treatment with potassium, gibberellic acid and combination of potassium and gibberellic acid treatment during the year 2019-20 and 2020-21.

Among potassium treatments, maximum TSS was recorded (3.28% and 3.92%) in K3 – 5000 ppm followed by K2 – 2500 ppm (3.21% and 3.81%), K1 – 1000 ppm (3.13% and 3.71%) during 2019-20 and 2020-21, respectively.

Among gibberellic acid treatments, maximum TSS was recorded (3.27% and 3.87%) in G3 – 15 ppm followed by G1 – 5 ppm (3.22% and 3.85%), G2 – 10 ppm (3.13% and 3.73%) during 2019-20 and 2020-21, respectively.

Among different combinations of potassium and gibberellic acid, maximum TSS was recorded (3.38% and 4.00%) in G3K3 – 15 ppm + 5000 ppm followed by G1K3 (3.29% and 3.93%), G3K2 (3.28% and 3.83%), G1K2 (3.23% and 3.83%) in year 2019-20 and 2020-21, respectively. Under these combinations, minimum TSS was recorded (3.10% and 3.60%) in G2K1 during 2019-20 and 2020-21, respectively. Minimum TSS (12.73% and 20.50%) was recorded in water sprayed (control) as compared to other treatments during 2019-20 and 2020-21. Highest TSS was recorded in potassium 5000 ppm and gibberellic acid at 10 ppm compared

to other treatments. The increase in TSS in the fruits appears to be the result of metabolite accumulation, which promoted the function of a number of enzymes in the physiological process, which, in turn, hydrolized starch and aided metabolic activity during the conversion of available starch into sugar and TSS. Similar opinion was observed by Hidayatullah *et al*., 2011 [10], Pandey *et al*., 2020 [7] in cucumber.

Table 1: Mean performance of moisture content (%), dry matter content (%), starch content (%) and TSS (%) in parthenocarpic cucumber

Treatments	Moisture content (%)	Dry matter content (%)	Starch content (%)	TSS (%)
Potassium				
K1 (1000 g.dm-3)	92.25	4.49	5.52	3.53
K2 (2500 g.dm-3)	93.13	4.85	5.94	3.43
K3 (5000 g.dm-3)	92.09	4.41	5.29	3.57
S.Em±	0.16	0.016	0.05	0.02
CD(0.05)	1.94	0.190	0.65	0.25
GA3				
G1 (5 g.dm-3)	92.89	4.75	5.38	3.42
G2 (10 g.dm-3)	92.51	4.56	5.68	3.51
G3 (15 g.dm-3)	92.07	4.44	5.99	3.60
S.Em±	0.16	0.016	0.05	0.02
CD(0.05)	1.94	0.190	0.65	0.25
Interaction				
G1K1 (1000 g.dm-3+5 g.dm-3)	94.13	5.20	5.44	3.45
G1K2 (2500 g.dm-3+5 g.dm-3)	91.95	4.34	5.98	3.53
G1K3 (5000 g.dm-3+5 g.dm-3)	90.67	3.94	6.04	3.61
G2K1 (1000 g.dm-3+10 g.dm-3)	92.46	4.78	5.66	3.35
G2K2 (2500 g.dm-3+10 g.dm-3)	94.53	5.24	6.01	3.44
G2K3 (5000 g.dm-3+10 g.dm-3)	92.41	4.54	6.16	3.50
G3K1 (1000 g.dm-3+15 g.dm-3)	92.09	4.26	5.04	3.46
G3K2 (2500 g.dm-3+15 g.dm-3)	91.06	4.12	5.05	3.56
G3K3 (5000 g.dm-3+15 g.dm-3)	93.14	4.85	5.78	3.69
S.Em±	0.48	0.05	0.16	0.06
CD(0.05)	3.37	0.33	1.12	0.44
Control	90.06	3.84	4.94	3.25
S.Em±	0.05	0.005	0.02	0.01
CD(0.05)	2.05	0.200	0.68	0.27

Conclusion

It is concluded that among several treatments G2K2 (10 ppm + 5000 ppm) was found superior over others in quality parameters such as moisture content and dry matter content, whereas G2K3 (10 ppm + 5000 ppm) and G3K3 (15 ppm + 5000 ppm) was found superior over others in starch content and total soluble solids, respectively.

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