

EFFECT OF PINCHING AND PACLOBUTRAZOL ON *HIBISCUS ROSA-SINENSIS*, L. cv. "Yellow" PLANT

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ABSTRACT: A pot experiment was carried out during two successive seasons 2014/2015 and 2015/2016 at the experimental nursery of Ornamental Plants and Landscape Gardening Department, Hort. Res. Inst. to study the effect of pinching and paclobutrazol (PP₃₃₃) on growth, flowering and chemical composition of *Hibiscus rosa-sinensis*, L. cv. "Yellow" to produce dwarfed plants. Plants were pinched before treating with paclobutrazol (0.0, 3 and 4 ppm as a drench at 250 cm³/pot, or 0.0, 30 and 40 ppm as a foliar spray). The plants received 6 doses at one month interval during the growing season. Data revealed that pinching decreased fresh and dry weight of flowers. It also increased the content of total carbohydrates, indoles and phenols in the leaves. Pinching and spraying the plants with PP₃₃₃ at 40 ppm decreased the height of plant, while spraying PP₃₃₃ at 40 ppm without pinching increased number of leaves, length of roots and fresh and dry weight of roots. Plants sprayed with PP₃₃₃ at 40 ppm with or without pinching had higher contents of total carbohydrate, indoles and phenols. Treating plants with paclobutrazol as a drench at 4 ppm increased chlorophyll a and b contents. It was recommended spraying pinched plants with PP₃₃₃ at 40 ppm to produce dwarfed plants.

Key words: Hibiscus, pinching, paclobutrazol, growth, flowering, chemical composition.

INTRODUCTION

Hibiscus rosa-sinensis, L. cv. "Yellow" is a shrub widely distributed in temperate and tropical countries. It belongs to the family Malvaceae. Flowers are yellow. It is a showy-flowered garden shrub. It is planted alone, in groups or as a hedge. It is propagated by woody cutting in February, in loamy soil. The height of plant is about 8 meters.

Pinching is used to shape branches and change the direction of the branch. When pinching of the branch is complete, it only needs detail work or ramification. This is done by removing the tip of the growing branch, usually removing two nodes of a three node shoot. This leads to two things: 1) It shortens the branch. 2) It releases the buds behind it by interrupting apical dominance.

The buds are held from opening by release of a hormone (auxin) manufactured by the last bud (Walston, 2001). Songul and Ece (2015) studied the effect of pinching and paclobutrazol on ornamental pepper. They found that pinching and PP₃₃₃ reduced plant height between 25 and 50% and the canopy diameter between 8% and 17%. Rezazadeh *et al.* (2015) on Red firespike (*Odontonema strictum*, Acanthaceae) reported that pinching didn't affect the number of branches. Pinching back plants can produce more flowers and leaves on a plant and helps the plant to put out energy on new growth (Rhonda, 2015)

Paclobutrazol is a plant growth regulator that slow the vegetative growth by inhibiting gibberellin biosynthesis creating more compact plants, prevent or hinder cell division in the meristem of apical and block

cell elongation, and improving potted flowering shrub production. Songul and Ece (2015) studied the effect of PP₃₃₃ on ornamental pepper, as they found that paclobutrazol increased total chlorophylls. Carver *et al.* (2014) found that the drench-applied paclobutrazol at 40 mg/l on *Borrchia frutescens* (Asteraceae) reduced shoot and root masses, and reduced number of leaves and internode extension. Youssef (2013) reported that using paclobutrazol with *Tabernaemontana coronaria* (Apocynaceae) decreased plant height and leaf area, whereas, it significantly increased number of branches and leaves/plant. Plants sprayed with PP₃₃₃ at 100 ppm gave the heaviest fresh and dry weight of leaves/plant, and significantly increased fresh and dry weight of flower. PP₃₃₃ treatments increased total carbohydrates and total chlorophylls content of leaves compared with untreated plants. YanHua *et al.* (2011) studied the effect of PP₃₃₃ on *Hibiscus rosa-sinensis* and *Carmona microphylla*, Boraginaceae plants, they reported that it significantly inhibited growth without affecting plant's general development and ornamental quality. El-Bably and Zaky (2009) using paclobutrazol with *Jacobinia carnea*, found that spraying paclobutrazol at 20 ppm or as soil drench at 2 mg/pot, twice at fortnightly intervals, was optimum for growth and flowering of *J. carnea*. El-Bably (2008) sprayed paclobutrazol on *Anisacanthus wrightii*, she found that most of the studied characteristics were significantly decreased due to application. The aim of the experiment, it produces dwarfed plants.

MATERIALS AND METHODS

A pot experiment was carried out during two successive seasons of 2014/2015 and 2015/2016 at the experimental nursery of Ornamental Plants and Landscape Gardening Department, Horti. Res. Insti. to study the effect of pinching only or pinching with paclobutrazol (PP₃₃₃) at 0.0, 3 and 4 ppm (drench) or 30 and 40 ppm (spray) on growth, flowering and chemical composition of *Hibiscus rosa-sinensis* L. cv. "Yellow"

plants, to produce dwarfed plant. Plants were about 30 cm highest, having number of leaves of about 33 and about 4 branches. The plants were individually potted (on 15th August 2014 and 2015) in 25 cm plastic pots filled with a mixture of sand: peatmoss (1:1 v/v) [Table a], Plants were pinched at 22 cm height, with about 14 leaves and 4 branches in 19th August. The plants received 6 doses at monthly interval during the growing season. The plants were pinched one week before being treated with PP₃₃₃. After 15 days, plants were fertilized every 2 weeks with kristalon (19:19:19) at 1 g/l (each pot was added 250 cm³).

Table a. Some physical properties of the growing media.

Season	B.D.	W.H.C %	pH	E.C.
Season 1	1.0204	45.08	7.05	3.88
Season 2	1.0998	49.10	7.17	2.31

B.D.: Bulk density g/m³
W.H.C.: Water holding capacity m³/100 g soil
E.C.: Electrical conductivity mmohs/m³

Data recorded:

Data were recorded on vegetative growth, flowering and chemical composition.

Vegetative growth:

- Height of plant (cm).
- Leaf area (cm²).
- Diameter of stem (mm).
- Number of branches /plant.
- Fresh and dry weight of branches (g).
- Number of leaves /plant.
- Fresh and dry weight of leaves (g).

Root characters:

- Fresh and dry weight of roots (g).
- Length of root (cm).

Flower characters:

- Fresh and dry weight of flower (g).
- Length of flower stalk (cm).

Chemical composition:

- Chlorophyll a, b and carotenoid (mg/100 g F.W.) was determined as described by Fahmy (1970).
- Indoles and phenols (%) was determined as according to Larsen *et al.* (2006) and A.O.A.C. (2000), respectively.
- Total carbohydrates (%) was determined as according to Herbert *et al.* (2005).

The experiment was laid as completely randomized in a factorial design, with 10 treatments, each treatment contained 3 replicates, and each replicate contained 3 plants. The obtained data were statistically analyzed using LSD test at 5% (Mead *et al.*, 1993).

RESULTS AND DISCUSSION

Effect of pinching and paclobutrazol on vegetative growth:

Data presented in Tables (1, 2 and 3) show the effect of pinching and paclobutrazol on vegetative growth of hibiscus plants.

Pinching the plants decreased height of plant and number of leaves, while it was not significantly to most the characteristics of vegetative growth. These results are agreement with those obtained of Rezazadeh *et al.* (2015) on *Odontonema strictum*.

Using paclobutrazol decreased most traits of vegetative growth compared with untreated plants. Drenching PP₃₃₃ at 4 ppm decreased fresh and dry weight of branches. These results are in agreement with those by Carver *et al.* (2014) on *Borrchia frutescens*. They found that paclobutrazol decreased shoot mass. On the other hand, spraying PP₃₃₃ at 40 ppm increased the number of leaves, while drenching PP₃₃₃ at 3 ppm gave the highest number of branches. A similar trend was obtained on *Tabernaemontana coronaria* by Youssef (2013) and YanHua *et al.* (2011) on *Hibiscus rosa-sinensis* and *Carmona microphylla*. They reported that paclobutrazol decreased plant height and leaf

area. On the other hand, it increased number of branches and leaves/plant.

The interaction between pinching and paclobutrazol showed that pinching + PP₃₃₃ at 40 ppm decreased the height of plant. These results are in agreement with those by Songul and Ece (2015) on ornamental pepper. They reported that pinching and paclobutrazol decreased height of plant. Drenching PP₃₃₃ at 3 ppm without pinching recorded the highest number of branches. On the other hand, untreated plant without PP₃₃₃ and pinching had more fresh and dry weight of leaves and branches, whereas spraying plants with PP₃₃₃ at 40 ppm without pinching gave the highest number of leaves.

Effect of pinching and paclobutrazol on root characters:

Data presented in Table (4) display the effect of pinching and paclobutrazol on rooting of hibiscus plant.

Pinching plants decreased fresh and dry weight and length of roots.

Spraying the plants with paclobutrazol at 40 ppm increased fresh and dry weight of roots and length of root.

The interaction between pinching and paclobutrazol showed that spraying plants with paclobutrazol at 40 ppm without pinching increased the most of characteristics of roots.

Effect of pinching and paclobutrazol on flower characters:

Data presented in Table (5) display the effect of pinching and paclobutrazol on flowering of hibiscus plant

Pinching plants decreased fresh and dry weight of flowers, and increased the length of the flower stalk.

Using paclobutrazol increased the fresh and dry weight of flowers, whereas it decreased the length of flower stalk compared with untreated plants. This trend was also observed by Youssef (2013) on *Tabernaemontana coronaria*. He stated that

Table 1. Effect of pinching and paclobutrazol on height of plant, leaf area and diameter of stem of *Hibiscus rosa-sinensis* L. cv. ‘‘Yellow’’ plant during the two seasons.

Treatments	First season						Second season					
	Height of plant (cm)			Leaf area (cm ²)			Diameter of stem (mm)					
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A
0.0 PP₃₃₃	47.83	49.42	48.63	56.45	72.23	64.34	9.22	8.63	8.92			
Drench PP₃₃₃ at 3ppm	36.92	34.58	35.75	17.00	21.34	19.17	8.57	8.45	8.51			
Drench PP₃₃₃ at 4ppm	37.13	35.00	36.07	16.45	24.22	20.33	7.73	8.25	7.99			
Spraying PP₃₃₃ at 30ppm	41.00	33.67	37.33	20.67	23.56	22.11	8.20	7.80	8.00			
Spraying PP₃₃₃ at 40ppm	32.87	31.17	32.02	17.78	18.22	18.00	7.89	8.76	8.33			
Mean B	39.15	36.77		25.67	31.91		8.32	8.38				
LSD at 5%	A: 2.67	B: 1.69	AB: 3.78	A: 1.80	B: 1.14	AB: 2.55	A: 0.77	B: 0.49	AB: 1.10			
	Second season											
0.0 PP₃₃₃	54.45	49.75	52.10	55.78	63.33	59.56	9.79	8.79	9.29			
Drench PP₃₃₃ at 3ppm	37.55	35.42	36.48	19.48	16.22	17.85	8.19	9.02	8.60			
Drench PP₃₃₃ at 4ppm	38.83	32.17	35.50	15.78	13.78	14.78	8.12	7.88	8.00			
Spraying PP₃₃₃ at 30ppm	40.87	32.42	36.65	22.67	26.44	24.56	8.83	8.54	8.69			
Spraying PP₃₃₃ at 40ppm	35.70	31.92	33.81	17.56	15.78	16.67	7.65	8.62	8.13			
Mean B	41.48	36.33		26.25	27.11		8.51	8.57				
LSD at 5%	A: 2.29	B: 1.45	AB: 3.24	A: 2.36	B: 1.49	AB: 3.34	A: 0.68	B: 0.43	AB: 0.97			

Table 2. Effect of pinching and paclobutrazol on number of branches/plant, fresh and dry weight of branches of *Hibiscus rosa-sinensis* L. cv. “Yellow” plant the two seasons.

Treatments	First season											
	Number of branches/plant			Fresh weight of branches (g)								
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A						
0.0 PP₃₃₃	8.50	6.83	7.67	16.31	16.42	16.36	Non pinching	5.00	Pinching	4.84	Mean A	4.92
Drench PP₃₃₃ at 3ppm	12.67	10.17	11.42	13.16	12.59	12.88	Non pinching	4.49	Pinching	4.23	Mean A	4.36
Drench PP₃₃₃ at 4ppm	9.50	9.50	9.50	11.37	12.81	12.09	Non pinching	4.17	Pinching	3.88	Mean A	4.02
Spraying PP₃₃₃ at 30ppm	8.67	10.50	9.58	14.14	11.85	13.00	Non pinching	4.94	Pinching	4.02	Mean A	4.48
Spraying PP₃₃₃ at 40ppm	8.00	10.00	9.00	11.87	13.07	12.47	Non pinching	3.89	Pinching	4.40	Mean A	4.14
Mean B	9.47	9.40		13.37	13.35		Non pinching	4.50	Pinching	4.27	Mean A	
LSD at 5%	A: 1.31	B: 0.83	AB: 1.85	A: 1.79	B: 1.13	AB: 2.52	Non pinching	A: 0.55	Pinching	B: 0.35	Mean A	AB: 0.77
	Second season											
0.0 PP₃₃₃	8.83	9.17	9.00	19.52	17.07	18.29	Non pinching	6.53	Pinching	5.14	Mean A	5.84
Drench PP₃₃₃ at 3ppm	10.17	10.00	10.08	14.57	13.51	14.04	Non pinching	4.59	Pinching	4.24	Mean A	4.41
Drench PP₃₃₃ at 4ppm	10.17	8.33	9.25	12.13	11.77	11.95	Non pinching	3.78	Pinching	3.70	Mean A	3.74
Spraying PP₃₃₃ at 30ppm	8.00	9.17	8.58	17.10	14.92	16.01	Non pinching	4.95	Pinching	5.08	Mean A	5.02
Spraying PP₃₃₃ at 40ppm	8.33	9.00	8.67	11.00	13.67	12.34	Non pinching	3.44	Pinching	4.29	Mean A	3.86
Mean B	9.10	9.13		14.86	14.19		Non pinching	4.66	Pinching	4.49	Mean A	
LSD at 5%	A: 0.93	B: 0.59	AB: 1.32	A: 1.67	B: 1.06	AB: 2.36	Non pinching	A: 0.41	Pinching	B: 0.26	Mean A	AB: 0.58

Table 3. Effect of pinching and paclobutrazol on number of leaves/plant, fresh and dry weight of leaves of *Hibiscus rosa-sinensis* L. cv. “Yellow” plant during the two seasons.

Treatments	First season						Second season											
	Number of leaves/plant			Fresh weight of leaves(g)			Dry weight of leaves (g)			Number of leaves/plant			Fresh weight of leaves(g)			Dry weight of leaves (g)		
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A
0.0 PP₃₃₃	36.17	26.33	31.25	23.71	20.68	22.20	4.41	3.58	4.00	25.17	23.50	24.33	20.99	19.42	20.20	3.96	3.48	3.72
Drench PP₃₃₃ at 3ppm	36.50	28.00	32.25	11.65	8.04	9.85	2.35	1.64	1.99	31.67	22.67	27.17	10.82	11.99	11.41	2.29	2.36	2.33
Drench PP₃₃₃ at 4ppm	29.83	28.33	29.08	8.82	8.27	8.54	1.73	1.90	1.82	34.33	24.33	29.33	10.81	9.24	10.02	2.16	1.84	2.00
Spraying PP₃₃₃ at 30ppm	28.67	27.17	27.92	12.72	9.59	11.16	3.09	1.99	2.54	32.83	25.17	29.00	11.22	12.87	12.05	2.47	2.56	2.52
Spraying PP₃₃₃ at 40ppm	38.67	34.67	36.67	10.27	10.24	10.26	2.12	2.05	2.09	35.83	32.50	34.17	10.71	10.13	10.42	2.12	1.87	2.00
Mean B	33.97	28.90		13.43	11.37		2.74	2.23		31.97	25.63		12.91	12.73		2.60	2.42	
LSD at 5%	A: 2.50	B: 1.58	AB: 3.53	A: 1.29	B: 0.81	AB: 1.82	A: 0.44	B: 0.28	AB: 0.616	A: 2.82	B: 1.78	AB: 3.98	A: 1.78	B: 1.12	AB: 2.51	A: 0.31	B: 0.19	AB: 0.44

Table 4. Effect of pinching and paclobutrazol on fresh and dry weight of roots and length of root of *Hibiscus rosa-sinensis* L. cv. "Yellow" plant during the two seasons.

Treatments	First season									
	Fresh weight of roots (g)			Dry weight of roots (g)			Length of root (cm)			
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	
0.0 PP₃₃₃	29.03	16.51	22.77	7.76	3.78	5.77	81.00	72.63	76.82	
Drench PP₃₃₃ at 3ppm	21.42	23.17	22.30	5.51	4.84	5.18	107.47	83.83	95.65	
Drench PP₃₃₃ at 4ppm	30.06	21.43	25.75	6.33	4.71	5.52	80.90	79.15	80.03	
Spraying PP₃₃₃ at 30ppm	26.84	16.54	21.69	4.96	4.02	4.49	53.37	74.00	63.68	
Spraying PP₃₃₃ at 40ppm	29.77	30.22	29.99	6.76	5.27	6.02	119.67	89.30	104.48	
Mean B	27.42	21.58		6.26	4.53		88.48	79.78		
LSD at 5%	A: 3.46	B: 2.19	AB: 4.89	A: 0.63	B: 0.40	AB: 0.88	A: 7.77	B: 4.91	AB: 10.98	
	Second season									
0.0 PP₃₃₃	26.50	15.36	20.93	7.27	3.74	5.50	96.73	71.30	84.02	
Drench PP₃₃₃ at 3ppm	29.71	19.23	24.47	6.80	4.54	5.67	103.03	60.35	81.69	
Drench PP₃₃₃ at 4ppm	17.63	18.40	18.02	4.47	3.82	4.15	95.20	63.17	79.18	
Spraying PP₃₃₃ at 30ppm	22.08	19.24	20.66	5.08	3.87	4.48	104.00	138.50	121.25	
Spraying PP₃₃₃ at 40ppm	35.63	25.35	30.49	7.71	5.23	6.47	108.70	104.10	106.40	
Mean B	26.31	19.52		6.27	4.24		101.53	87.48		
LSD at 5%	A: 3.07	B: 1.94	AB: 4.34	A: 0.75	B: 0.47	AB: 1.05	A: 8.38	B: 5.30	AB: 11.85	

Table 5. Effect of pinching and paclobutrazol on fresh and dry weight of flower and flower stalk of *Hibiscus rosa-sinensis* L. cv. ‘‘Yellow’’ plant during the two seasons.

Treatments	First season									
	Fresh weight of flower (g)			Dry weight of flower (g)			flower stalk (cm)			
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	
0.0 PP ₃₃₃	2.85	3.00	2.92	0.44	0.42	0.43	4.66	5.50	5.08	
Drench PP ₃₃₃ at 3ppm	3.35	2.15	2.75	0.55	0.49	0.52	1.53	1.00	1.27	
Drench PP ₃₃₃ at 4ppm	3.76	2.96	3.36	0.55	0.48	0.52	1.30	1.75	1.53	
Spraying PP ₃₃₃ at 30ppm	3.54	3.47	3.50	0.51	0.51	0.51	1.37	1.93	1.65	
Spraying PP ₃₃₃ at 40ppm	3.19	2.98	3.09	0.59	0.46	0.52	1.50	0.95	1.23	
Mean B	3.34	2.91		0.53	0.47		2.07	2.23		
LSD at 5%	A: 0.37	B: 0.23	AB: 0.52	A: 0.08	B: 0.05	AB: 0.11	A: 0.48	B: 0.30	AB: 0.67	
	Second season									
0.0 PP ₃₃₃	3.25	2.41	2.83	0.46	0.31	0.39	4.71	6.50	5.60	
Drench PP ₃₃₃ at 3ppm	3.89	2.40	3.15	0.56	0.44	0.50	1.70	1.20	1.45	
Drench PP ₃₃₃ at 4ppm	3.47	2.59	3.03	0.51	0.45	0.48	1.30	1.33	1.32	
Spraying PP ₃₃₃ at 30ppm	3.62	2.38	3.00	0.60	0.45	0.53	1.71	1.35	1.53	
Spraying PP ₃₃₃ at 40ppm	3.99	3.39	3.69	0.61	0.43	0.52	1.43	1.85	1.64	
Mean B	3.64	2.63		0.54	0.42		2.17	2.45		
LSD at 5%	A: 0.21	B: 0.14	AB: 0.30	A: 0.05	B: 0.04	AB: 0.08	A: 0.41	B: 0.26	AB: 0.57	

paclobutrazol increased fresh and dry weight of flowers

The interaction between pinching and paclobutrazol showed that spraying plants with paclobutrazol at 40 ppm without pinching increased fresh and dry weight of flowers, also, the untreated pinched plants showed long flower stalks.

Effect of pinching and paclobutrazol on chemical composition:

Data presented in Tables (6 and 7) show the effect of pinching and paclobutrazol on chemical composition of Hibiscus plants.

Pinching plants increased total carbohydrates, indoles and phenols contents.

Using PP₃₃₃ increased most of chemical contents in plants compared to untreated plants. These results are in agreement with those by Youssef (2013) on *Tabernaemontana coronaria*. He found that treating plants with paclobutrazol increased total carbohydrates content of the leaves.

The interaction between pinching and paclobutrazol showed that PP₃₃₃ at 40 ppm sprayed on pinched plants increased total carbohydrates, indoles and phenols percentages in the leaves.

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Table 6. Effect of pinching and paclobutrazol on chlorophyll a, b and carotenoid mg/g fresh weight of *Hibiscus rosa-sinensis* L. cv. "Yellow" plant during the two seasons.

Treatments	First season											
	Chlorophyll a (mg/100 g F.W.)			Chlorophyll b (mg/100 g F.W.)			Carotenoid (mg/100 g F.W.)					
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A
0.0 PP₃₃₃	1.785	1.793	1.789	1.785	1.793	1.789	1.785	1.793	1.789	1.785	1.793	1.789
Drench PP₃₃₃ at 3ppm	1.788	1.788	1.788	1.788	1.788	1.788	1.788	1.788	1.788	1.788	1.788	1.788
Drench PP₃₃₃ at 4ppm	1.818	1.801	1.809	1.818	1.801	1.809	1.818	1.801	1.809	1.818	1.801	1.809
Spraying PP₃₃₃ at 30ppm	1.782	1.789	1.786	1.782	1.789	1.786	1.782	1.789	1.786	1.782	1.789	1.786
Spraying PP₃₃₃ at 40ppm	1.799	1.798	1.798	1.799	1.798	1.798	1.799	1.798	1.798	1.799	1.798	1.798
Mean B	1.794	1.794		1.794	1.794		1.794	1.794		1.794	1.794	
LSD at 5%	A: 0.071	B: 0.045	AB: 0.101	A: 0.061	B: 0.039	AB: 0.087	A: 0.007	B: 0.005	AB: 0.010	A: 0.007	B: 0.005	AB: 0.010
	Second season											
0.0 PP₃₃₃	1.736	1.742	1.739	1.312	1.309	1.311	1.312	1.309	1.311	0.323	0.367	0.345
Drench PP₃₃₃ at 3ppm	1.740	1.770	1.755	1.266	1.984	1.625	1.266	1.984	1.625	0.383	0.188	0.286
Drench PP₃₃₃ at 4ppm	1.786	1.774	1.780	2.223	1.791	2.007	2.223	1.791	2.007	0.103	0.247	0.175
Spraying PP₃₃₃ at 30ppm	1.766	1.772	1.769	1.537	1.486	1.511	1.537	1.486	1.511	0.296	0.320	0.308
Spraying PP₃₃₃ at 40ppm	1.769	1.786	1.778	1.446	1.878	1.662	1.446	1.878	1.662	0.324	0.207	0.266
Mean B	1.760	1.769		1.557	1.690		1.557	1.690		0.286	0.266	
LSD at 5%	A: 0.066	B: 0.042	AB: 0.094	A: 0.063	B: 0.040	AB: 0.090	A: 0.007	B: 0.005	AB: 0.010	A: 0.007	B: 0.005	AB: 0.010

Table 7. Effect of pinching and paclobutrazol on indoles, phenols and total carbohydrates of *Hibiscus rosa-sinensis* .cv. “Yellow” plant during the two seasons.

Treatments	First season						Second season					
	Indoles (%)			Phenols (%)			Total carbohydrate (%)			Total carbohydrate (%)		
	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A	Non pinching	Pinching	Mean A
0.0 PP₃₃₃	3.196	2.066	2.631	0.183	0.183	0.183	11.73	10.22	0.183	11.73	10.22	10.98
Drench PP₃₃₃ at 3ppm	2.235	2.750	2.493	0.097	0.197	0.147	9.95	9.63	0.147	9.95	9.63	9.79
Drench PP₃₃₃ at 4ppm	2.549	3.516	3.033	0.209	0.285	0.247	7.81	12.45	0.247	7.81	12.45	10.13
Spraying PP₃₃₃ at 30ppm	2.487	2.235	2.361	0.213	0.200	0.207	9.25	8.60	0.207	9.25	8.60	8.92
Spraying PP₃₃₃ at 40ppm	3.409	4.250	3.830	0.244	0.303	0.274	12.18	12.70	0.274	12.18	12.70	12.44
Mean B	2.775	2.963		0.189	0.234		10.19	10.72		10.19	10.72	
LSD at 5%	A: 0.059	B: 0.037	AB: 0.083	A: 0.007	B: 0.004	AB: 0.009	A: 0.47	B: 0.30	AB: 0.67	A: 0.47	B: 0.30	AB: 0.67
	First season						Second season					
0.0 PP₃₃₃	3.014	2.091	2.553	0.255	0.132	0.194	12.11 d	10.09	0.194	12.11 d	10.09	11.10
Drench PP₃₃₃ at 3ppm	2.135	3.183	2.659	0.113	0.181	0.147	10.79 e	12.37	0.147	10.79 e	12.37	11.58
Drench PP₃₃₃ at 4ppm	3.642	2.731	3.187	0.186	0.195	0.191	10.01 f	13.03	0.191	10.01 f	13.03	11.52
Spraying PP₃₃₃ at 30ppm	2.662	4.012	3.337	0.097	0.161	0.129	10.59 ef	13.16	0.129	10.59 ef	13.16	11.88
Spraying PP₃₃₃ at 40ppm	2.436	2.574	2.505	0.266	0.300	0.283	12.75 bc	13.69	0.283	12.75 bc	13.69	13.22
Mean B	2.778	2.918		0.183	0.194		11.25 B\	12.47		11.25 B\	12.47	
LSD at 5%	A: 0.055	B: 0.034	AB: 0.077	A: 0.007	B: 0.004	AB: 0.009	A: 0.43	B: 0.27	AB: 0.61	A: 0.43	B: 0.27	AB: 0.61

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تأثير التطويش والباكlobوترازول على نبات الهبسكس

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أجريت هذه التجربة خلال موسمى ٢٠١٤/٢٠١٥ و ٢٠١٥/٢٠١٦ فى مشتل تجارب قسم بحوث الزينة وتنسيق الحدائق- معهد بحوث البساتين لدراسة تأثير التطويش والباكlobوترازول على النمو والتزهير والمحتوى الكيمايى لنبات الهبسكس الصينى صنف أصفر، بهدف إنتاج نباتات مقزومة. تم تطويش النباتات قبل معاملتها بالباكlobوترازول (إضافة للتربة بتركيز صفر و ٣ و ٤ جزء فى المليون بمعدل ٢٥٠ سم/أصيص أو رش على الأوراق بتركيز صفر و ٣٠ و ٤٠ جزء فى المليون)، النباتات إستقبلت ٦ جرعات (مرة كل شهر) خلال موسم النمو. أظهرت البيانات أن عملية التطويش قللت الوزن الطازج والجاف للأزهار وأيضاً أدت إلى زيادة محتوى الأوراق من الكربوهيدرات الكلية والإندولات والفينولات. عملية التطويش مع رش النباتات بالباكlobوترازول بتركيز ٤٠ جزء فى المليون قللت إرتفاع النبات، بينما الباكلوبوترازول ٤٠ جزء فى المليون بدون تطويش أدى إلى زيادة عدد الأوراق وطول الجذور والوزن الطازج والجاف للجذور. أدى رش النباتات بالباكlobوترازول بتركيز ٤٠ جزء فى المليون (مع أو بدون التطويش) إلى الحصول على أعلى محتوى من الكربوهيدرات الكلية والإندولات والفينولات. أدت إضافة الباكلوبوترازول للتربة بتركيز ٤ جزء فى المليون إلى زيادة كلوروفيل أ، ب. يوصى برش النباتات بعد تطويشها بالباكlobوترازول بتركيز ٤٠ جزء فى المليون للحصول على نباتات مقزومة.