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Effect of growth regulators and organic promoters on graft success and growth of bitter gourd on pumpkin rootstock

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Abstract
A field trail entitled "effect of growth regulators and organic promoters on graft success and growth of bitter gourd grafted on pumpkin rootstock was carried out at field of vegetable science unit kittur rani Channamma College of horticulture Arabhavi, Belagavi district Karnataka. In the present study bitter gourd scions were treated with different growth regulators and organic promoters at different concentrations and grafted on pumpkin rootstock using wedge grafting method and this experiment was conducted during two cropping seasons of *kharif* (2018-19) and *rabi* (2019-20). The study revealed that the significant and maximum percentage of graft success was observed in bitter gourd scions treated with IBA @ 50 ppm and grafted on pumpkin rootstock, maximum vine length and number of nodes per graft per vine in bitter gourd scions treated with GA_3 @ 25 ppm and final girth of graft union in bitter gourd scions treated with GA_3 @ 50 ppm respectively during both *kharif* (2018-19) and *rabi* (2019-20) seasons.

Keywords: Bitter gourd, pumpkin, growth regulators, wedge grafting, graft success and growth

Introduction
Now a day's grafting vegetables is one of the popular propagation methods especially the crops belongs to family solanaceae and cucurbitaceae to overcome the soilborne diseases and also to get higher yield. However the commercialization of grafted plants has not reached its full potential mostly because of high price of grafted seedlings and incompatibility of scion and rootstock, especially at later stages of fruit bearing. Many scientists reported that the hormones are involved in the rootstock-scion interaction (Aloni *et al*., 2010) [1]. Understanding the signaling process in plant and the impact of harmones as signaling and control factors, thus we can visualize improvement in grafting technology and increase its implementation (Aloni *et al*., 2010) [1]. Many scientists reported that grafting has significant contribution in scion performance under diverse environmental conditions. But only few of them have attempted to study the relationship between the horticultural benefits and the role of harmones. Hence the present investigation was carried out at Kittur Rani Channamma College of Horticulture, Arabhavi, UHS, Bagalkot, Karnataka, to know the effect of growth regulators and organic promoters on graft success and growth of bitter gourd.

Materials and Methods
The experiment was conducted in the field of vegetable science unit of Kittur Rani Channamma College of Horticulture (KRCCH), Arabhavi, Belagavi district, Karnataka and is located in northern dry zone of Karnataka state at 16°15' North latitude, 74°45' East longitude and at an altitude of 612.05 m above MSL. Arabhavi comes under the zone-3 and region-2 among the agro-climatic zones of Karnataka and benefited from both south-west and north-east monsoons. In this study bitter gourd was used as scion and it was treated with growth regulators at different concentrations *viz.*, {(GA_3 @ 25 & 50 ppm, IBA @ 25 & 50 ppm, cow urine @ 1.0, 1.5, 2.0%, coconut milk @ 10.0, 15.0, 20.0% and distil water treatment (control)}. After scion treatment with different growth regulators and organic promoter's it was grafted on pumpkin rootstock by using wedge grafting method. The experiment was laid out in randomized completely block design with two replications and the experiment was repeated in two seasons (*Kharif* 2018-19 & *Rabi* 2019-20).

Observations recorded

Percentage of graft success (%): Percentage of graft success was calculated by using formula

$$= \frac{\text{Number of grafts survived}}{\text{Total number of plants grafted}} \times 100$$

Vine length: Length of scion was measured using centimeter scale from the graft union to the tip of the scion at 10, 15, 20, 25, 30 and 40 days after grafting. Mean of five plants per treatment and replication wise length was calculated and expressed in centimeters.

Number of nodes per vine: The number of nodes produced in each plant was recorded above the graft union up to 60 days at 15 days interval starting from 15 days after grafting. Mean of the five plants per treatment and replication wise numbers was calculated.

Initial and final girth of graft union: The diameter of the plants at the graft union (stock) was recorded using vernier calipers initially at 10, 20, 30 and final girth of the graft union at 60 and 90 days after grafting. Mean girth of five plants per treatment and replication wise girth was calculated and expressed in terms of millimeter.

Results and Discussion

Percentage of graft success: The results on percentage of graft success revealed that, the bitter gourd scions treated with IBA @ 50 ppm (T_4) recorded maximum percentage of graft success (98.00, 97.50 & 99.00, 98.50%) and it was similar with bitter gourd scions treated with GA_3 @ 50 ppm (T_2) (96.00, 95.00 & 94.00, 93.00%) and grafted on pumpkin rootstock using wedge grafting method. Whereas, minimum percentage of graft success was noticed in bitter gourd scions treated with cow urine @ 2.0% (T_7) (58.00, 56.00 & 60.50, 58.50%) during both *kharif* (2018-19) and *rabi* (2019-20) seasons (Table 1). The pooled data revealed, maximum percentage of graft success (98.50 & 98.00%) in bitter gourd scions treated with IBA @ 50 ppm (T_4) which was at par with bitter gourd scions treated with GA_3 @ 50 ppm (T_2) (95.00 & 94.00%) and minimum percentage of graft success (59.25 & 57.25%) in bitter gourd scions treated with cow urine @ 2.0 per cent (T_7). Highest percentage of graft success may attributed to the presence of maximum quantity of auxins and morphogeneric substances which help in better graftage and transportation of nutrients helps in maximum percentage of graft success and *vice- versa* for minimum percentage of graft success. Similar result was also reported by Kose and Guleryuz, (2006) [3] who concluded that scion and rootstock treatment with IBA and cytokinin resulted in better callusing rate and callusing degree at grafting point compared to control treatment.

Table 1: Effect of growth regulators and organic promoters on graft success (%) of bitter gourd grafted on pumpkin at 10 and 30 DAG

Treatments	Graft success (%)					
	10 DAG			30 DAG		
	2018-2019	2019-2020	Pooled	2018-2019	2019-2020	Pooled
T_1	76.00(60.67)	77.88(61.96)	77.94(61.98)	75.00(60.01)	76.88(61.27)	75.94 (60.64)
T_2	96.00(79.99)	94.00(76.99)	95.00(77.11)	95.00(77.11)	93.00(75.16)	94.00 (76.28)
T_3	78.00(62.03)	85.75(67.84)	81.88(65.31)	77.50(61.70)	84.75(67.02)	81.13 (64.25)
T_4	98.00(81.84)	99.00(84.23)	98.50(83.03)	97.50(80.95)	98.50(83.07)	98.00 (81.87)
T_5	72.00(58.05)	71.46(57.75)	71.73(57.86)	70.50(57.11)	69.96(56.79)	70.23 (56.94)
T_6	68.00(55.57)	67.25(55.07)	67.63(55.30)	66.50(54.65)	65.75(54.18)	66.13 (54.41)
T_7	58.00(49.60)	60.50(51.05)	59.25(50.31)	56.00(48.45)	58.50(49.90)	57.25 (49.17)
T_8	60.00(50.83)	64.75(53.61)	62.38(52.15)	58.50(49.94)	63.25(52.70)	60.88 (51.32)
T_9	84.00(66.60)	87.75(69.51)	85.88(67.94)	82.50(65.35)	86.75(68.65)	84.63 (66.94)
T_{10}	72.00(58.04)	89.25(71.04)	80.63(64.43)	70.50(57.10)	88.25(70.04)	79.38 (62.99)
T_{11}	78.00(62.18)	77.50(61.93)	78.25(62.18)	76.00(60.73)	75.50(60.45)	75.75 (60.58)
SEm ±	3.93	3.70	2.81	2.74	2.45	2.37
CD at 5%	12.38	11.65	8.84	8.63	7.71	7.45
CV (%)	7.28	6.57	5.08	5.61	4.42	4.36

*Figures in the parenthesis are arcsine transformation
DAG- Days after grafting
T_1-Bitter gourd scions treated with GA3 @ 25 ppm
T_2-Bitter gourd scions treated with GA3 @ 50 ppm
T_3-Bitter gourd scions treated with IBA @ 25 ppm
T_4-Bitter gourd scions treated with IBA @ 50 ppm
T_5-Bitter gourd scions treated with cow urine @ 1.0%
T_6-Bitter gourd scions treated with cow urine @ 1.5%
T_7-Bitter gourd scions treated with cow urine @ 2.0%
T_8-Bitter gourd scions treated with coconut milk @ 10.0%
T_9-Bitter gourd scions treated with coconut milk @ 15.0%
T_{10}-Bitter gourd scions treated with coconut milk @ 20.0%
T_{11}- Bitter gourd scions treated with distilled water (control)

Vine length (cm): Length of the scion varied significantly among the treatments in the present study. Significant and maximum length of the scion was recorded in bitter gourd scion treated with GA_3 @ 25 ppm (T_1) (251.56 cm at 40 DAG) which was followed by IBA @ 25 ppm (T_3) (238.68 cm 40 DAG) and grafted on pumpkin rootstock using wedge grafting method (Table 2). These findings may attributed to the fact that auxins affect the production and activity of cytokinins which are known to be produced in the root and translocated to the shoot where they control important developmental processes such as cell multiplication, shoot growth and productivity. The results of the present study are in agreement with earlier studies Yamasaki *et al*. (1994) [5], Kavya (2017) [2] who revealed that, the auxins activated shoot growth which might have resulted in elongation of stem through cell division resulting higher shoot length in black pepper. Whereas, control i.e. bitter gourd scions treated with distilled water (T_{11}) and cow urine @ 1 to 2.0 per% recorded minimum vine length may be because of lack of growth promoting substances which might have resulted in lower cell activities like cell elongation and cell division leading to poor growth. There was not much difference between the two seasons (*Kharif* & *rabi*) indicating that the rootstocks were more stable under different environmental conditions as

studied by Mohamed *et al*. (2012) [4] in watermelon.

Number of nodes per graft per vine: Pooled mean of two seasons revealed that the bitter gourd scions treated with GA_3 @ 50 ppm and IBA @ 50 ppm (T_2 & T_4) (210 and 169.17 at 60 DAG) has recorded higher number of nodes per graft (Table 2). Application of IBA helps in enhancement of cell division leading to early callus formation and chlorophyll accumulation which in turn reflected on the increased vegetative growth parameters like length of the scion and higher number of nodes.

Initial and final girth of graft union: Initial girth of graft union recorded at 10, 20 and 30 days after grafting was found to be non significant. This might be attributed to the facts that slow growth at initial stage. Whereas, final girth of graft union recorded at 60 and 90 days after grafting was found to be significant during both *kharif* (2018-19) and *rabi* (2019-20). The maximum increment in girth of graft union (17.44 & 19.78 mm at 60 and 90 DAG) was noticed in bitter gourd scions treated with GA_3 @ 25 ppm followed by T_3 and T_4 (IBA @ 25 & 50 ppm) and coconut milk @ 20 per cent (T_{10}) (Table 2). This may be due to that auxins helps in cellular activity which resulted in higher photosynthetic activity which had lead to accumulation of reserved food material that ultimately facilitated the increase in girth of graft union.

Table 2: Effect of growth regulators and organic promoters on growth parameters of bitter gourd grafted on pumpkin rootstock under protected environment (Shade net)

Treatments	Vine length (cm)						Number of nodes per graft				Initial and final girth of graft union (mm)				
	10 DAG	**15 DAG**	**20 DAG**	**25 DAG**	**30 DAG**	**40 DAG**	**15 DAG**	**30 DAG**	**45 DAG**	**60 DAG**	**10 DAG**	**20 DAG**	**30 DAG**	**60 DAG**	**90 DAG**
T_1	21.01	27.89	43.15	77.59	136.99	251.26	5.30	16.59	69.25	151.08	5.20	5.51	6.94	17.44	19.78
T_2	19.20	23.74	34.59	69.21	115.24	190.09	4.11	14.50	106.50	210.00	4.88	5.51	7.34	15.67	17.73
T_3	21.11	24.22	37.24	50.96	93.93	238.68	4.25	13.76	65.59	134.15	5.01	5.31	7.03	15.78	17.77
T_4	20.30	25.62	37.05	72.93	99.57	185.30	4.55	15.00	74.51	169.17	4.79	5.46	6.82	15.51	17.91
T_5	17.89	25.45	29.83	47.87	78.27	148.35	4.22	13.67	42.64	140.98	4.99	5.51	6.84	9.64	13.14
T_6	18.71	23.40	26.64	49.00	71.13	151.26	4.17	11.42	42.75	114.58	4.61	5.15	6.46	13.31	14.75
T_7	19.37	22.99	31.56	52.77	71.61	175.43	3.42	13.42	34.59	103.59	4.76	5.19	6.52	10.25	15.16
T_8	18.72	23.90	33.70	57.41	98.45	157.41	3.83	13.00	65.17	112.50	4.75	5.30	6.86	11.89	15.81
T_9	17.89	22.13	33.20	54.00	91.87	155.68	4.17	13.34	60.68	134.84	4.78	5.27	7.09	13.28	14.81
T_{10}	22.15	27.64	41.20	61.45	103.45	230.80	5.04	15.67	75.51	150.84	4.72	5.15	7.24	16.35	18.93
T_{11}	19.67	25.00	32.51	44.05	83.81	104.37	3.84	10.92	51.09	95.59	4.70	5.25	6.72	13.26	14.77
SEm ±	1.55	1.27	2.46	4.50	2,63	4.78	0.20	0.83	2.40	5.06	0.16	0.17	0.26	0.58	0.47
CD at 5%	NS	NS	8.07	14.17	8.29	15.08	0.62	2.61	7.56	15.93	NS	NS	NS	1.84	1.47
CV (%)	11.19	7.26	10.44	10.98	3.92	3.74	6.54	8.53	5.43	5.18	4.78	4.64	5.39	5.97	4.04

DAG- Days after grafting NS- Non significant

T_1- Bitter gourd scions treated with GA_3 @ 25 ppm T_2- Bitter gourd scions treated with GA_3 @ 50 ppm

T_3-Bitter gourd scions treated with IBA @ 25 ppm T_4- Bitter gourd scions treated with IBA @ 50 ppm

T_5- Bitter gourd scions treated with cow urine @ 1.0% T_6-Bitter gourd scions treated with cow urine @ 1.5%

T_7- Bitter gourd scions treated with cow urine @ 2.0% T_8- Bitter gourd scions treated with coconut milk @ 10.0%

T_9-Bitter gourd scions treated with coconut milk @ 15.0% T_{10}- Bitter gourd scions treated with coconut milk @ 20.0%

T_{11}- Bitter gourd scions treated with distilled water (control)

Conclusion

In our study we found that bitter gourd scions treated with IBA and GA_3 @ 25-50 ppm and grafted on pumpkin rootstock using wedge grafting method was found better with respect to percentage of graft success and better growth.

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