

**SEED YIELD AND QUALITY AS INFLUENCE BY PLANT GROWTH
REGULATORS AND STAGES OF SPRAY IN BITTER GOURD
(*Momordica charantia* L.)**

**HIRPARA, ANJITA J., VADDORIA, M. A., JIVANI, L. L., PATEL, J. B. AND
POLARA, A. M.**

**DEPARTMENT OF SEED SCIENCE AND TECHNOLOGY
COLLEGE OF AGRICULTURE
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH - 362001, GUJARAT, INDIA**

E-MAIL: anjitahirpara311@gmail.com

ABSTRACT

*A field experiment was conducted to find out the effect of plant growth regulators and stages of spray on seed yield and quality in bitter gourd (*Momordica charantia* L.) cv. Phule Green Gold during summer-2013. The experiment consisted of 10 treatments involving four growth regulators viz, Gibberrellic Acid (GA_3 ; 25 and 50 ppm); Ethrel (250 and 500 ppm); Naphthalic Acetic Acid (NAA; 50 and 100 ppm) and Cycocel (CCC; 100 and 200 ppm), water spray and control (no spray) and Three stages of sprays viz, two to four leaf stage (M_1), flower initiation stage (M_2) and fifteen days after flower initiation stage (M_3). Among different plant growth regulators, application of GA_3 @ 50 ppm (S_2) exerted significantly the maximum vine length (396.11 cm), number of matured fruit per vine (8.85), fruit yield per plant (0.59 kg), seed yield per plant (10.38 g) and 100 seed weight (21.01 g). Among three different stages, application of plant growth regulators at two to four leaf stages found effective.*

KEY WORDS: *Bitter gourd, plant growth regulators, seed yield*

INTRODUCTION

Bitter gourd is one of the most important cucurbitaceous vegetable crop widely cultivated in Gujarat. Bitter gourd is a different nature's bountiful gifts to mankind which not only have fabulous digestional properties, it is a store house of remedies for many common ailment. Fruits, leaves and even the roots of this vegetable have been used in ayurveda for number of diseases. It has immense medicinal properties due to the presence of beneficial phytochemicals, which are known to have antibiotic, antimutagenic, antioxidant, antiviral,

antidiabetic and immune enhancing properties. A compound known as 'charantin', present in the bitter gourd is used in the treatment of diabetes in reducing blood sugar level.

Cucurbits share about 5.6 per cent of the total vegetable production of India and were cultivated on about 9,205 thousand hectares with production of 1,62,187 million tones (Anonymous, 2013). In Gujarat area under cucurbits is 0.44 lakh hectares with production of 5.25 million tonnes (Anonymous, 2013).

Growth regulators enhance the number of female flowers and fruits

that lead to increase the seed yield and quality in bitter gourd. Though a number of improved varieties are available in India, an efficient seed production package is lacking especially aimed at manipulating the sex ratio for enhance seed yield and quality. Considering all these, the present investigation was under taken to increase the seed yield and quality in phule green gold during summer-2013.

MATERIAL AND METHODS

A field trial was conducted at College of Agriculture, J. A. U., Junagadh, Gujarat, India during summer-2013 with three replication in split plot design. The seed were sown in field with 2m x 1m. Three seeds were sown per hill and 10 hill per raw. After germination thinning operation done and only one healthy seedling was kept per hill. The fertilizers were applied at the rate of 50:60:60 NPK kg/ha, respectively. The whole quantity of P₂O₅ and K₂O was given as basal dose in form of Single Super Phosphate and Murate of Potash, respectively. Half quantity of nitrogen in the form of Urea was applied as basal dose and remaining half nitrogen was applied as top dressing 30 days after sowing.

The plant protection measures were adopted as and when required. Five plants from each treatment were selected randomly for recording the observations. Four growth regulators each with two concentrations viz., Gibberrellic Acid (GA₃ ; 25 and 50 ppm); ethrel (250 and 500 ppm); Naphthalic Acetic Acid (NAA; 50 and 100 ppm) and Cycocel (CCC; 100 and 200 ppm) were used for foliar application with water spray and control (no spray) makes total 10 treatments. Three sprays of each 10 treatments were given at two to four leaf stage (M₁), flower initiation stage (M₂) and fifteen days after flower

initiation stage (M₃). Precaution was taken to prevent drifting of spray solutions from one treatment plot to other. Fruits were harvested as and when they turn orange red colour and seeds were extracted manually. Five plants in each plot were randomly selected for recording the growth and yield parameters. Statistical analysis of split plot design was carried out as per Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The effect of growth regulators, stages of spray and their combination on crop growth, fruit set and seed yield parameters are given in Table 1.

Growth parameters such as vine length, number of matured fruit per plant, fruit yield, seed yield per plant and 100 seed weight were significantly influenced by the growth regulators, stages of spray and their combinations.

Vine length

Among the growth regulators, GA₃ @ 50 ppm exerted significantly the maximum vine length (396.11 cm). This may be due to stimulatory action of GA₃ to enhance cell elongation and cell division resulting in increasing vine length. These results are in conformity with the findings of Biradar *et al.* (2010) and Mia Baset *et al.* (2014) recorded longest vine length in bitter gourd with the application of GA₃. They reported increased vine length with the application of GA₃ may be due to elongation of the cell and plasticity of cell wall.

Number of fruit per vine and fruit yield per plant

Maximum number of fruit per vine and fruit yield per plant was recorded with application of GA₃ @ 50 ppm and was superior as compared to other growth regulators and control recorded maximum number of matured fruits per plant (8.85) and fruit yield per plant (0.59 kg).

Increasing in fruit yield with GA₃ 50 ppm, might be due to the effect of auxins to cause physiological modification in the plant mainly in sex ratio, increased fruit set, fruit weight and higher photosynthetic activity, synthesis and translocation of metabolites from source to sink points. Gedam *et al.* (1998), Marbhal *et al.* (2005), Shantappa *et al.* (2005), Hossain *et al.* (2006), Biradar *et al.* (2010), Arvindkumar *et al.* (2012), Momin *et al.* (2013) and Mia *et al.* (2014), who reported that application of different plant growth regulators was most effective to increase the number of fruit and fruit yield due to more number of pistillate flowers and fruit set per vine in bitter gourd.

Seed yield per plant and 100 seed weight

Among the growth regulator treatments, GA₃ @ 50 ppm (S₂) registered first position by producing significantly the maximum seed yield per plant (10.38g) and 100 seed weight (21.01g).

Increase in seed yield per plant which may be due to the PGRs may increased root activity and plasticity of cell wall to provide greater absorption of nutrients and cause enhancement in fruit growth and yield. Increase in 100-seed weight by GA₃ is probably due to an increase in carbohydrate metabolism, accumulation of carbohydrates and increased metabolic activity leading to higher translocation of metabolites from source to sink points, which resulted in better development of seeds. The beneficial effects of plant growth regulators on seed yield and 100 seed weight were also reported by Gedam *et al.* (1998) and Arvindkumar *et al.* (2012) in bitter gourd, who reported that boron at 4 ppm produced maximum seed yield. Marbhal *et al.* (2005) and Shantappa *et al.* (2007) were also observed similar

effects of NAA at 50 ppm in bitter gourd; Rashmi (2003) with NAA 100 ppm in bottle gourd; Hilli *et al.* (2010) with NAA 100 ppm in ridge gourd; Adirai *et al.* (2001) with ethrel 250 ppm and Shirzad *et al.* (2012) with GA₃ @ 25 ppm in pumpkin.

CONCLUSION

From the foregoing discussion, it can be concluded that application of GA₃ @ 50 ppm (S₂) exerted significantly the maximum vine length (396.11 cm), number of matured fruit per vine (8.85), fruit yield per plant (0.59 kg), seed yield per plant (10.38 g) and 100 seed weight (21.01 g). Among three different stages, application of plant growth regulators at two to four leaf stages found effective.

REFERENCES

- Adirai, N., Vijayakumar, A. and Natarajan, K. (2001). Effect of nitrogen application and ethrel spray on seed yield and quality of pumpkin cv. CO 1. *Orissa J. Horti.* **29(2)**: 28-30.
- Anonymous, (2013). Department of Agriculture and Co-operation, Government of Gujarat, Gandhinagar.
- Arvindkumar, P. R., Vasudevan, S. N., Patil, M. G. and Rajrajeshwari, C. (2012). Influence of NAA, triacontanol and boron spray on seed yield and quality of bitter gourd (*Momordica charantia* L.) cv. Pusa Visesh. *The Asian J. of Horti*, **7**: 36-39.
- Biradar, C. M., Nawalagatti, M. B. Doddamani and M. B. Chetti (2010). Effect of plant growth regulators on morpho-physiological parameters and yield in bittergourd. *Intn. J. of Agril. Sci.* **6 (2)**: 504-507.
- Gedam, V. M., Patil, R. B.; Suryawanshi, Y. B. and Mate, S. N. (1998). Effect of plant growth regulators and boron on

- flowering, fruiting and seed yield in bitter gourd. *Seed Res*; **26(1)**: 97-100.
- Hilli, J. S., Vyakarnahal, B. S., Biradar, D. P. and Hunje, Ravi (2010). Effect of growth regulators and stages of spray on growth, fruit set and seed yield of ridge gourd. *Karnataka J. Agric. Sci.* **23 (2)**:239-242.
- Hossain, K. M. A.; Pramanik, M. H. R. and Rahman, A. M. S. (2006). Effect of gibberellic acid (GA₃) on flowering and fruit development of bitter gourd (*Momordica charantia* (L.)). *Inter. J. Botany.* **2(3)**: 329-332.
- Marbhal, S. K., Musmade, A. M., Kashid, N. V., Kamble, M. S. and Kamthe, P. V. (2005). Effect of growth regulators and picking sequence on seed yield of bitter gourd (*Momordica charantia* L.) cv. Phule Green Gold. *J. Maharashtra Agril. Uni.* **32 (2)**: 306-308.
- Mia Baset, M. A., Islam, M. S. and Shamsuddin, Z. H. (2014). Altered sex expression by plant growth regulators: An overview in medicinal vegetable bitter gourd *Momordica charantia* (L.). *J. of Medicinal Plant Research.* **8 (8)**: 361-367.
- Momin, M. A., Islam, ABM J., Hossain, A. and Rashid, M. M. (2013). Effect of plant growth regulators and fertilizer management practices on reproductive growth of bitter gourd *Momordica charantia* (L.). *Eco-friendly Agril. J.* **6 (12)**: 273-278.
- Panse, V. G. and Sukhatme, P. V. (1985). Statistical Methods for Agricultural Workers (Second edition), I.C.A.R., New Delhi.
- Rashmi, R. N. (2003). Effect of nutrients and growth regulators on seed yield and quality of bottle gourd cv. Arka Bahar. M. Sc. (Agri.) Thesis, (Unpublished) Univ. Agric. Sci., Dharwad (India).
- Shantappa Tirakannanavar; Gouda, M. S.; Reddy, B. S.; Adiga, J. D. and Kukanoor, L. (2005). Effect of growth regulators and stages of spray on growth and seed yield in bitter gourd (*Momordica charantia* L.). *Karnataka J. Horti.* **1 (2)**: 55-62.
- Shirzad Sure, Hosein Arooie and Majid Azizi (2012). Influence of plant growth regulators (PGRS) and planting method on growth and yield in oil pumpkin (*Cucurbita pepo* var. styriaca). *Notulae Scientia Biologicae*, **4 (2)**:101-107.

Table 1: Effects of plant growth regulators and stages of spray on seed yield and quality characters in bitter gourd.

Plant Growth Regulators	Vine Length (cm)				Number of Matured Fruits Per Vine				Matured Fruit Yield Per Plant (kg)			
	(M ₁)	(M ₂)	(M ₃)	Mean	(M ₁)	(M ₂)	(M ₃)	Mean	(M ₁)	(M ₂)	(M ₃)	Mean
GA ₃ 25 ppm (S ₁)	376.00	320.00	377.33	357.78	8.72	8.34	8.69	8.58	0.57	0.50	0.53	0.53
GA ₃ 50 ppm (S ₂)	453.00	356.33	379.00	396.11	8.91	8.45	9.20	8.85	0.65	0.54	0.56	0.59
Ethrel 250 ppm (S ₃)	332.67	380.00	304.00	338.89	7.50	5.27	8.15	6.97	0.51	0.42	0.39	0.44
Ethrel 500 ppm (S ₄)	335.67	344.33	377.67	352.56	7.79	6.84	7.46	7.36	0.52	0.44	0.45	0.47
NAA 50 ppm (S ₅)	273.33	321.33	345.67	313.44	5.73	6.19	6.22	6.05	0.34	0.39	0.40	0.38
NAA 100 ppm (S ₆)	300.33	332.33	281.67	304.78	6.67	6.30	5.58	6.18	0.45	0.40	0.34	0.40
CCC 100 ppm (S ₇)	324.67	330.00	282.00	312.22	6.25	6.28	5.58	6.04	0.35	0.37	0.32	0.35
CCC 200 ppm (S ₈)	349.67	291.00	272.33	304.33	6.50	5.89	5.48	5.96	0.38	0.33	0.32	0.34
Water spray(S ₉)	307.00	303.67	282.33	297.67	5.58	5.54	5.10	5.41	0.29	0.32	0.30	0.30
Control (No spray) (S ₁₀)	280.67	315.33	271.33	289.11	5.33	5.65	4.99	5.32	0.26	0.30	0.27	0.28
Mean	333.33	329.43	317.33		6.90	6.48	6.65		0.43	0.40	0.39	
	Stages (M)	Spray (S)	M x S		Stages (M)	Spray (S)	M x S		Stages (M)	Spray (S)	M x S	
S.Em.±	3.99	8.31	14.39		0.14	0.14	0.24		0.01	0.01	0.02	
C.D. at 5%	NS	23.56	40.81		NS	0.39	0.67		NS	0.03	0.04	
C.V.%	6.71	7.66			11.23	6.12			6.71	12.70		

Table 1: Contd.....

Plant Growth Regulators	Seed Yield Per Plant (g)				100- Seed Weight (g)			
	(M ₁)	(M ₂)	(M ₃)	Mean	(M ₁)	(M ₂)	(M ₃)	Mean
GA ₃ 25 ppm (S ₁)	11.56	9.58	9.57	10.24	21.97	19.86	20.29	20.71
GA ₃ 50 ppm (S ₂)	11.83	9.78	9.52	10.38	22.11	20.63	20.30	21.01
Ethrel 250 ppm (S ₃)	8.87	11.11	10.15	10.04	19.27	21.51	20.55	20.44
Ethrel 500 ppm (S ₄)	10.88	9.21	10.38	10.15	21.39	19.61	20.78	20.59
NAA 50 ppm (S ₅)	10.45	9.44	9.74	9.88	20.86	19.84	20.14	20.28
NAA 100 ppm (S ₆)	8.56	10.92	9.90	9.79	18.96	21.32	20.30	20.19
CCC 100 ppm (S ₇)	9.94	9.08	9.85	9.63	20.33	19.48	20.25	20.02
CCC 200 ppm (S ₈)	8.47	10.31	10.67	9.82	18.87	20.69	21.06	20.21
Water spray(S ₉)	8.01	9.78	9.07	8.95	18.41	20.18	19.47	19.35
Control (No spray) (S ₁₀)	7.79	8.90	9.40	8.70	18.18	19.30	19.80	19.09
Mean	9.64	9.81	9.83		20.04	20.24	20.29	
	Stages (M)	Spray (S)	M x S		Stages (M)	Spray (S)	M x S	
S.Em.±	0.14	0.19	0.33		0.24	0.23	0.40	
C.D. at 5%	NS	0.54	0.94		NS	0.65	1.12	
C.V.%	7.81	5.87				6.24		

[MS received: July 22,2014]

[MS accepted: August 27, 2014]