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RESEARCH ARTICLE

INFLUENCE OF PLANT GROWTH REGULATORS ON CERTAIN YIELD AND QUALITY ATTRIBUTES OF BITTER GOURD (*MOMORDICA CHARANTIA* L.) ECOTYPE 'MITHIPAGAL' IN THE RICE FALLOW OF CAUVERY DELTA REGION

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ABSTRACT

Investigation on "Influence of plant growth regulators on growth and yield of bitter gourd ecotype mithipagal in the rice fallow of cauvery delta region" was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamilnadu The treatment schedule comprised five growth regulators in two levels such as GA_3 (25 and 50 ppm), Ethrel (ethylene) (250 and 500 ppm), NAA (100 and 250 ppm), Triacantanol (5 and 10 ppm) and Brassinosteroid (0.5 and 1.0 ppm) sprayed on 15, 30 and 45 DAS and untreated control with twelve treatments laid in randomized block design with three replications. The observations *viz.,* yield and quality parameters along were recorded. It was observed that the application of GA_3 @ 25 ppm (T_1) recorded the maximum values in number of fruits plant^{-1}, fruit weight, fruit length, fruit diameter, volume, fruit yield plant^{-1} (1.77 kg) and fruit yield ha^{-1} (22.47 t) were recorded with the application of ethrel @ 250 ppm (T_3). It was followed by T_{10} (brassinosteroid @ 1.0 ppm). Regarding the fruit quality characters, the ascorbic acid content and total soluble solids were found to be the maximum with the treatment T_3 ethrel @ 250 ppm and it was followed by T_7 (triacontanol @ 5 ppm).

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INTRODUCTION

Bitter gourd (*Momordica charantia* L.) is one of the most popular vegetable in South East Asia. It is a member of the cucurbitaceae family along with cucumber, watermelon, snake gourd and musk melon In the districts of Cauvery delta region, rice is grown extensively in monocropping. In Kharif season, the pulse (mung bean) is grown in relay cropping with rice. After the harvest of the rice and pulse, many farmers leave their lands fallow, though there is some irrigation facilities available. This restriction of cultivation is mainly due to the non-availability of suitable cost effective technologies for the cultivation of cash crops like vegetables in rice fallow land and lack of farmers awareness on alternate crops. Though some farmers are growing rice fallow vegetables such as bitter gourd ecotype 'mithipagal', they are not adopting appropriate technologies for the effective cultivation.. This situation leads unemployment, poverty and malnutrition among the small and marginal farmers and landless agricultural labours. Hence, it is an imperative need to find out suitable technologies for reducing the cost of inputs and for the effective utilization of vegetables such as bitter gourd in the fallow land. Nowadays, they are having an excellent yield potential under the rice fallow of cauvery delta region in Tamilnadu, India.

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Use of growth regulators in vegetable production must be specific their action and toxicologically and environmentally safe. The physiological activity of vegetable crops regulates and after the application of growth regulator finally enhances the vegetable production.The present study was planned with use of different plant growth regulators and their application(Sharma and Jookla, 2000).

MATERIALS AND METHODS

The experiment was carried out in the Experimental Farm, Department of Horticulture, Faculty of Agriculture, Annamalai University to study the influence of plant growth regulators on yield and quality of bitter gourd ecotype 'mithipagal'

Experiment details

Design	:	RBD (Randomized Block Design)
Treatments	:	9
Replication	:	3
Spacing	:	100 x 75 cm

Treatment details

T_1	-	Gibberellic acid (GA_3) @ 25 ppm
T_2	-	Gibberellic acid (GA_3) @ 50 ppm
T_3	-	Ethylene (Ethrel) @ 250 ppm
T_4	-	Ethylene (Ethrel) @ 500 ppm
T_5	-	Naphthalene acetic acid (NAA) @ 50 ppm
T_6	-	Naphthalene acetic acid (NAA) @ 100 ppm
T_7	-	Triacontanol @ 5 ppm
T_8	-	Triacontanol @ 10 ppm
T_9	-	Brassinosteroid @ 0.5ppm
T_{10}	-	Brassinosteroid @ 1.0 ppm
T_{11}	-	Control

The experiment was laid out in randomized block design with 3 replications. The field was well prepared with conservation (minimum) tillage and divided into plots of 20.0 x 12.5 m dimension. Pits with the size of 30 cm^3 were formed with the spacing of 100 x 75 cm. The recommended dose of inorganic fertilizer (45:22.5:22.5 kg NPK ha^{-1}) + vermicompost @ 2.5 t ha^{-1} along with biofertilizers (Azospirillum + Phosphobacteria each @ 2 kg ha^{-1}) + Panchakavya @ 3% foliar spray (at 30, 60 DAS) was commonly employed for all the treatments. 4 seeds pit^{-1} were sown and thinned out 15 days after sowing. As per the treatment schedule, the foliar application of growth regulators (GA_3, Ethrel, NAA, triacontanol and brassinosteroid) with different concentrations were sprayed at 15, 30 and 45 DAS. The spraying was done on the forenoon. A precaution was taken to prevent drifting of spray solution from one treatment plot to another. A control was maintained with water spray. Regular irrigation and uniform cultural practices were adopted for all the treatment plots in the experiment. The biometric observations on yield and fruit quality parameters were recorded The experimental data were analysed statistically as per the procedure described by Panse and Sukhatme (1978) and wherever, the results are found to be significant, the critical differences were arrived at five per cent level to draw statistical conclusions.

RESULTS AND DISCUSSION

Plant growth regulators have varied effects on growth and yield parameters of different crops. They can effectively be employed to improve the quality aspects of vegetables. Several findings were registered by the scientists such as Kshirsagar *et al*. (1995) in cucumber with GA_3, NAA, ethrel and triacantanol, Mujica and Mogollon (2005) in garlic with brassinosteroid. The problem of flowering and fruiting of bitter gourd, a cucurbit vegetable which is monoecious in nature therefore has a highly variable range in the ratio of male to female flowers. Normally staminate flowers are developed more in number than pistillate flowers. The modification and shift of sex form from male to female in cucurbits by the application of plant growth regulators was received considerable attention of researchers in our country, Arora *et al*. (1985) in bottle gourd with a view to increase fruit set and yield. With this information the effect of plant growth regulators such as GA_3, NAA, ethrel, triacontanol and brassinosteroid in different concentrations on growth and yield attributes of bitter gourd ecotype 'mithpagal' are registered and discussed hereunder. In this study, the yield attributing characters such as days to fruit maturity, number of fruits $plant^{-1}$, fruit weight, length, diameter, volume, fruit yield $plant^{-1}$ and ha^{-1} were found to be the best in ethrel @ 250 ppm. Early fruit maturity could be attributed due to the role of ethylene in fruit ripening due to its senescent effect on fruit (El-kholy and Hafez, 1982). Similar results were also reported by Gedam *et al*. (1998) in bitter gourd and Rashmi (2003) in bottle gourd. The increased number of fruits $plant^{-1}$ with ethrel may be due to the production of more branches $plant^{-1}$ which is responsible for production of more number of pistillate flowers and ultimately more fruit set which is in conformity with the findings of Arora *et al*. (1985) in ridge gourd. Among the treatments, the increased fruit weight in ethrel application might be due to the sole function of fertilized ovules in relation to growth of fruits with the help of synthesized one or more hormones which initiate and maintain a metabolic gradient along with foods and this can be transported from the other parts of the plants towards the fruit. This is in line with the reports of Singh and Singh (1984) in cucumber. The increase in fruit yield with ethrel was due to the more fruit production per plant which enhances the fruit yield ha^{-1} ultimately. These findings are confirmity with the reports of Sanjay Kumar *et al*. (2006) in bottle gourd. As the beneficial influence of growth regulators was noticed on fruit yield, consequently growth regulators also exhibited significant influence on fruit quality characters like total soluble solids and ascorbic acid which showed the maximum values in ethrel @ 250 ppm and it was closely followed by triacontanol @ 5 ppm. The increased content of total soluble solids and ascorbic acid might be due to the stimulation and balancing of the growth hormones with application of ethrel which also enhances the accumulation and translocation of photosynthates from source to sink (fruits). These findings are in conformity with the results of Arora *et al*. (1995) in ridge gourd, Elizabeth *et al*. (1999) in snake gourd and Muralidharan *et al*. (2002) in chilli.

Table 1. Influence of plant growth regulators on number of fruits $plant^{-1}$, fruit weight (g $fruit^{-1}$) and fruit length (cm) of bitter gourd ecotype 'mithipagal' under rice fallow condition

Treatments	Number of fruits $plant^{-1}$	Fruit weight (g $fruit^{-1}$)	Fruit length (cm)
T_1 – GA_3 @25 ppm	40.95	35.07	4.01
T_2 – GA_3 @50 ppm	41.88	36.39	4.25
T_3 – Ethrel @250 ppm	45.37	41.02	4.97
T_4 – Ethrel @500 ppm	43.75	38.89	4.64
T_5 – NAA @50 ppm	41.61	36.18	4.17
T_6 – NAA @100 ppm	42.57	37.34	4.43
T_7– Triacontanol @5 ppm	42.75	37.51	4.46
T_8 – Triacontanol @10ppm	44.04	39.13	4.67
T_9 – Brassinosteroid @0.5ppm	43.07	37.97	4.48
T_{10} – Brassinosteroid @1.0 ppm	44.69	40.08	4.82
T_{11} – Control	39.86	33.36	3.83
SED	0.32	0.46	0.07
CD (p = 0.05)	0.65	0.92	0.14

Table 2. Influence of plant growth regulators on fruit diameter(cm) and fruit volume(cm^3) and fruit yield $plant^{-1}$ (kg) of bitter gourd ecotype 'mithipagal' under rice fallow condition

Treatments	Fruit diameter (cm)	Fruit volume (cm^3)	Fruit yield $plant^{-1}$(kg)
T_1 – GA_3 @25 ppm	2.91	6.62	1.35
T_2 – GA_3 @50 ppm	3.03	7.08	1.44
T_3 – Ethrel @250 ppm	3.31	8.53	1.77
T_4 – Ethrel @500 ppm	3.19	7.92	1.62
T_5 – NAA @50 ppm	2.96	6.93	1.42
T_6 – NAA @100 ppm	3.09	7.39	1.49
T_7– Triacontanol @5 ppm	3.10	7.52	1.51
T_8 – Triacontanol @10ppm	3.20	8.01	1.63
T_9 – Brassinosteroid @0.5ppm	3.13	7.65	1.54
T_{10} – Brassinosteroid @1.0 ppm	3.25	8.27	1.70
T_{11} – Control	2.85	6.39	1.24
SED	0.03	0.12	0.02
CD (p = 0.05)	0.05	0.24	0.05

Table.3. Influence of plant growth regulators on ascorbic acid content (mg g^{-1}) and total soluble solids (^{0} Brix) of bitter gourd ecotype 'mithipagal' under rice fallow condition

Treatments	Ascorbic acid content (mg g^{-1})	Total soluble solids (^{0}Brix)
T_1 – GA_3 @25 ppm	1.62	3.57
T_2 – GA_3 @50 ppm	1.58	3.53
T_3 – Ethrel @250 ppm	1.82	3.78
T_4 – Ethrel @500 ppm	1.69	3.65
T_5 – NAA @50 ppm	1.76	3.71
T_6 – NAA @100 ppm	1.64	3.59
T_7– Triacontanol @5 ppm	1.79	3.75
T_8 – Triacontanol @10ppm	1.75	3.70
T_9 – Brassinosteroid @0.5ppm	1.68	3.63
T_{10} – Brassinosteroid @1.0 ppm	1.71	3.66
T_{11} – Control	1.55	3.49
SED	0.01	0.01
CD (p = 0.05)	0.03	0.03

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