

Effect of Gibberllic Acid and Cycocel on Yield and Quality of Bitter Gourd

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ABSTRACT

The present Research trial was conducted at the Research Farm of Division of Horticulture Faculty of Agriculture, Wadura, during Kharif season of 2017 and 2018 to study the effect of Plant Growth regulators (Gibberllic Acid & Cycocel) on flowering, yield and quality of bitter gourd. Exogeneous application of both GA3 & Cycocel significantly increased the growth and yield of Bitter Gourd with an improvement in quality characteristics of the fruit over the control. GA3 proved better than the Cycocel in improving the growth Yield and quality characteristics of the Bitter gourd. Application of GA3 60ppm (T₃) recorded the Maximum number of branches, Length of vine (cm), Number of fruits per plant, Yield (q/ha) and quality parameters like Moisture content of fruit (%), TSS (%) and Ascorbic acid (mg/100g pulp).

Keywords: GA3, Cycocel, Yield, Quality, Bitter Gourd

INTRODUCTION

Bittergourd (*Momordica charantia* L.) is one of the most important cucurbitaceous vegetable widely cultivated in India. The importance of bittergourd has long been recognized due to its high nutritive value and medicinal properties. The fruit is a rich source of vitamin C, iron, phosphorous and carbohydrates (Behera, 2004). Bitter gourd has immense medicinal properties due to the presence of beneficial phytochemicals which is known to have antibiotic, antimutagenic, antioxidant, antiviral, antidiabetic and immune enhancing properties (Grover & Yadav, 2004). A compound known as charantin, present in the bittergourd is used in the treatment of

diabetes in reducing blood sugar level (Lotlikar and Rajaramrao, 1966). This vegetable is a different nature's bountiful gifts to mankind, which does not only have fabulous digestional properties, but also it is a storehouse of remedies for many common ailments such as diabetes, rheumatism and gout (Mia et al., 2014). The fruit accumulates bitterness with time due to build up of three pentacyclic triterpenes momordicin, momordicinin and momordicilin, and then loses the bitterness during ripening (Cantwell et al., 1996). In India, it is cultivated in an area of 26,004 ha with a production of 1,62,196 tons and the productivity level is 6.23 t/ha.

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The plant growth regulators (PGRs) is considered as a new generation of agrochemicals after fertilizers, pesticides and herbicides, known to enhance the source sink relationship and stimulate the translocation of photo assimilates thereby helping better fruit set. Similarly, even in bittergourd, it is possible to increase the yield level by increasing the fruit set per cent by use of some growth regulators. Use of plant growth regulators (PGRs) might be a useful alternative to increase crop production. Gibberellic acid is an important growth regulator that has many uses to modify the growth, yield and yield contributing characters of plant (Rafeekher et al. 2002). Though the PGR's have great potentialities to influence plant growth morphogenesis, its application and acroal assessments have to be judiciously planned in terms of optimal concentrations, stage of application, species specificity, seasons, etc. Which constitute the major impediments in PGR's applicability. Since, very little information is available on the effect of growth regulators on growth and yield in vegetables especially in bittergourd.

Bitter gourd is a monoecious plant naturally, inducing greater number of male flowers than the female flowers and this flowering behavior is not advantageous and economical, because it results in lower fruit set and yield (Mangave et al., 2016). To have the higher yield, the male and female flower ratio needs to be decreased and synchronized. Maleness and femaleness can usually be altered by environmental variables such as temperature, photoperiod and nutrition or by the application of growth regulators (Krishnamurthy, 1981). It is seen that proper and judicious use of plant growth regulators (PGRs) is one of the ways to increase the yield of bitter gourd by inducing female flowers and reducing male flowers. Gibberellic acid (GA₃) and naphthalene acetic acid (NAA) are two important growth regulators that are used to modify the growth, yield and yield contributing characters of cucurbitaceous crops (Rafeekar et al., 2002; Iqbal et al., 2013; Chovatia et al., 2010; Dalai et al., 2015; Singh et al., 2015). GA₃ plays a key role in promoting male sex expression and are

antagonistic to that of ethylene and abscisic acid (Rudich, 1983; Zhang et al., 2017). Exogenous application of GA₃ promotes female flowers as well as fruit setting and development of bitter gourd crop (Banerjee and Basu, 1992 the present investigation was aimed to find out suitable growth regulators for increasing the fruit yield potential and also quality in bittergourd with the objective to find out the effect of plant growth regulators on growth and yield in bittergourd.

MATERIALS AND METHODS

The experimental work was conducted on the Vegetable Farm at Division of Horticulture Faculty of Horticulture Wadura, SKUAST (K) Shalimar, during the two consecutive Kharif seasons of 2017 and 2018. The experiment was carried out in Randomized Block Design with Six treatments, (T₁=GA₃ 20ppm, T₂=GA₃ 40ppm, T₃=GA₃ 60ppm, T₄=Cycocel 100ppm, T₅= Cycocel 200ppm, T₆=Control) and four replications Treatments were imposed at two true leaf stage. Five plants from each plot were randomly selected for observations like No of branches, numbers of female flowers, Length of vine, number of fruits and individual fruit weight. The vine length was measured from the cotyledonary node upto the growing tip and expressed in centimeters. The total number of branches were estimated by counting the individual branch from top to bottom of the plant expressed as number of branches per plant. Total numbers of female flowers produced per plant were counted in each treatment. The number of fruits per plant and fruit yield were worked out as per the standard procedures. Standard procedures were adopted for the evaluation of TSS, Moisture Percentage and ascorbic acid content from the fruit samples.

RESULTS AND DISCUSSION

Growth parameters

The data on Number of branches and vine length as presented in Table 1 indicates asinificant differences between the treatments. The maximum number of branches (11.8) and vine length (351 cm) was recorded in treatment, T₃, (GA₃ 60 ppm) and was found significantly superior over cycocel application

at both (100 & 200 ppm) levels, and control. The application of cycocel also improved significantly the Number of branches and vine length of the plants over the control but the effect of GA3 was more than Cycocel on these growth parameters. Similar results were also obtained by Mangal et al. (1981) in bittergourd. The promotion of growth either in terms of increase in the vine length or the leaf area and leaf number has been thought to be by increasing plasticity of the cell wall followed by hydrolysis of starch to sugars which lowers the water potential of cell, resulting in the entry of water into the cell causing elongation. These osmotic driven responses under the influence of gibberellins might have attributed to increase in photosynthetic activity, accelerated translocation and efficiency of utilizing photosynthetic products, thus resulting in increased cell elongation and rapid cell division in the growing portion (Sargent, 1965). Increase in the number of branches might be due to its additional availability of GA in seed, which might have increased the level of amylase in the aleurone tissues of seed for better conversion of complex starch into simple sugars for providing energy to growth (Ram Asrey et al., 2001). The decrease in both the vine length as well as number of branches with CCC could be due to the nature of onium compounds to which CCC belongs and it is known to interfere in the GA biosynthetic pathway.

Yield parameters

Yield parameters as shown in the table 1 were significantly affected by the application of both GA3 and Cycocel i.e there was a

significant improvement in the parameters like number of fruits plant⁻¹, fruit weight & yield. Although application both the growth regulators (GA3 and Cycocel) showed significant improvement in these parameters over the control yet the application of GA3 showed significantly higher results than the application of Cycocel. The treatment T₃ i.e the application of GA3 @60 ppm showed significantly maximum number of fruits plant⁻¹ (14.1), Individual fruit weight(84.8 g) and Yield (145.4q/ha). An increase in fruit yield in treated plants may be attributed to the reason that plants remain physiologically 'more active to build up sufficient assimilates for the developing flowers and fruits, ultimately leading to higher yield. The increase in fruit yield by GA3 is probably due to an increase in carbohydrate metabolism and accumulation of carbohydrates (Mishra et al., 1972), auxin directed mobilization of metabolites from source to sink (Vasantkumar & Sreekumar, 1981).

Quality Parameters

Moisture content, TSS & ascorbic acid content are considered as the important quality characteristics of the bitter gourd which were significantly affected/ improved by the application of both plant growth regulators (Cycocel and GA3) over the control i.e no application of any PGR. Response of quality parameters as present in Table 2 to the application of GA3 was more than to the application of cycocel. The highest moisture content (82.3 %), TSS (3.96 %) and Ascorbic acid (40.8 mg/100g pulp) was observed with the treatment T₃ (60 ppm GA3).

Table 1: Effect of GA3 and Cycocel on vegetative growth and yield attributing characters of Bitter gourd

Treatment	No of Branches	Length of Vine (cm)	No of fruits plant ⁻¹	Individual fruit weight(g)	Yield (q/ha)
T1 (GA ₃ 20ppm)	9.87	330.1	17.0	67.05	104.3
T2 (GA ₃ 40ppm)	10.80	329.0	10.1	76.97	111.2
T3 (GA ₃ 60ppm)	11.8	351.5	14.1	84.8	145.4
T4 (Cycocel 100ppm)	8.75	315.5	8.3	64.6	109.8
T5 (Cycocel 200ppm)	10.0	316.2	7.3	60.3	91.2
T6 (Control)	8.5	258.6	5.75	46.9	86.0
SEm	0.37	9.00	0.53	1.0	5.59
CD (P=0.05)	0.75	16.3	1.18	2.42	11.8

Table 2: Effect of GA3 and Cycocel on Quality characters of Bitter gourd

Treatments	Moisture content of Fruit(%)	TSS (%)	Ascorbic acid (mg/100g pulp)
T1 (GA ₃ 20ppm)	78.3	3.5	38.5
T2 (GA ₃ 40ppm)	80.4	3.6	39.4
T3 (GA ₃ 60ppm)	82.3	3.96	40.8
T4 (Cycocel 100ppm)	78.4	3.56	38.8
T5 (Cycocel 200ppm)	77.8	3.5	39.3
T6 (Control)	75.4	3.2	34.7
SEm	0.39	0.04	0.34
CD (P=0.05)	0.83	0.09	0.72

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