

Effect of auxins and cytokinin on budding and growth of saplings of *bael*

(*Aegle marmelos Correa.*)- a medicinal plant

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Abstract

In this investigation, NB-9 cultivar of *bael* (*Aegle marmelos Correa.*) was selected as mother plant for obtaining scion bud. The foliar spray of NAA, IBA and BA (25 and 50 ppm each) either on rootstock or/and scion branch was applied seven days prior to budding. The most responsive treatment was foliar spray on rootstocks with BA at 50 ppm concentration. Rootstocks treated with BA (50 ppm) resulted in early bud breaking (10.67 days), maximum bud sprouting percentage (100%), length of sprouted scion 30 days after budding (22 cm), diameter of sprouted scion (2.53 mm), number of leaves (7.13) and maximum scion growth initiation in plants (87.50%) as compared to other treatments. In another experiment, when plant growth regulators were applied to scion branch of mother plant at seven days prior to budding, did not respond satisfactorily with respect to almost all the parameters except bud sprouting percentage and bud survival percentage. These treatments failed to have promotive effect on length of scion shoot and percentage of plants with scion growth.

Keywords: Bael (*Aegle marmelos Correa.*), budding, growth regulators (NAA, IBA, BA)

Introduction

The bael (*Aegle marmelos Correa.*), an ancient fruit of India being grown throughout the tropical and subtropical regions of the country and thrives well up to the elevation of 1200 meter. Bael is quite hardy, prolific bearer and highly remunerative even without much care under arid and semi arid climatic conditions. It is a tall, slow growing, sub-tropical deciduous

fruit tree having wide diversity of fruit (Singh et al. 2015) which is suitable for various soil-climatic conditions ranging from swampy to dry soils and can tolerate alkaline soils (Singh & Roy, 1984). It can be grown in soils having pH range 5 to 10, where many other fruit trees fail to grow (Jauhari & Singh 1971; Haldhar et al. 2010; Samadia 2016; Yashwanti et al. 2016). Looking to its adaptation to varied adverse climatic conditions, *bael* has tremendous scope in the arid and semi arid region of India (Singh et al. 2016). The fruit contains a therapeutically active substance marmelosin that is known as panacea of the stomach ailments. In view of the importance of *bael*, it is summarised that increased cultivation of *bael* may prove to be boon for the upliftment of farmers economy. There is lack of organised orcharding of this fruit in Rajasthan and most of the plantation is either from seedling origin or planted in a scattered way. One of the problems faced by farmers in increasing the cultivation of *bael* rapidly is lack of availability of suitable true to type planting material.

Bael can be propagated by both sexual and asexual methods but it is commonly propagated by seeds, which is not desirable because of its several inherent disadvantages of uneven growth and development of morphological parts, fruits and ripening behaviour of fruits, long juvenile phase, uneconomic or poor production, productivity and quality of fruits. Seed propagation method is largely employed for raising root stocks on which budding operation is performed in *bael*. In order to overcome the disadvantages of seed propagation and for large scale multiplication of superior and true-to-type planting material, vegetative method of propagation has been recommended in *bael*. Presently, under crop improvement programmes, *bael* varieties of different characteristics and quality traits has been developed which needs clonal propagation for commercial orcharding.

Long back, the vegetative method of propagation either by budding or grafting has been tried for this crop (Singh, 1954; Singh et al. 1976; Moti et al. 1976; Chadha 2001) with varied success rate in different agro climatic conditions of the country. These studies were mostly conducted in more favourable agro-ecological conditions which are more congenial for the vegetative propagation. However, yet few attempts seems to be made for standardization of vegetative propagation technique under arid ecosystem of Rajasthan. The arid ecosystem of Rajasthan is characterised by high temperature up to 50⁰C in summer, low temperature during winter near to 0⁰C, high wind speed, intense sand storm, low and erratic rainfall, high evaporation and low relative humidity during most of the months of the year (Singh & More, 2008). All these climatic elements adversely affect vegetative propagation of fruit crops and thus results in poor success rate of grafting or budding methods. Therefore, under extreme adverse climatic conditions of arid region, several times formation of bud or graft union becomes difficult and leads to poor bud uptake. Furthermore, scion grows slowly due to climatic stresses. Therefore, there is an urgent need to improve vegetative propagation

efficiency using plant growth regulators under arid climatic conditions. The use of certain plant growth regulators such as NAA, IBA and BA have been found to be beneficial in improving graft union formation (Shimomura & Fuzihara 1977; Parkinson 1982). Keeping in view, the adverse ecological problems being faced in vegetative propagation and ever increasing demand of planting material of *bael* in arid regions, there is pressing need to improve the efficiency and technique of vegetative propagation of *bael* in arid region

Materials and methods

Experimental site and plant material

The experiment was conducted at Hi-Tech nursery complex, Central Institute for Arid Horticulture, Beechhwal, Bikaner. In order to achieve the objectives of this investigation, three sets of experiments were laid out in completely randomized design (CRD). Under this experiment, one year old rootstocks and/ or scion branch of mother plant were selected for spraying growth regulators. One year old 6-7 mm diameter seedling rootstocks were used for budding. All selected rootstocks were almost of uniform in size, healthy and free from insect-pest and diseases. The physiologically active buds were collected from the mother plant of *bael* cultivar NB-9. The treatments were replicated thrice.

Plant Growth Regulators

The aqueous solution of different concentrations of NAA (25 and 50 ppm), IBA (25 and 50 ppm) and BA (25 and 50 ppm) was sprayed by hand sprayer 7 days before on the experimental seedling rootstocks and scion stick of mother plants during the month of July, 2008. The untreated bud sticks were used for excision of buds for budding on treated rootstocks.. In order to avoid drying of buds during budding operation, the scion shoots were wrapped in newspapers with moist moss and tied in gunny bags. Budding operation were performed immediately after cutting the scion shoots in the morning.

Observations

The data were recorded from all the five plants in each replication, tagged for different treatments. The following observations were recorded during the experimentation: number of days took in bud sprouting, Bud sprouting percentage. Bud survival percentage after budding. Length of scion after budding (cm) Number of leaves after budding. Sprouted scion diameter after budding (mm). Scion growth initiation in plants after budding.

Budding operation

Patch budding method was adopted. A rectangular patch of bark was removed completely from the rootstock and a patch of bark of the same size containing a bud of the desired variety was inserted there. The procedure followed by tying of inserted patch leaving the bud open to

grow. The fresh buds were taken out from the scion shoot of the desired variety and budding was performed on the rootstock at a height of 10-15 cm above ground level. In tying the bud, the ends of polythene were held in place by inserting them under the adjacent turn often. The tying was done from top to down to avoid forcing the bud cut through the horizontal cut. As a usual practice, when the bud union took place, the polythene wrap was also removed followed by the removal of the upper portion of rootstocks to enforce the bud sprouting. All the sprouts of rootstocks were removed as and when they appear. The necessary operations were performed for the care of saplings during the experimentation. The data were analysed using the analysis of variance technique. The critical differences were calculated to assess the significant differences between treatment means.

Result and Discussion

It is evident from the results that encouraging results with respect to number of days taken in bud sprouting, bud sprouting percentage, bud survival percentage after bud sprouting, length and diameter of sprouted scion, number of leaves and percentage of plants with scion growth were observed with plant growth regulators (NAA, IBA and BA) when applied to one year old seedling rootstocks of bael at seven days prior to budding operation. Number of days taken for bud sprouting in budded plants was significantly influenced by 50 ppm of NAA and or BA. Both the treatments were found to induce early bud sprouting with 9.67 to 11 days, whereas, late (17.67 days) bud sprouting was observed under control conditions (Table 1). The bud sprouting percentage was also maximum (100%) with BA 50 ppm treatment followed by BA 25 ppm and NAA 25 ppm as compared to minimum (70%) in control. Kako et al. (2012) also suggested that various auxin had significant effects on fruit trees budding by affecting xylem and phloem differentiation and on lignifications process which is considered as very important factors in formation of a strong unite area in grafting and budding. Further, adventitious bud formation believed to be triggered by the synergism of auxin and cytokinin for their growth (Phillips 1965).

Table 1. Effect of foliar spray of NAA, IBA and BA on seedling rootstocks of bael on bud union formation and growth of budded plants

Treatment	Number of days taken in bud sprouting	Bud sprouting (%)	Bud survival (%) after 60 days of budding
Control	17.67	70 (56.84)#	100
NAA 25 ppm	12.67	100 (90.00)	100
NAA 50 ppm	9.67	80 (63.93)	87.5
IBA 25 ppm	15.33	80 (63.93)	100

IBA 50 ppm	13.67	80 (63.93)	75
BA 25 ppm	11.00	100 (90)	100
BA 50 ppm	10.67	100 (90)	100
S.Em	0.38	2.51	

Angular transformed values are given in parenthesis.

There is significant difference observed among the treatments with respect to length of sprouted scion (Table 2). The maximum length (30.20 cm) and diameter (4.10 mm) of sprouted scion was obtained in BA 50 ppm treatment after 120 days of budding and the minimum length (15.07 cm) and diameter (2.86 mm) was recorded in control. BA was found to promote rapid scion shoot growth because physiologically cytokinin promotes lateral bud development and reduce apical dominance. Further, the function of cytokinin in plant tissue is to increase DNA, RNA and protein levels which mainly contribute to shoot tip growth (Fox, 1968; Srivastava, 1968; Audus, 1972). The mean maximum number of leaves (11.00) was also recorded at BA 50 ppm treatment after 120 days of budding. After 120 days of budding, the BA 50 ppm resulted 87.5 per cent of scion growth and BA 25 ppm resulted 100 per cent, whereas, minimum percentage (50%) of plants with scion growth was recorded in control. Ferguson et al. (1986) also observed increased in number of leaves of sour orange seedlings treated with BA in combination with elevated CO₂. The promotive effect on shoot growth and development may be due to stimulative effect of BA on the budded plants. These findings may be indirectly supported by the reports of Tripathi & Kumar (2004) who observed variable length of scion shoot growth when budded at different period that can be correlated with the level of endogenous hormones during different periods.

In another experiment when plant growth regulators (NAA, IBA and BA) were applied as foliar spray to scion branch of mother plant at seven days prior to budding not responded satisfactorily with respect to almost all the parameters except bud sprouting percentage and bud survival percentage. These treatments failed to give sufficient length of scion and percentage of plants with scion growth. Thus, response of foliar application of plant growth regulators (NAA, IBA and BA) to scion wood proved to have an inhibitory effect.

Table 2. Effect of foliar spray of NAA, IBA and BA on seedling rootstocks of bael on growth and development of budded plants

Treatment	Length of sprouted scion after 120 days of budding (cm)	Number of leaves	Diameter of sprouted scion (mm)	Percentage of plants with scion growth initiation
Control	15.07	5.87	2.86	50

NAA	25	16.77	7.17	3.14	70
NAA	50	23.30	7.73	3.22	87.5
IBA	25	22.67	7.37	2.87	100
IBA	50	19.47	8.03	3.09	75
BA	25	24.17	8.20	3.40	100
BA	50	30.20	11.00	4.10	87.5
S.Em		0.43	0.10	0.08	

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