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Enhancement of seed germination in kiwi fruit by stratification and gibberellic acid application

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ABSTRACT

Seeds of two kiwi fruit varities *viz.*, Bruno and Hayward were treated with four concentrations of GA_3 @ 500, 1000, 1500 and 2000 ppm for a period of 20 h and stratified at 4.4°C for 6, 8, 10 weeks well as and sown directly in open field conditions. The seeds after treatment were sown during the first week of March whereas the open field sowing was done in first week of February. The germination of seed was higher in cv. Bruno as compared to cv. Hayward. With the increase in concentration of gibberellic acid, seed germination was enhanced in both the varities. However, the effect was much more pronounced in cv. Bruno as compared to cv. Hayward. Maximum seed germination (67.25 and 53.00%) was observed with the application of 2000 ppm GA_3 in cvs. Bruno and Hayward respectively. Ten and 6 weeks stratification at 4.4°C were adequate for higher seed germination in cvs. Hayward and Bruno respectively. The seeds of Hayward revealed much more positive response to stratification as compared to gibberellic acid whereas it was least in cv. Bruno.

Key words: Kiwi fruit, stratification, gibberellic acid, seed, germination.

INTRODUCTION

Kiwi fruit (*Actinidia deliciosa* (A. Chew) C.F. Lianget AR Ferguson var. *deliciosa* formally *Actinidia chinensis* (Planch) is a green flushed berry belonging to family Actinidiacae is known as 'China's miracle' as well as 'Horticulture wonder of New Zealand'. It is cultivated in wide range of climatic condition where 950 h of chilling temperature at 4°C are met. Currently, kiwi fruit is being grown in Kullu district of Himachal Pradesh with an estimated production of 150 tonnes, whereas country imported nearly 900 tonnes a year worth Rs. 5.64 crores during 2005-2006. The preliminary observation indicates that the climatic conditions of Kashmir valley is most suitable for its successful cultivation. Due to the wide adaptability, hardy nature, less care in cultivation and high nutritive value (Rathore, 6), farmers of the valley have shown keen interest for growing kiwi fruit in the senile orchards of apple, peach and plum and diversification of monoculture practices of apple, which require special care with regards to pest and disease management. The university has developed technique for rooting of cutting which, however, render merely 31% success (Sharma *et al*., 7). Owing to increasing demand of plants, the requirement is not fulfilled through cutting. Hence, it was felt that the genuine planting material of kiwi fruit needs be raised by budding owing to the fact that budding characteristically bear the advantage over cutting where single scion wood give rise to more number of plants as compared to cuttings. Thus, the rootstock is basic material for budding of any fruit plant and that can be met by raising plants through seed. However, the seed germination of kiwi fruit is meagre. The fresh kiwi fruit seeds undergo rest and do not germinate unless fruit ripened after after harvest for a certain period at a low temperature. The effect of gibberellic acid on seed germination is well known in many fruit species such as persimmon (Taha, 8), peach (El-Khoreiby and Salem, 2). Accordingly, the present investigation was undertaken to find out a practical method to enhance kiwi fruit seed germination by means of low temperature chilling and GA_3 treatments.

MATERIALS AND METHODS

The investigation was conducted at the experimental orchards of the Division of Pomology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar. The treatments comprising two varieties (Bruno and Hayward) in main plot and four concentrations of GA_3 (500,1000, 1500 and 2000 ppm) and four stratification treatments (6, 8, 10 weeks at 4.4°C and open field) were tested in split plot design with two replications. One plant each of Hayward and Bruno varieties were selected both the seasons. Fifty fruits of each variety were collected in two years and kept in wooden box for ripening after wrapping the individual fruit with newspaper sheets for about one month. Seeds were extracted from the ripened fruits and immediately washed with tap water and air-dried. The seeds after treatment were kept in

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refrigerator and sown during the first week of March, whereas the open field treatments combinations were shown in first week of February at a distance of 2.5 to 3.0 cm from seed-to-seed and row-to-row with a depth of 2.3 cm in well moistured germination medium of coarse sand placed in perforated galvanized iron tray (90 × 45 × 10 cm). One hundred seeds in each treatment with 50 seeds as a unit were taken in each replication. The seeds were kept under observation for germination till 60 days after sowing. The data were pooled and statistically analyzed as suggested by Gomez and Gomez (4).

RESULTS AND DISCUSSION

Gibberellic acid had significantly enhanced the seed germination in both the varieties (Figs. 1 & 2). However, the response to GA_3 was much more in cv. Bruno as compared to Hayward. With the increase in GA_3 dose, the seed germination were enhanced in cv. Bruno but cv. Hayward had very little effect of gibberellic acid treatment (Fig. 1). Maximum seed germination was observed with the application of 2000 ppm GA_3 in cvs. Bruno and Hayward respectively, whereas the minimum seed germination (48.62%, 45.87%) were registered with 500 ppm GA_3 in cvs. Bruno and Hayward respectively. There were no significant difference on seed germination of Hayward variety when seeds were treated either with 1,500 or 2,000 ppm GA_3 indicating that 1,500 ppm is optimum for economic and better seed germination for cv. Hayward. Enhancement of seed germination by growth regulators might be due to increase of transcription and/or translation during protein synthesis (Villers, 9). The mobilization of protein and lipid storage bodies upon specific enzymes, which hydrolyze stored molecules and catalyze (Noland and Murrphy, 5) result into the production of energy and substrates, which in turn provide the structural components essential for growth and emergence of the embryo. The results are in accordance with the findings of Chin *et al.* (1) who observed that GA_3 treatment broke dormancy and increased seed germination with increase concentration of GA_3 upto 2,500 ppm. Similarly, Xu and Gu (10) observed best seed germination (78.8%) with the application of GA_3 @ 1,500 ppm, whereas Gao *et al.* (3) also found increased in kiwi seed germination fruit with higher concentration of GA_3 (1,500 to 3,500 ppm). Stratification had positive influence on seed germination in Hayward variety (Fig. 1). Maximum seed germination in cv. Hayward variety was recorded when the seeds of this variety were stratified for 10 weeks. No significant differences were observed when seeds of cv. Hayward were stratified at 6 or 8 weeks and sown without stratification in open field conditions. In these treatments, the germination was below average. The result suggest that the seeds of cv. Hayward require stratification for 10 weeks at 4.4°C for maximum seed germination. The stratification did not show any influence on the seed germination in cv. Bruno (Fig. 2). Data suggest that stratification of cv. Bruno seeds for more then 6 weeks is sufficient for enhancing seed germination. The highest germination in kiwi fruit seeds by stratification could be attributed to the fact that low temperature may have depressed the growth inhibitor contents in seed. The interaction effect of gibberellic acid and stratification was found significantly increased seed germination in both the cultivars (Table 1). There was no significant difference in seed germination of kiwi fruit cultivars when seeds are treated with 1000, 1500 and 2000 ppm GA_3 for same period of stratification

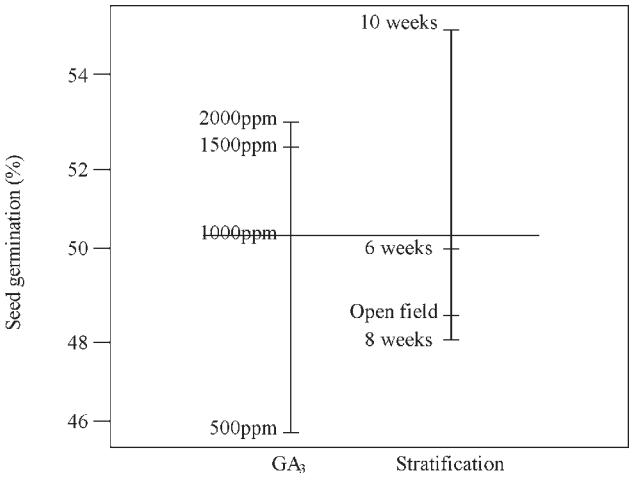

Fig. 1. Effect of GA_3 and stratification on seed germination in kiwi fruit cv. Hayward.

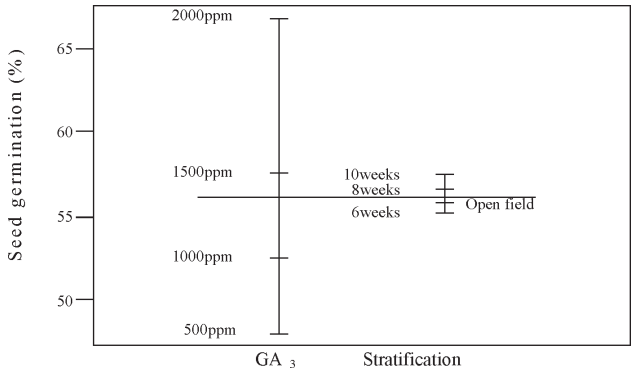

Fig. 2. Effect of stratification and GA_3 on seed germination in kiwi fruit cv. Bruno. The effect of GA_3 is more than that of stratification on seed germination as vertical line for GA_3 is longer than that of stratification. The horizontal line shows the average germination percentage at corresponding levels of the factors.

Table 1. Interaction effect of GA_3 and stratification treatments on seed germination (%) in kiwi fruit cvs. Hayward and Bruno.

GA_3	Stratification at 4.4°C in weeks							
	Open field		6		8		10	
(ppm)	Hayward	Bruno	Hayward	Bruno	Hayward	Bruno	Hayward	Bruno
500	42.5	53.5	45.5	45.2	43.5	47.0	52.0	48.7
1000	43.5	52.0	51.5	46.7	50.0	55.2	56.2	57.7
1500	52.5	53.7	53.7	59.2	51.7	60.5	54.7	58.2
2000	55.0	64.7	64.7	71.7	46.5	65.5	58.0	67.0

$CD_{0.05}$ = 5.10

indicated that the cv. Hayward seeds should be treated with 1000 ppm GA_3 for maximum benefit. The seeds of cv. Hayward showed more response to stratification as compared to gibberellic acid treatment. It is also suggested that the 'Hawyard' seeds should be treated with GA_3 @ 1,000 ppm and stratified more the 10 weeks either in control or in open field conditions. Whereas, the maximum seeds germination of 71.7% were recorded in cv. Bruno with 2,000 ppm GA_3 and 6 weeks stratifications. It is concluded that the cv. Hayward is more responsive to statification and required atleast 10 weeks stratification as compared to cv. Bruno, which required only 6 weeks stratification for achieving better germination.

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