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# Effect of Dormex on bud-break, flowering and yield in kiwifruit cv. Hayward in mid-hill zone of Himachal Pradesh

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## ABSTRACT

**The present investigation was carried out on eight year old Hayward kiwifruit vines to study the effect of Dormex on bud-break, flowering and yield. Treatments included spray of Dormex (2 & 4%) on February 10$^{th}$, 20$^{th}$ and March 2$^{nd}$. Application of 4% Dormex on 10$^{th}$ February, i.e., 40 days prior to anticipated date of natural bud-break, resulted in advancement of bud break and floral-bud emergence by seven days, fruit-set by five days and increase in flowering period by five days.**

**Key words:** Kiwifruit, Dormex, bud-break, yield

## INTRODUCTION

The kiwifruit, being a perennial and winter-dormant vine, requires winter chilling for breaking bud dormancy and inducing flowering the following spring. The chilling requirement is reported to cause transition of both vegetative and floral buds of temperate or semi-deciduous subtropical fruit species, including kiwifruit (George *et al*, 2002). In the event of unavailability of chilling period, Dormex (hydrogen cyanamide) has been successfully used for break dormancy in many crops. In addition to increasing and indusing highly synchronized bud-break, hydrogen cyanamide is also known to increase number of flowers per shoot and to synchronize the flowering period (Henzell and Briscoe, 1986; Linsley-Noakes, 1989; Walton and Fawke, 1993). Dormex is also found to advance the date of bud-break by 10 to 15 days in kiwifruit (McPherson *et al*, 1999). It is found to inhibit action of the enzyme catalase. Catalase plays a very important role in plants in detoxifying hydrogen peroxide by catalyzing its breakdown to water and oxygen. When the action of catalase is inhibited by Dormex, the plant detoxifies hydrogen peroxide via a sequence of reactions eventually coupled to the oxidative pentose phosphate pathway (PPP). Dormex stimulates these reactions which, in turn, lead to increase in turnover rate of PPP. Due to stimulation of PPP, a range of substances (RNA, DNA, pentose sugars etc.) responsible for new growth in a plant are produced at higher rates.

The Hayward variety of kiwifruit has highest chilling requirement among the commercial varieties (Lawes, 1984). This cultivar sometimes produces a poor crop due to lack of chilling and non-synchronized of flowering of male and female cultivars. The present investigation was, therefore, carried out to study the effects of Dormex on bud-break, flowering and fruit yield in 'Hayward' kiwifruit.

## MATERIAL AND METHODS

The experiment was conducted in Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.), located at 30°51'N latitude. Temperature prevailent during the experiment was 25°C. Eight year old vines of 'Hayward' kiwifruit, planted at a distance of 4m x 6m and trained on T-bar system were selected for the study which comprised seven treatments, viz., $T_1$ (Dormex 2% on 10$^{th}$ February), $T_2$ (Dormex 2% on 20$^{th}$ February), $T_3$ (Dormex 2% on 2$^{nd}$ March), $T_4$ (Dormex 4% on 10$^{th}$ February), $T_5$ (Dormex 4% on 20$^{th}$ February), $T_6$ (Dormex 4% on 2$^{nd}$ March) and $T_7$ (Control). Dormex was applied as foliar spray approximately 30-45 days prior to natural bud-break.

The time of bud-break was recorded on ten randomly tagged shoots located at the periphery of each vine when bud-break was distinctly visible. Emergence of flower buds was also recorded on these tagged shoots. Date of full bloom was recorded when more than 75% flowers opened, and

**Table 1. Effect of Dormex on blooming characteristics in Hayward kiwifruit**

| Treatment details | Date of flower bud emergence | | Date of full bloom | | Date of fruit set | | Duration of flowering (days) | |
|---|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 | 2011 | 2012 |
| $T_1$ (Dormex 2% on 10th Feb) | 18/04 | 20/04 | 29/04 | 01/05 | 07/05 | 09/05 | 20 | 20 |
| $T_2$ (Dormex 2% on 20th Feb) | 21/04 | 22/04 | 30/04 | 02/05 | 09/05 | 10/05 | 19 | 19 |
| $T_3$ (Dormex 2% on 2nd Mar) | 22/02 | 24/04 | 03/05 | 04/05 | 10/05 | 12/05 | 18 | 18 |
| $T_4$ (Dormex 4% on 10th Feb) | 16/04 | 18/04 | 28/04 | 30/05 | 05/05 | 07/05 | 21 | 21 |
| $T_5$ (Dormex 4% on 20th Feb) | 20/04 | 21/04 | 29/04 | 01/05 | 06/05 | 08/05 | 16 | 19 |
| $T_6$ (Dormex 4% on 2nd Mar) | 22/04 | 23/04 | 01/05 | 03/05 | 09/05 | 10/05 | 17 | 17 |
| $T_7$ (Control) | 24/04 | 25/04 | 03/05 | 04/05 | 10/05 | 12/05 | 16 | 17 |

the date of fruit set when all petals dropped after complete fruit set. Total fruit yield was determined on the basis of total weight of fruits harvested from a vine under each treatment, and average yield per vine was calculated. Yield was expressed as kilograms per vine (kg/vine). Fruits harvested from the vines were categorized into three grades on the basis of fruit weight. These grades were: A grade (>80g), B grade (50-80g) and C grade (<50g).

Per cent fruits of different grades per vine was calculated using the following formula:

$$\%\ \text{yield of grade 'X'} = \frac{\text{Yield of grade 'X' (kg/vine)}}{\text{Total Yield (kg/vine)}} \times 100$$

where,

'X' = Grade A or B or C

Data obtained from the investigation were statistically analyzed for Randomized Block Design and differences exhibited by different treatments were tested for significance as per Gomez and Gomez (1984).

## RESULTS AND DISCUSSION

### Bud break

Maximum advancement in time of bud-break i.e., seven days was recorded in vines sprayed with 4% Dormex on 10th February, where bud-break was observed on 13th March (Fig. 1). Vines sprayed with 2% Dormex on the same date showed bud-break on 14th March and advanced bud-break by six days over the Control. Bud-break in untreated vines occurred on 20th March. Dormex has been shown to promote early and more uniform bud-break in kiwifruit (Linsley-Noakes, 1989 and Schuck and Petri, 1995). Dormex penetrates bud scales better and gets absorbed in buds, leading to bud-break (Foott, 1987).

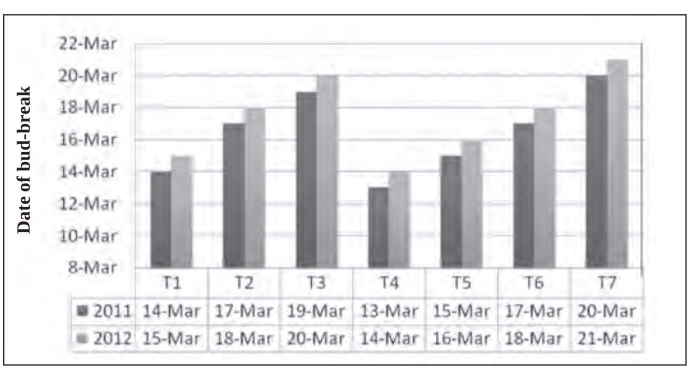


**Fig 1. Effect of Dormex on date of bud-break in kiwifruit cv. 'Hayward'**

**Table 2. Effect of Dormex on fruit yield (kg) in kiwifruit cv. Hayward**

| Treatment details | Different grades | | | Total |
|---|---|---|---|---|
| | A | B | C | |
| $T_1$ (Dormex 2% on 10th Feb) | 20.83 | 10.50 | 2.50 | 33.83 |
| $T_2$ (Dormex 2% on 20th Feb) | 19.50 | 10.17 | 3.17 | 32.83 |
| $T_3$ (Dormex 2% on 2nd Mar) | 11.33 | 7.67 | 3.33 | 22.33 |
| $T_4$ (Dormex 4% on 10th Feb) | 24.17 | 11.50 | 1.33 | 37.00 |
| $T_5$ (Dormex 4% on 20th Feb) | 19.17 | 11.17 | 3.00 | 33.50 |
| $T_6$ (Dormex 4% on 2nd Mar) | 11.33 | 9.17 | 2.67 | 23.13 |
| $T_7$ (Control) | 8.33 | 5.50 | 3.17 | 17.00 |
| CD $P=0.05$ | 5.59 | 3.5 | NS | 8.98 |

### Flowering characteristics

It is evident from data presented in Table 1 that Dormex applied at various time intervals and concentrations influenced blooming characteristics, namely, floral-bud emergence, full-bloom date and duration of flowering in kiwifruit in both the years of study, viz., 2011 and 2012. Among different treatments, 4% Dormex on 10th February, i.e., 40 days prior to anticipated bud-break advanced flower-bud emergence by seven days, fruit set by five days and increased flowering span by five days. Early bud-break, full-bloom and fruit set observed in the present study may be due to advancement of bud-break with Dormex application. Increase in duration of flowering may be attributed to increased bud-break and higher number of flowers, as reported by McPherson *et al* (1999) in kiwifruit. Chauliaras *et al* (1996) also observed that application of Dormex 45 days before bud-break advanced blooming and fruit-set by 12 to 14 days in kiwifruit cv. Hayward. Similarly, Pandey (1989) in grapes, Powell (1997) in kiwifruit and Singh and

**Table 3. Effect of Dormex on net benefit per vine and % increase in net benefit over Control in kiwifruit cv. Hayward**

| Treatment details | *Cost (Rs.) | | | Gross income | Chemical + Labour cost | Net benefit (gross returns-chemicalcost) (Rs.) | Benefit over Control | % increase in net benefit over control |
|---|---|---|---|---|---|---|---|---|
| | A | B | C | | | | | |
| $T_1$ (Dormex 2% on 10th Feb) | 1333.12 | 493.50 | 80.00 | 1906.62 | 40.00 | 1866.62 | 973.56 | 109.01 |
| $T_2$ (Dormex 2% on 20th Feb) | 1248.00 | 477.99 | 101.44 | 1827.43 | 40.00 | 1787.43 | 894.37 | 100.15 |
| $T_3$ (Dormex 2% on 2nd Mar) | 725.12 | 360.49 | 106.56 | 1192.17 | 40.00 | 1152.17 | 259.11 | 29.01 |
| $T_4$ (Dormex 4% on 10th Feb) | 1546.88 | 540.50 | 42.56 | 2129.94 | 70.00 | 2059.94 | 1166.88 | 130.66 |
| $T_5$ (Dormex 4% on 20th Feb) | 1226.88 | 524.99 | 96.00 | 1847.87 | 70.00 | 1777.87 | 884.81 | 99.08 |
| $T_6$ (Dormex 4% on 2nd Mar) | 725.12 | 430.99 | 85.44 | 1241.55 | 70.00 | 1171.55 | 278.49 | 31.18 |
| $T_7$ (Control) | 533.12 | 258.50 | 101.44 | 893.06 | - | 893.06 | - | - |

*(Cost : Grade A @Rs. 64/kg, Grade B @Rs. 47/kg and Grade C @Rs. 32/kg
Chemical cost : Rs. 600/l
Labour cost : 30min/plant @ Rs. 120/man day),
other factors being constant

Mann (2002) in pear reported advancement in flowering by 12-13 days, and fruit set by 10 to 12 days with 4% Dormex application.

### Fruit yield

Highest (37kg/vine) fruit yield was recorded in treatment $T_4$ (Dormex 4% on 10th February), and the lowest (17kg/vine) in untreated vines (Table 2). These observations are supported by Veloso and Oliveira (1970) who observed 4% Dormex to be most effective in increasing kiwifruit yield due to increase in flower-bud formation and higher fruit-set. Similar results were obtained by Powell (1997) with application of Dormex at 4% too, who recorded significantly higher total and 'A' grade fruit yields over Control. Powell *et al* (2000) reported that Dormex at 1, 1.5 and 2% significantly increased fruit yield, recording maximum values when applied 3-4 weeks before normal bud-break. Fruit size and overall fruit quality were also good. Dormex performed quite well when 600-700 chilling hours were experienced in 'Hayward' kiwifruit in the test area. Huang *et al* (2003) conducted an experiment in Portugal to determine the effect of Dormex at 0, 4 and 6% on bud-break and yield of kiwifruit cv. Hayward. Significant differences were observed between treated and untreated vines for bud-break indices, number offertile buds, flowers and the marketable yield.

### Economic analysis

Economic analyses of Dormex application at various time intervals and concentrations showed that Dormex @ 4% on 10th February was the most beneficial treatment. This resulted in highest total yield, with maximum proportion of of 'A' grade fruits. Market price for 'A' grade fruits was higher in comparison to 'B' or 'C' grade fruits. Therefore, income generated from vines treated with Dormex (4%) sprayed on 10th February was maximum, thereby more remunerative.

Results obtained in the present study showed that application of Dormex (4%) on 10th February, i.e., 40 days prior to anticipated date of bud-break in 'Hayward' kiwifruit resulted in an advancement in bud-break and floral-bud emergence by seven days, fruit-set by five days and increased flowering period by five days too. This advancement in blooming characteristics and enhancement in flowering span may lead to better synchronization between male and female cultivars of kiwifruit. Further, application of 4% Dormex as spray on 10th February resulted in enhanced of fruit yield, with higher proportion of 'A' and 'B' grade fruits. This treatment resulted in maximum net benefit in comparison to untreated kiwifruit vines.

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