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## Influence of Dormex on the phenology of flowering and fruit production of Hayward kiwifruit

**Babita and Vishal S Rana**

**Abstract**

The investigation was conducted in the experimental orchard of Department of Fruit Science during 2015-16 on 12 years old Hayward cultivar of kiwifruit. Dormex was sprayed approximately, 45 days before natural bud break immediately after pruning as a foliar application. Dormex 4 percent along with 2 percent mineral oil resulted in an advancement of bud break by 9 - 10 days, flower bud emergence by 9 days, full bloom by 9 - 10 days. However, the fruit set was advanced by 11 - 12 days and the maximum numbers of shoots were observed under 4 percent Dormex + 2 percent mineral oil.

**Keywords:** Kiwifruit, Dormex, mineral oil, bud break, yield

**Introduction**

The kiwifruit (*Actinidia deliciosa* Chev.) is a deciduous and dioecious vine native to the Yangtze River valley of northern China [1]. Fruit has refreshing delicate flavor, pleasing aroma with high nutritive and medicinal value. It is rich source of vitamin C and minerals like potassium, calcium, phosphorus and low in calories [2]. The Hayward variety of kiwifruit has highest chilling requirement among the commercial varieties [3]. This cultivar sometimes produces a poor crop due to lack of chilling and non-synchronized of flowering of male and female cultivars. Overcoming dormancy represents one of the major limitations for fruit trees production in the warm areas [4]. Inadequate chilling in warm winter periods causes poor bud break and fruit set in kiwifruit cv. Hayward and fruit has high demand in area for both local consumption and export, therefore the use of dormancy breaking agents is essential. In order to overcome low chill occurrence, application of rest breaking agents like Dormex (49% Hydrogen Cyanamide) and mineral oil have been a practice in orchards [5-7]. Hydrogen Cyanamide is known to increase/ synchronize the bud-break, hydrogen cyanamide is also known to increase number of flowers per shoot and to synchronize the flowering period in kiwifruit [8-11]. Dormex has also been reported to advance the date of bud-break by 10 to 15 days in kiwifruit [12].

Mineral oil was the first chemical used to break dormancy [13]. Adding several chemical compounds later enhanced its effect [14]. The effect of different concentrations of hydrogen cyanamide (HCN) and oil on budburst, yield, fruit quality and vegetative growth have been studied in mature 'Golden Delicious' apple [15]. However, such study in kiwifruit is lacking in India. Hence, the present study was conducted to elucidate the effect of Dormex (Hydrogen cyanamide) alone or in combination with mineral oil on bud break, blooming characteristics, fruit set and fruit yield of Hayward kiwifruit.

The experimental was conducted in the kiwifruit Block of Department of Fruit Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (India), located at 30°51'N latitude. This experiment was laid out according to Randomized Block design (RBD). The whole field was divided into three homogenous blocks and each block into seven plots. Treatments are then allocated random to the plots of a block, fresh randomization being done for each block. For randomization we use Tippet's random number tables and each treatment was replicated three times, having one vine under each replication (Figure 1). Twelve years old plants of Hayward kiwifruit, planted at a distance of 4m × 6m, trained on T-bar system were selected for the study which comprised of seven treatments viz., T<sub>1</sub> (DORMEX 2%), T<sub>2</sub> (DORMEX 2% + Mineral oil 2%), T<sub>3</sub> (DORMEX 4%), T<sub>4</sub> (DORMEX 4% + Mineral oil 2%), T<sub>5</sub> (DORMEX 6%), T<sub>6</sub> (Mineral oil 2%) and T<sub>7</sub>

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(control-water spray). Mineral oil (Orchol; hydrocarbon used as dormant spray) alone or in combination with Dormex (Hydrogen Cyanamide 49%) were prepared directly by dissolving the requisite quantity of chemicals in the required quantity of water. Dormex was sprayed approximately, 45 days before natural bud break immediately after pruning as a foliar spray.

The time of bud break was recorded by randomly tagging of 10 shoots/ vine per replication when bud break was distinctly visible. The emergence of flower buds was also recorded on these tagged shoots. At the time of flowering, the number of bearing shoots were counted on each cane and expressed as bearing shoots per cane. Total number of flowers on each shoot were counted and expressed as number of buds per flowering shoot. The date of full bloom was recorded when more than 75 percent flowers opened and the date of fruit set when all petals dropped after complete fruit setting (Figure 2). The total fruit yield was determined on the basis of total weight of fruits harvested from the vine under each treatment and average yield per vine was calculated and expressed in kilogram per vine (kg/vine).

The data obtained from the investigation were statistically analyzed according to Randomized Block Design and the differences exhibited by different treatments were tested for their significance as per the procedure described by SPSS [16]. During the two years study i.e. 2015 and 2016, it was observed that the maximum advancement in bud break was under Dormex 4% along with mineral oil 2% was applied approximately 45 days before anticipated date of bud break. During 2015 and 2016, maximum advancement in bud break was observed on 11<sup>th</sup> March and 13<sup>th</sup> March, when vines were treated with Dormex 4% with mineral oil 2% (T<sub>4</sub>) exhibiting an advancement of 8 and 9 days than the vines under control where bud burst was recorded on 20<sup>th</sup> and 23<sup>rd</sup> March, respectively (Figure 3). This treatment was closely followed by Dormex 4% (T<sub>3</sub>).

Application of Hydrogen cyanamide (HCN) is known to enhanced budbreak and flower production in the region with mild climate [17]. Dormex penetrates in the bud scale better and gets absorbed in the buds which initiate the process leading to bud break [18]. Dormex is rapidly metabolized in plants and helps in the synthesis of amino acids which further, decrease the catalase activity [19]. Catalase plays a very important role in the plants because it detoxifies hydrogen peroxide by catalysing its breakdown to water and oxygen. Dormex stimulates reactions, which in turn that lead to an increase in rate of Pentose Phosphate Pathway (PPP). Due to stimulation of the PPP, a range of substances responsible for new growth are produced at higher rates. It was reported that application of 4 percent Dormex on 10<sup>th</sup> February i.e. 40 days prior to the anticipated date of bud break in Hayward kiwifruit resulted in an advancement of bud break by 7 days [11].

Application of Dormex and mineral oil also have followed more or less similar trend for all other parameters including time of first flower bud emergence. The date of flower buds emergence was recorded on 14<sup>th</sup> April and 15<sup>th</sup> April in vines sprayed with 4 percent Dormex along with mineral oil 2 percent (T<sub>4</sub>) during 2015 and 2016, respectively. This treatment advanced emergence of flower buds by 9 days in both the years and was closely followed by Dormex application at 4 percent. However, the date of flower bud emergence in control vines was observed on 23<sup>rd</sup> and 24<sup>th</sup> April during 2015 and 2016, respectively (Figure 4). Similarly, earliest date of full bloom was observed on 24<sup>th</sup> April during both the years respectively with treatment T<sub>4</sub>

where Dormex was sprayed at 4 percent along with mineral oil, advancing the full bloom date by 9 and 11 days during both the years 2015 and 2016, respectively (Figure 5). This treatment was closely followed by sole application of Dormex at 4 percent (T<sub>3</sub>), noticing full bloom on 25<sup>th</sup> and 26<sup>th</sup> April during 2015 and 2016, respectively. This treatment advanced the date of full bloom by 6 days in comparison to control.

The dormex and mineral oil have observed significant role on number of shoots emerged and maximum number of shoots (2.67) were observed when 4 percent Dormex alone or in combination with 2 percent mineral oil was sprayed 45 days prior to anticipated date of bud break during 2015. During 2016, maximum shoots i.e. 3.33 were obtained in vines treated with 4 percent Dormex along with 2 percent mineral oil, followed by Dormex 4% (T<sub>3</sub>), however, minimum was in observed in control vines. The numbers of buds per flowering shoots were also observed maximum in vines treated with treatment T<sub>4</sub>, recording 8.33 during both the years (Table 1). The results are in line with George and Nissen [20], who reported that nitrogenous compounds such as cyanamide application to grapes doubled yields by increasing bud burst on cordons and number of spurs, number of shoot/spur and number of bunches per shoot on cordons and spurs.

During both the years, the vines sprayed with Dormex at 4 percent in combination with 2 percent mineral oil resulted in earliest fruit set i.e. on 1<sup>st</sup> May in 2015 and 2<sup>nd</sup> May in 2016 which advanced the fruit set by 11 and 12 days. This treatment was closely followed by the vines sprayed with Dormex at 4 percent resulting fruit set on 2<sup>nd</sup> and 3<sup>rd</sup> May during 2015 and 2016, exhibiting advancement of 10 and 11 days, respectively over control (Figure 6). A perusal of the data revealed that total fruit yield per vine was significantly increased by the different concentrations of Dormex alone and in combination with mineral oil. The highest total fruit yield (38.00 and 41.00 Kg) was recorded with the treatment T<sub>4</sub> in comparison to other treatments. However, lowest fruit yield was recorded in control vines during the year 2015 and 2016, respectively (Figure 7).

The results pertaining to blooming parameters are in conformity with the findings of [20], who observed that the application of Hydrogen cyanamide (Dormex), 45 days before the bud break advanced blooming and fruit set by 12 to 14 days in kiwifruit cv. Hayward. Similarly, in grapes [22], kiwifruit [23] and pear [22] reported an advancement of flowering by 12-13 days and fruit set by 10 to 12 days with 4 percent Dormex application. Hydrogen cyanamide (1 to 2%) coupled with mineral oil (4%) accelerated budburst and flowering and reduced the flowering period, reducing considerably the symptoms of delayed foliation of mature 'Golden Delicious' apple trees. Budburst increased with Dormex concentration and was calculated 45 percent more at the 1 and 2 percent rate on one-year-old wood [14]. Results obtained on the total fruit yield are in agreement with Cheng<sup>24</sup> who, reported that hydrogen cyanamide was effective in increasing the yield of 8 year old kiwifruit cv. Bruno and yield enhancement was attributed to the percent increase in bud break and synchronization of flowering.

An advancement of 8 to 9 days in bud break was observed when Dormex 4% along with mineral oil 2% was sprayed 45 days before anticipated date of bud break. The time of flower bud emergence, full bloom and fruit set also observed more or less similar pattern as that of bud break during both the years. It was also inferred that advancement in full bloom due to Dormex application lead to synchronization of flowering with staminate cultivars, resulting increased fruit set and yield.





Fig 1: Layout of orchard and bearing habit of kiwifruit



a. Bud Swell

b. Bud Break



c. Flower Bud Emergence

d. Full Bloom

e. Fruit Set

Fig 2: Effect of Dormex on the bud break and blooming parameters of kiwifruit cv. Hayward

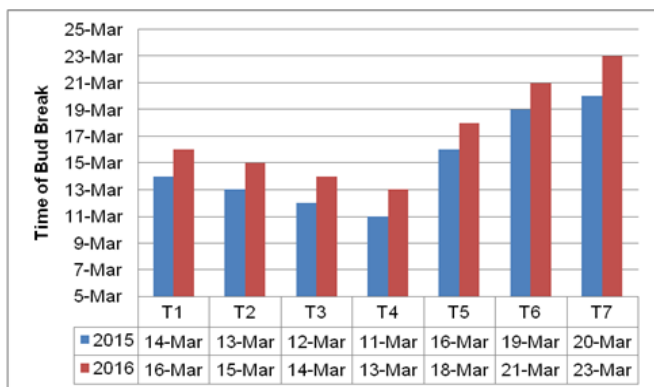


Fig 3: Influence of Dormex and mineral oil on date of bud-break in Hayward kiwifruit

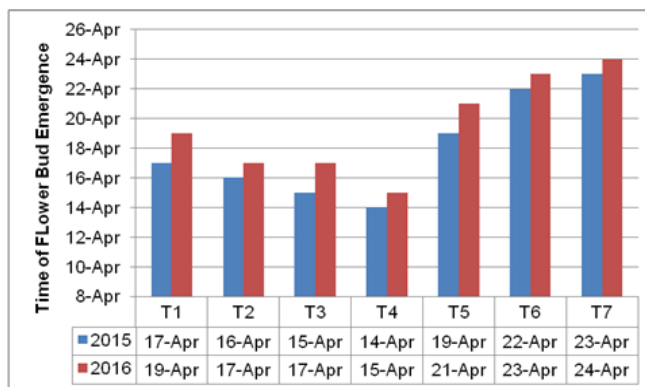


Fig 4: Influence of Dormex and mineral oil on time of first flower bud emergence in Hayward kiwifruit

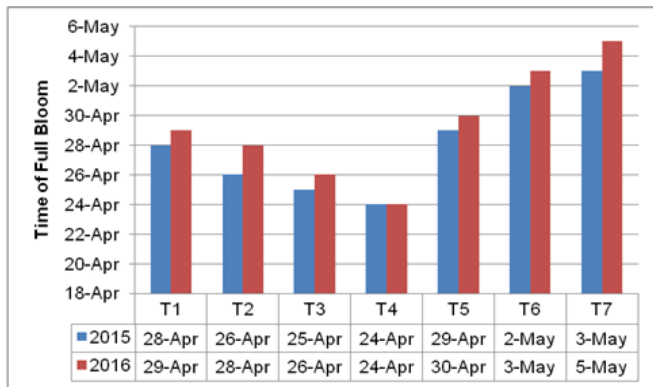


Fig 5: Influence of Dormex and mineral oil on time of full bloom in Hayward kiwifruit

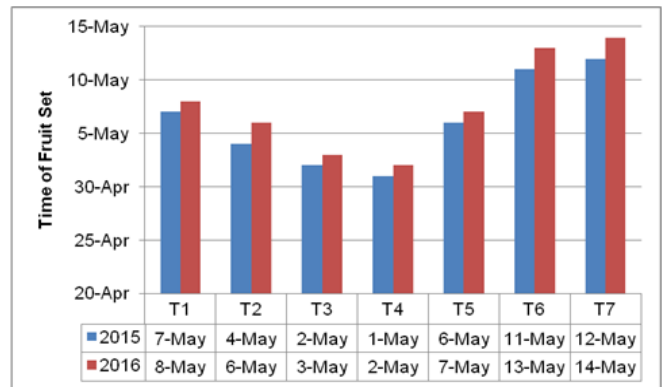


Fig 6: Influence of Dormex and mineral oil on time of fruit set in Hayward kiwifruit

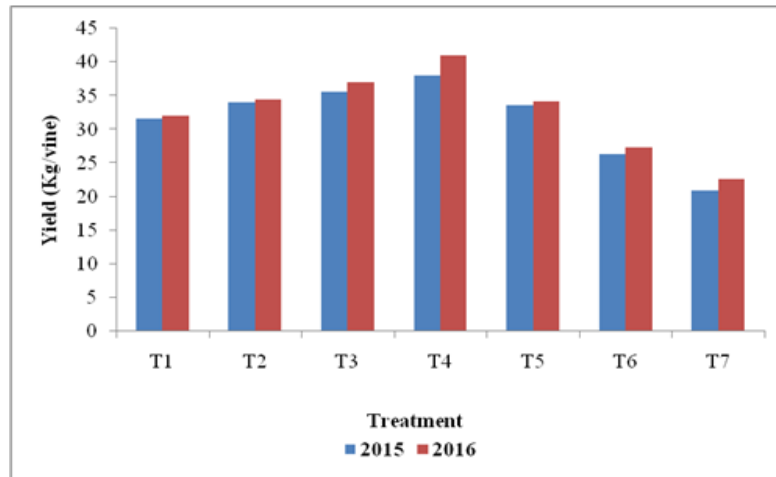


Fig 7: Influence of Dormex and mineral oil on total fruit yield of Hayward kiwifruit

Table 1: Influence of Dormex and mineral oil on the growth parameters of Hayward kiwifruit

Treatment Code	Treatment details	Number of shoots emerged		Number of buds per flowering shoots	
		2015	2016	2015	2016
T1	DORMEX 2%	2.00	2.33	4.67	5.00
T2	DORMEX 2% + Mineral oil 2%	2.33	2.67	6.33	7.00
T3	DORMEX 4%	2.67	3.00	7.33	7.67
T4	DORMEX 4% + Mineral oil 2%	2.67	3.33	8.33	8.33
T5	DORMEX 6%	2.00	2.67	4.67	5.00
T6	Mineral oil 2%	1.67	2.00	4.00	4.33
T7	Control (water spray)	1.33	1.67	3.33	3.67
CD <sub>(p=0.05)</sub>		NS	NS	0.99	1.01

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