All About Almonds
Fact Sheet 03 – Dormancy Breaking

Welcome to the third edition of "All About Almonds", Dormancy Breaking. Fact sheets are distributed to almond growers via email and fax, in addition to being made available for download from the levy payers' access page on the ABA website: www.australianalmonds.com.au (follow links to the login section of the "industry" page).

The information provided in these fact sheets should be kept confidential.

Background

International and domestic research into the artificial control of budbreak has been quite extensive over the years with research into products such as oils, dinitro-o-cyclohexylphenol (DNOC), hydrogen cyanamide, gibberellic acid, cytokinins, paclobutrazol, potassium nitrate and fatty amines. The research has primarily been brought about by the commercial growing of deciduous fruit trees in warmer climates where there is the potential for insufficient chilling. Insufficient chilling of deciduous trees causes three effects of varying intensity depending on the level of deficiency: a) poor budbreak, poor foliage development, sparse bloom and abnormal flowers, b) delayed foliation and bloom and uneven budbreak; and c) poor fruit set, reduced leaf area due to a lack of growing points, and early growth cessation due to secondary dormancy (Erez, 1987).

The use of chemicals to artificially break dormancy is generally reliant of dosage and timing with the higher the dose and the later the treatment, the stronger the effect. However, this practice also brings about a greater risk of phytotoxicty and significant damage. Flower buds and flower parts are more sensitive than vegetative buds and species such as stonefruit are more sensitive than grapes. It should also be noted that the result of using such chemicals can further be influenced by other factors such as the climatic conditions around the time of application, the level of bud development at the time of application and previous management practices such as irrigation, fertiliser and pruning. Furthermore, it should be noted that no chemical will compensate for the total absence of the chilling requirement (Erez, 1987).

The main concern for almond growers is the lack of chilling may cause a lack in flowering overlap needed for cross pollination and successful fruit set. It has been reported that in an average year, only 30% of almond flowers result in a nut, however, this can range between 20% and 40% depending on the seasonal variations in flower numbers per tree, pollination conditions, etc (Polito *et al*, 1996). Consequently, to maximise cross pollination all almond orchards have been planted with two criteria in mind: 1) plant at least two pollen compatible varieties (e.g. Non-Pareil and Carmel) but more commonly orchards have three to four (e.g. Non-Pareil, Carmel, Price and Peerless/Ne Plus) pollen compatible varieties, and 2) each of the pollen compatible varieties have flowering times which generally overlap each other.

CT Optimisation Trial

The CT Trial is planted to three varieties: 50% Non-Pareil, 33% Carmel and 17% Ne-Plus. This particular planting pattern was reasonably common in the past but less so recently. This planting pattern is particularly limiting because: a) Ne-Plus generally flowers too early with a peak flowering time approximately 5 days earlier than Non-Pareil and to a lesser degree, b) the percentage of early flowers are minimal because of the low percentage of Ne-Plus rows, and c) Carmel is approximately 3 days later than the peak flowering of Non-Pareil. Consequently, at the CT Trial it was decided that the best chance of obtaining an optimum fruit set was to use a foliar program of Potassium Nitrate, which when used by itself, has been mildly successful on other deciduous crops such as peaches (Erez, 1987 and Erez et al., 1971). Research has shown the specific effect of Potassium Nitrate has been the enhancement of flower budbreak (Erez et al., 1971) with two to three, sequential applications the most effective (George and Nissen, 1993).

The aim of the Potassium Nitrate program in the CT Trial was to not only provide two macro-elements to the trees, but to primarily advance the flowering of Carmel and to promote a more intensive and more uniform break of flowering buds across ALL varieties. Indirectly, this program is also thought to have also promoted a more intense and even break of the vegetative buds, which has in turn promoted greater leaf area, more shoots, and potentially a greater number of flowering buds in the following season.

Dormant Oil which was already used to control Bryobia mite and San Jose scale in the CT Trial can also indirectly have the same benefits mentioned above. It is thought the oil affects budbreak by influencing bud respiration, where as Potassium Nitrate provides a nitrate ion which influences some of the chemical compounds which promote flowering (George and Nissen, 1993).

1. **Dormant Oil**

Spraying of dormant trees with Winter Oil or Summer Oil occurs on the CT Trial at the traditional Winter Oil or Summer Oil concentrations of 2% (i.e. 20L/1000L).

2. **Potassium Nitrate**

The general, specific timing is based on a visual assessment of the Non-Pareil flowering buds. The first application (i.e. 50Kg/1000L) is ideally applied to Carmel only, when the Non-Pareil flower buds have moderately, advanced swelling and prior to budbreak. The second application (i.e. 50Kg/1000L) is applied approximately 5 days later to Non-Pareil only, and also prior to budbreak of both varieties. The third spray (i.e. 30Kg/1000L) is applied at a lower concentration due to the more advanced bud swell and risk of phytotoxicity. The fourth spray (i.e. 30Kg/1000L) has been an optional spray, depending on whether the Carmel needs more assistance to break and coincide with Non-Pareil flowering.

SEASON	DATE APPLIED	VARIETY	CHEMICAL	RATE	PURPOSE
2005/2006	20th July	Carmel	Potassium Nitrate	50 Kg/1000L	Initiate budbreak
	25th July	Non-Pareil	Potassium Nitrate	50 Kg/1000L	Initiate budbreak
	26th July	Carmel	Potassium Nitrate	30 Kg/1000L	Advance budbreak
	1st August	Carmel, Non-Pareil	Potassium Nitrate	30 Kg/1000L	Advance budbreak
2006/2007	17th July	Carmel	Potassium Nitrate	50 Kg/1000L	Initiate budbreak
	21st July	Non-Pareil	Potassium Nitrate	50 Kg/1000L	Initiate budbreak
	24th July	Carmel, Non-Pareil	Potassium Nitrate	30 Kg/1000L	Advance budbreak
2007/2008	19th July	Carmel	Potassium Nitrate	50 Kg/1000L	Initiate budbreak
	25th July	Non-Pareil	Potassium Nitrate	30 Kg/1000L	Advance budbreak
	2nd August	Carmel	Potassium Nitrate	30 Kg/1000L	Advance budbreak

The primary aim of the 50Kg/1000L rate is to **initiate** budbreak of both varieties while the primary aim of the 30Kg/1000L rate is to further **advance** budbreak of both varieties. Each season is slightly different and can require a different number of sprays dependent on the effort necessary to firstly initiate budbreak, secondly assist budbreak and thirdly assist flowering coincidence of the two varieties.

For further information contact Ben Brown, Industry Liaison Manager

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Telephone (08) 8582 2055 Facsimile (08) 8582 3503

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