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PINOLENE NEWSLETTER #109

### VAPOR GARD® USED TO REDUCE EARLY FRUIT DROP OF AVOCADOS

Test Area: Mundubbra, Australia

Date: November 12, 1982 (Spring Season)

Cooperator: Golden Mile Farm

Problem: Weather conditions early in the season were very hot during the day (104°F./40°C.). Additionally, hot, dry winds were prevalent. Even though the trees were under irrigation, the young fruit, approximately two centimeters in diameter, were dropping from the tree, in quantities greater than normal for that time of the year.

Objective: The objective of the Vapor Gard application was to determine whether a 1% Vapor Gard application, sprayed to full coverage, would significantly reduce the number of small fruits being dropped from the trees.

Details of Test Program: 10 trees were selected as an untreated check and 10 other trees in the same block were selected for treatment with Vapor Gard. Young fruits that had recently started to drop were raked from under the tree so there was a clean surface area for evaluation. On November 12, 1982 the full coverage application of 1 liter of Vapor Gard per 100 liters of water was applied to the 10 trees. Three weeks after the application, fruit drop counts were made under each tree - Check and Vapor Gard treatments.

Results:

<u>Treatment</u>	<u>Average No. of Dropped Fruits/Tree</u>	<u>Percentage</u>
Vapor Gard	47	29.7%
Untreated Check	158	100.0%

The above number of drops per tree on the untreated check was used to define the problem at 100%. Vapor Gard activity is shown as a percent of that 100% or 29.7%.

Conclusion: Under the test conditions noted, the application of Vapor Gard reduced the fruit drop problem by 70%, due to the fact that Vapor Gard reduced moisture stress.

Vapor Gard - Reg. trademark of Miller Chemical & Fertilizer Corporation

# **VAPOR GARD®**

**anti-transpirant concentrate  
for fruits and vegetables**



**ANTI-TRANSPIRANT**

**Miller Chemical & Fertilizer  
Corporation USA**

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## 1. INTRODUCTION

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Vapor Gard (active ingredient Pinolene) is an anti-transpirant that reduces moisture loss from crops under hot dry conditions and has shown the ability to improve the plants tolerance to cold conditions. It has shown the following benefits over a wide range of field trials and grower use:

- ✓ Reduces plant moisture loss (transplant survival, tree & vine survival)
- ✓ Improves crop water use efficiency
- ✓ Reduces the effects of sunburn
- ✓ Reduces fruit cracking and splitting
- ✓ Reduces heat stress
- ✓ Reduces seedling transplant shock
- ✓ Reduces the effects of frost
- ✓ Improves fruit colour

Vapor Gard is manufactured by Miller Chemical & Fertilizer Company, USA, and has been used globally as an anti-transpirant and for over 35 years.

Vapor Gard is a naturally derived product from pine resin from forestry. It is often referred to as a soft-film former as opposed to acrylics that are hard-film formers. Soft-film formers derived from Beta Pinene polymers allow the movement of carbon dioxide ( $\text{CO}_2$ ) and oxygen ( $\text{O}_2$ ) into and out of the plant allowing important processes such as Photosynthesis and Respiration to continue. Hard-film formers can restrict the movement of gases into and out of the plant, and therefore affect these important physiological processes.

Vapor Gard adds to the natural wax layer of the plant and allows the plant to better tolerate adverse weather conditions that affect crop production.





## 2. GENERAL INFORMATION

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### **VAPOR GARD® (96% Di-1-p-menthene + 4% Emulsifier)**

- ✓ Is a natural terpene product that is extracted from conifers known as Pinolene.
- ✓ Is a water emulsifiable organic concentrate for use on plants and various fruit and vegetable crops as a full coverage spray to reduce water evapo-transpiration.
- ✓ The soft flexible film formed after the spray application dries, significantly reduces moisture loss by the plant foliage.
- ✓ Vapor Gard® dries on plants to form a clear, glossy film which slows normal moisture loss without interfering with plant growth or normal respiration.
- ✓ Vapor Gard reduces the effect of cold damage on crops as a result of frost events
- ✓ Vapor Gard reduces the incidence on sunburn on fruit.
- ✓ Vapor Gard reduces fruit splitting.

All anti-transpirant spray applications must ensure full coverage of the leaves and fruits.

VAPOR GARD® should be sprayed at least one hour during daylight and before an anticipated rain. Sunlight is needed for the protective film to set. No additional spreader is needed with VAPOR GARD®.

VAPOR GARD® can be applied with most agricultural ground spray equipment.

**VAPOR GARD® helps the grower control Evapo - transpiration of plants.**

**VAPOR GARD® has been extensively tested and its use gives REAL BENEFITS.**

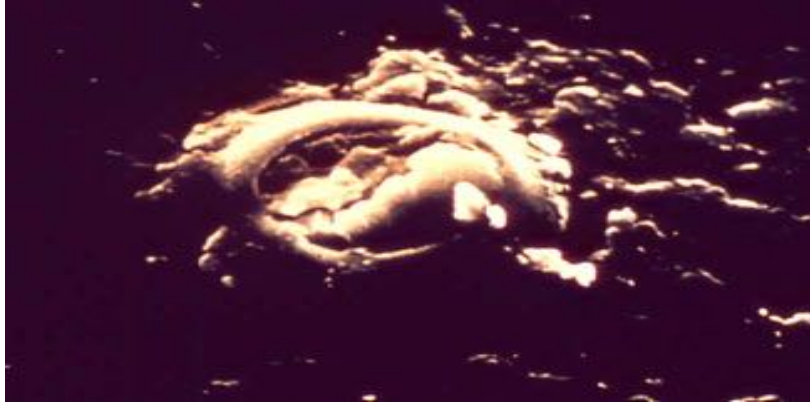
Due to its natural origin, VAPOR GARD® is biodegraded by soil micro-organisms and is non toxic to bees and other beneficial insects.

VAPOR GARD® controls transpiration and improves the physiological conditions of plants, improving production both in terms of quality and quantity.

### 3. MODE OF ACTION

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When Vapor Gard is added to the spray tank and applied to the plant it forms a soft film that adds to the natural cuticular wax layer of the plant.



Vapor Gard covering a stomata magnification 1200X

After application and drying, (at least 1-2 hours of daylight/sunlight, before an anticipated rainfall, is required for the Vapor Gard layer to set), the Vapor Gard forms a soft, pliable film that bonds with the waxy surface of the plant. The setting of the layer is critical for the Vapor Gard to dissolve into the waxy leaf surface i.e. form the soft-film over the plant surface. This process is called polymerisation.

#### MODE OF ACTION UNDER FROST CONDITIONS:

Vapor Gard stops the formation of the ice crystal through transpired water vapor on the leaf surface. Dehydration of cells during the frost causes plant damage. Vapor Gard will assist in the reduction of cold damage but will not stop it 100%.

#### HOW LONG DOES THE VAPOR GARD LAYER LAST?

When used at 10 l/HA or 1%, the Vapor Gard layer breaks down (degrades) in a controlled manner over a period of 3-6 months. This process is referred to as polymerization and it is influenced by ultra-violet light and oxygen. Polymerisation is the weathering of the Pinolene layer over time as it's degraded by UV light and oxygen. This weathering process results in the powdering away of the film surface over time allowing surface active compounds to be slowly released over time providing maximum protection to the plant. This process can take between 3-6 months pending the amount of sunlight it's exposed to.

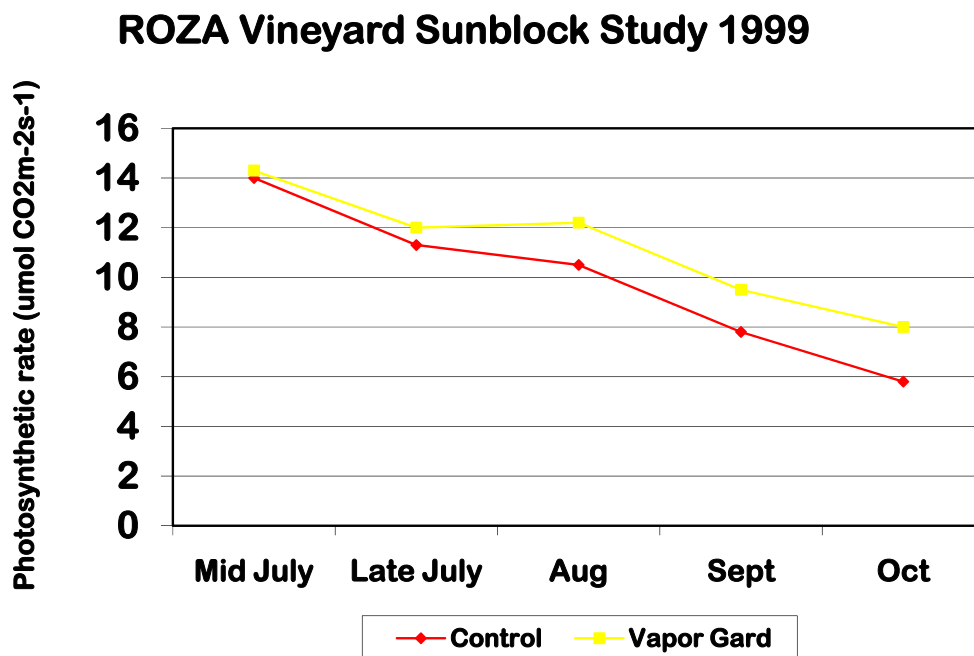
#### 4. VAPOR GARD AND PHOTOSYNTHESIS

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##### WILL VAPOR GARD SUFFOCATE THE PLANT?

No. When used at the correct rate of application Vapor Gard will not suppress photosynthetic rates or growth of the crop when used correctly. The enclosed graph shows the effect of Vapor Gard on grape leaf over time. Vapor Gard does not slow photosynthetic rate but actually improve leaf performance when applied to the crop.

Failing to follow the label directions will cause the plants treated to yellow or be suppressed in this instance the use of Vapor Gard should be stopped until plants recovers. Always refer to label directions for correct use. Do not exceed 9.5l/ha within a 6 week period.



#### 5. COMPATABILITY

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**Vapor Gard should not be mixed with any pesticide.** It is compatible with commonly used foliar fertilizers and other tolerance exempt materials.

## 6. FEATURES AND BENEFITS

The film forming properties of VAPOR GARD® protects plant tissues against

FEATURES	BENEFITS
Vapor Gard is Soft Film Forming adjuvant.	1. Improves wetting of leaves and spreading of agrochemicals.
	2. The soft film allows the exchange of CO <sub>2</sub> and O <sub>2</sub> through the layer. This means that photosynthesis and respiration is not affected.
	3. Gives consistent performance with different types of equipment.
Reduces Environmental Stress Effects <ul style="list-style-type: none"><li>• Reduces Moisture Loss</li><li>• Reduces Heat Stress</li><li>• Reduces Sunburn Incidence</li><li>•</li></ul>	Reduces Fruit Drop Reduces Fruit Splitting/Cracking in cherries Reduces sunburn in apples and melons
Enhances Fruit Appearance	Improves Fruit Size & Colour
Rain fastness.	Longevity of activity on the crop
Low freeze / high flash point	1. Low hazardous risk to end-users. 2. Easier storage.

### Unique Selling Points:

Vapor Gard enhances crop production by;

- ✓ Vapor Gard reduces moisture loss (evapo-transpiration) from the plants leaves in hot, dry or windy conditions.
- ✓ Vapor Gard reduces cold desiccation (frost) by reducing moisture loss from the plants cells.
- ✓ Vapor Gard provides sunburn protection. It does this by reducing moisture loss from fruit and also intercepting UV light. Ultra-violet light is breaking down the Vapor Gard film rather than damaging the skin of fruit.
- ✓ Vapor Gard is used to reduce splitting of cherries. The film prevents moisture from being absorbed into the fruit.
- ✓ Other beneficial attributes when using Vapor Gard can be increased fruit size, increased fruit colour and extended shelf life after harvest.



## 7. MAJOR USES

### 7.1 ANTI-TRANSPIRANT – SEEDLING TRANSPLANT

Vapor Gard can be applied to evergreens, trees, flowers and vegetable seedlings such as tomato, capsicums, melons, celery, cucurbits and lettuce prior to transplanting to avoid seedling shock, and increase the survival of seedling transplants.

Application rate is 1 -2% solution of Vapor Gard applied with full coverage. Seedlings can be dipped in Vapor Gard solution but do not dip the root zone of the seedling.



Celery transplant with and without Vapor Gard Applied. Note the difference plant establishment 1% Vapor Gard solution sprayed prior to transplant.

(California USA 1974 Miller Chemical)

## 7. MAJOR USES

### 7.1 ANTI-TRANSPIRANT – SEEDLING TRANSPLANT

#### Lettuce 30 days after application with Vapor Gard

(Applied 1% solution 60% leaf coverage)



Untreated control



Vapor Gard treated

A foliar spray of Vapor Gard® increased both survival and growth of two sources of loblolly pine seedlings when out planted on high risk drought sites (Rowan 1988)

Vapor Gard Treat			Control	
Bareroot loblolly	Survival	Height	Survival	Height
pine seedlings	(%)	Growth (cm)	(%)	Growth (cm)
- Georgia source	66.0 c	93.3 a	63.4 b	77.3 a
- Texas source	47.0 b	85.0 a	29.1 a	90.7 a

Survival and height means followed by a common letter are not significantly different at the 95 % level Forest Nursery Notes • January 1998







**Results:** Vapor Gard treated plants in forestry application establish better under dry weather conditions and establish more growth when compared with untreated plants.



## 7. MAJOR USES

### 7.1 ANTI-TRANSPIRANT – SEEDLING TRANSPLANT

#### ***Establishment of Mucuna bracteata***

Vapor Gard Treated 1%	Untreated
	
After transplanting	After transplanting
	
14 days after transplanting	14 days after transplanting
	
21 days after transplanting	21 days after transplanting

## 7. MAJOR USES

### 7.2 ANTI-TRANSPIRANT – CHERRY SPLIT & COLOURING

Vapor Gard has proven successful in most varieties of cherries. One of Vapor Gard's main uses is to increase the size and yield of cherries. Growers have also seen other benefits from the use of Vapor Gard. The use of Vapor Gard has been shown reduce cherry splitting after rainfall. This event primarily occurs in summer just prior to harvest.



During the summer of 1996 a study on the visual effects of Vapor Guard was undertaken in co-operation with one of the major cherry packers in [Wenatchee, Washington](#). Three samples of cherries (Vapor Gard treated, 50% each Vapor Gard treated and control, and a control) were kept in cold storage for four weeks. At the end of the 4 week period the cherries' appearance was evaluated by 5 of the warehouse personnel. The Vapor Gard treated cherries were rated the best looking, the 50% blend of each was rated the next best control and the control was last. The cherries were then stored at room temperature for one week. The pictures above show that the Vapor Gard treated cherries have less mould and less dehydration (dark colour) than the control.

Examples of Reduced Splitting from a Single Application of Vapor Gard (1% application 4weeks prior to harvest)		
	Untreated	Vapor Gard Treated
1975 Michigan Trial	21% splits	15% splits
1990 Mattawa WA	10% splits	4.5% splits

#### *Why do cherries split?*

- 1- After a rain, water absorbed through the skin of the fruit causes the cherry to swell faster than the skin can stretch, which results in splits.
- 2- Drought (moisture stress) before rains can cause the cherry to be more sensitive to rain and can increase the percentage of split cherries. This is possibly one of the reasons that we can see differences in the amount of splitting from field to field.



## 7. MAJOR USES

### 7.2 ANTI-TRANSPIRANT – CHERRY SPLIT & COLOURING

**Vapor Gard, a film forming anti-transpirant, reduces the amount of splitting in two ways:**

1. The film formed by Vapor Gard helps to repel rain and reduces the amount of moisture absorbed by the cherry. As the cherry increases in size the effectiveness of the film is reduced and it may be necessary to make additional applications for maximum protection.
2. Vapor Gard, an anti-transpirant, reduces the amount of water lost by the fruit and tree during periods of moisture stress, such as afternoon heat and dry soils. This protection from excessive moisture loss reduces the sensitivity of the cherry to rapid changes in available moisture.

Method of application is that growers begin with an application of Vapor Gard applied approximately 4 weeks before anticipated harvest. Then, watching weather forecasts and when rain is predicted, they will make additional applications if it has been more than seven days since the last application. After the first applications (approximately 4 weeks before harvest) of Vapor Gard, they avoid the use of pesticides that leave highly visible residues such as sulfur.

- The first application is at the rate of 10 L/ha.
  - Any subsequent applications are made at the rate of 5 L/ha.
- GA sizing sprays benefit from the addition of Vapor Gard and can be integrated.

#### **Testing in New Zealand on Brix, Color, Size and Splitting in Cherries.**

Applications: 10 litre/ha 3 weeks before harvest  
5 litre/ha 7 days before harvest

<b>Variety</b>	<b>Unsprayed Kg/Ha</b>	<b>Sprayed Kg/Ha</b>	<b>% Change</b>
<b>Sweet Valentine</b>	1840 kg	4200 kg	128 %
<b>Sweetheart</b>	3580 kg	3535 kg	- 1.35 %
<b>Compact Stella</b>	6585 kg	9235 kg	40 %
<b>Lapins</b>	8900 kg	10430 kg	17.2 %
<b>TOTAL</b>	<b>20905 kg</b>	<b>27400 kg</b>	<b>31 %</b>

## 7. MAJOR USES

### 7.2 ANTI-TRANSPIRANT – CHERRY SPLIT & COLOURING

Results:

- Lapins
- Noticeable difference in color and size
- Brix levels up 0.5 – 1.0 (relative to color)
- Splitting not a problem on Lapins or Compact Stella

**Partial Summary of Replicated Trials Conducted by  
R. A. Brown & Associates. Wenatchee WA 2000**

Bing	9 row & larger	9.5	10	10.5	11	11.5	12 and smaller
Vapor Gard	35.34	22.78	18.22	12.22	5.78	4.33	1.34
Control	21.0	17.00	23.00	16.22	10.78	8.33	3.66
% Change	14.34	5.78	-4.78	-4.00	-5.00	-4.00	-2.32

Results: .There was no significant change in either firmness or sugar in this test.  
Row size refers to how many cherries fit into a standard row used to measure  
fruit size for cherries based on USDA standard.

**Cherries Treated with Vapor Gard had less storage rots and maintained  
green stems for a longer period of time making them more saleable.**

## 7. MAJOR USES

### 7.3 ANTI-TRANSPIRANT – WATER MELONS

Vapor Gard studies in the USA have shown significant benefit in melon growth and sunburn reduction when compared with other methods of control. Vapor Gard can be applied to melons under dry land, drip centre pivot and travelling gun.



**Vapor Gard Treated Watermelon Vines**



**Surround (Clay) Treated watermelon Vines**

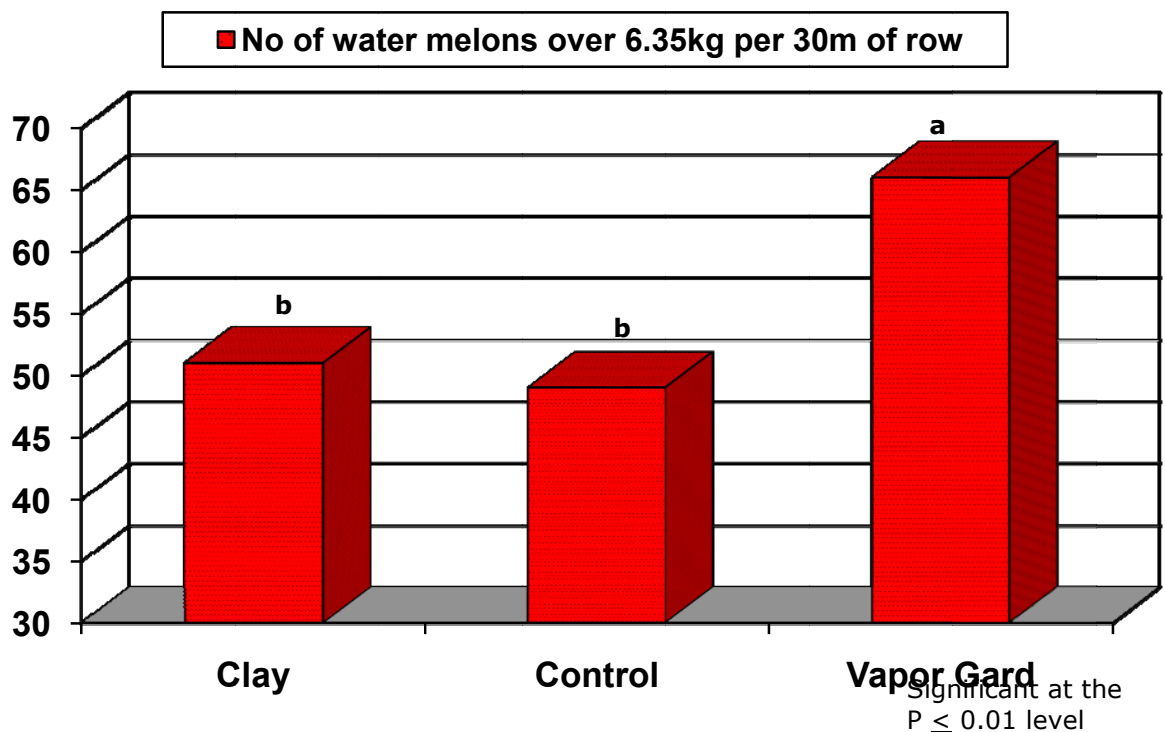
## 7. MAJOR USES

### 7.3 ANTI-TRANSPIRANT – WATER MELONS

Vapor Gard: Easy to apply and protects foliage and keeps the canopy turgid to protect the fruit from sunburn. By keeping a healthier canopy it promotes vine growth and fruit size.

Surround Clay: Creates a physical barrier to sunburn and stunts vine growth, this reduction in growth of vine reduces the ability of the crop to maintain a large enough canopy to protect itself from sunburn. It has been noted in the testing a reduction in leaf size when clay is applied.

The clay must be removed from the fruit prior to sale. In some crops e.g. apples this can prove difficult in removal from the calyx and stem ends in the brush baths.



**Watermelon Count At 6.35kg and Higher as Influenced by Treatment**

Vapor Gard applied a 25 l/ha applications D&D Produce Drifton GA USA (Miller Corp USA 2004)



## 7. MAJOR USES

### 7.4 ANTI-TRANSPIRANT – REDUCE COLD DESSICATION

It is the dehydration of cells during the frost event that causes plant damage from frosts and low temperatures. Vapor Gard reduces the formation of the ice crystals through transpired water vapor on the leaf surface.

Vapor Gard is effective against radiation frost which is the common type of frost experienced in Australia.



#### What is frost?

In Australia there are 2 main types of frost events and these are:

1. Radiation Frosts: Clear nights, katabatic winds and inversion layers of air can form causing frost vents usually near dawn. Usually associated with a high-pressure cell in the weather charts.

2. Adeptive Frosts: caused by freeze or wind frosts as a result of wind chill.

The above 2 events will lead to 2 main types of frost on the plants that are usually seen:

**White Frost:** High humidity, dew point below 0°C. Characterized by white ice crystals.

**Black Frost:** Occurs under dry conditions. Frozen tissue but no ice formation on ground or plants.

The intensity, duration, and type of frost as well as the timing of application relative to growth stage of the crop will all have a significant bearing on the ability of Vapor Gard to work effectively.

## 7. MAJOR USES

### 7.4 ANTI-TRANSPIRANT – REDUCE COLD DESSICATION

#### What is the impact of frost?

**Frost causes economic loss and in the case of severe events it can destroy the current season fruit buds resulting in a total loss of the year's crop.**

To reduce the effects of frost events Vapor Gard can be applied to crops to reduce cold injury at rates of 9.5L/ha or 1-2% depending on canopy size.

For Vapor Gard to be effective it's important to apply water rates to the point of run-off. 60% + coverage ideally 500-1000 l/ha. It's also important to apply Vapor Gard at least 2-3 days before a frost event and Vapor Gard will be rain fast in 1-2 hours after daylight application.

Pesticides can be applied over Vapor Gard when dry and

NuFilm-17 can assist with pesticide application while also adding to the Vapor Gard layer. Vapor Gard is usually effective down to - 2-3°C.

Note: •**VAPOR GARD** will not protect an actively growing crop for a prolonged cold period. New growth will not be protected. •**VAPOR GARD** should be used as a management tool with other cultural practices when looking for frost prevention. In vineyards and orchards, grass swards should be mown short to allow soils to warm up in the day. •Application of **VAPOR GARD** with Nutrient Express® 4-41-27 @ 5kg/Ha may help plants to tolerate colder temperatures.

The intensity, duration, and type of frost as well as the timing of application relative to growth stage of the crop will all have a significant bearing on the ability of Vapor Gard to perform.

- Vapor Gard is an effective tool in frost management
- Vapor Gard does not give 100% protection
- Frost can be highly variable as an event
- Integrated approach to frost management is required
- Guidelines for using Vapor Gard are important and must be followed

## 7. MAJOR USES

### 7.4 ANTI-TRANSPIRANT – REDUCE COLD DESSICATION

Competitor Information:

	<b>Envy</b>	<b>Vapor Gard</b>
<b><u>Composition</u></b>	Polymer – Synthetic acrylic polymer	Pine Resin (Pinolene <sup>®</sup> ) – Similar to composition of plant cuticle.
<b>Rain-fast</b>	Yes – after 4hrs	Yes – after 1-2 hrs
<b>Film Forming</b>	Yes	Yes – Flexible. Will stretch 3 times initial deposition size.
<b>Mixing</b>	High quality water MUST be used or coagulation will occur.	Water of any quality can be used to apply Vapor Gard.
<b>Spray Program Limitations</b>	No applications of fertilisers and fungicides for 2wks after application. May inhibit absorption of systemic products.	Do not spray on fruit with visible residue present. If close to harvest ensure all MRL's have expired on previously applied products.
<b>Wetting Agent</b>	Agral 600 recommended.	No wetter required. Vapor Gard has wetter, sticker and spreader properties.
<b>Rate</b>	5-10L/100Litres up to max. 20L/ha Eg. 500 L/ha water = 20L/ha Envy 2 <sup>nd</sup> Application 3% = 3L/100L	1% early season or 9.5 l/ha full canopy Eg. 500L/ha water = 5L/ha (1% solution)
<b>Cost/Litre (Retail)</b>	\$12.00/L	\$22.00/L
<b>Cost/ha</b>	1 <sup>st</sup> Application \$240/ha 2 <sup>nd</sup> Application \$180/ha	1 <sup>st</sup> Application \$110/ha 2 <sup>nd</sup> Application \$110/ha
<b>Longevity</b>	7-10 days	7-10 days (film persists for 3 months on old growth)

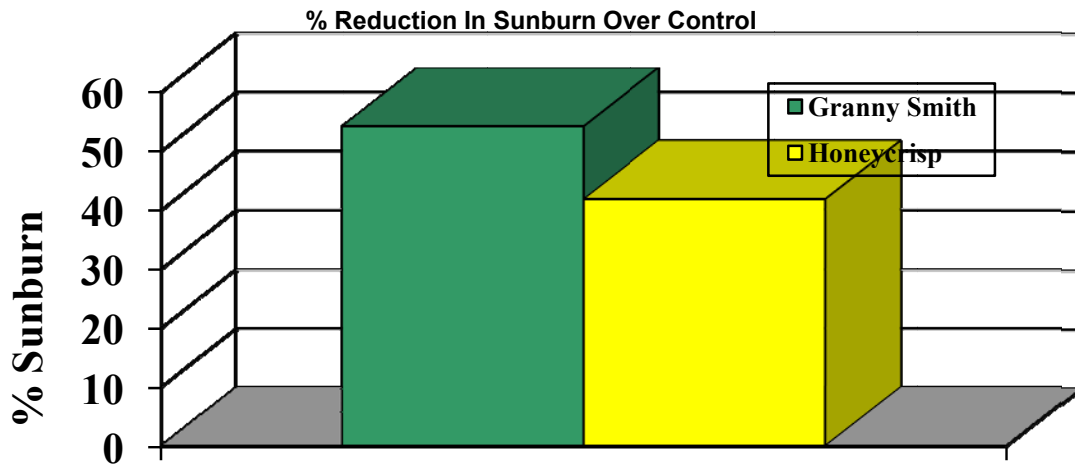
## 7. MAJOR USES

### 7.5.1 ANTI-TRANSPIRANT – APPLES - SUNBURN

#### Apples to Reduce Sunburn and assist with Fruit Size:

Vapor Gard has been proven over many years in USA, Europe, New Zealand and Australia to assist with sunburn in fruit.

Vapor Gard should be applied at a rate of 10 Litres per hectare with sufficient water to cover the foliage. Timing is important and should begin 60-70 days after bloom. Some varieties have pubescence on the apple for 60-70 days. When you see the pubescence stage has gone its time to start the Vapor Gard Program. Applications should be repeated every 4 weeks at 10 Litres per hectare.



**Washington Tree Research Commission USA  
Vapor Gard® Trials 2001**

In terms of results 30 years of experience has consistently shown the following improvements:

- Improved and Uniform Sizing.
- Reduction in Sun burnt Fruit and Stem End Cracking
- Improved Colouring (Red Varieties only)
- Reduction in Russetting
- Improved storability of final product.

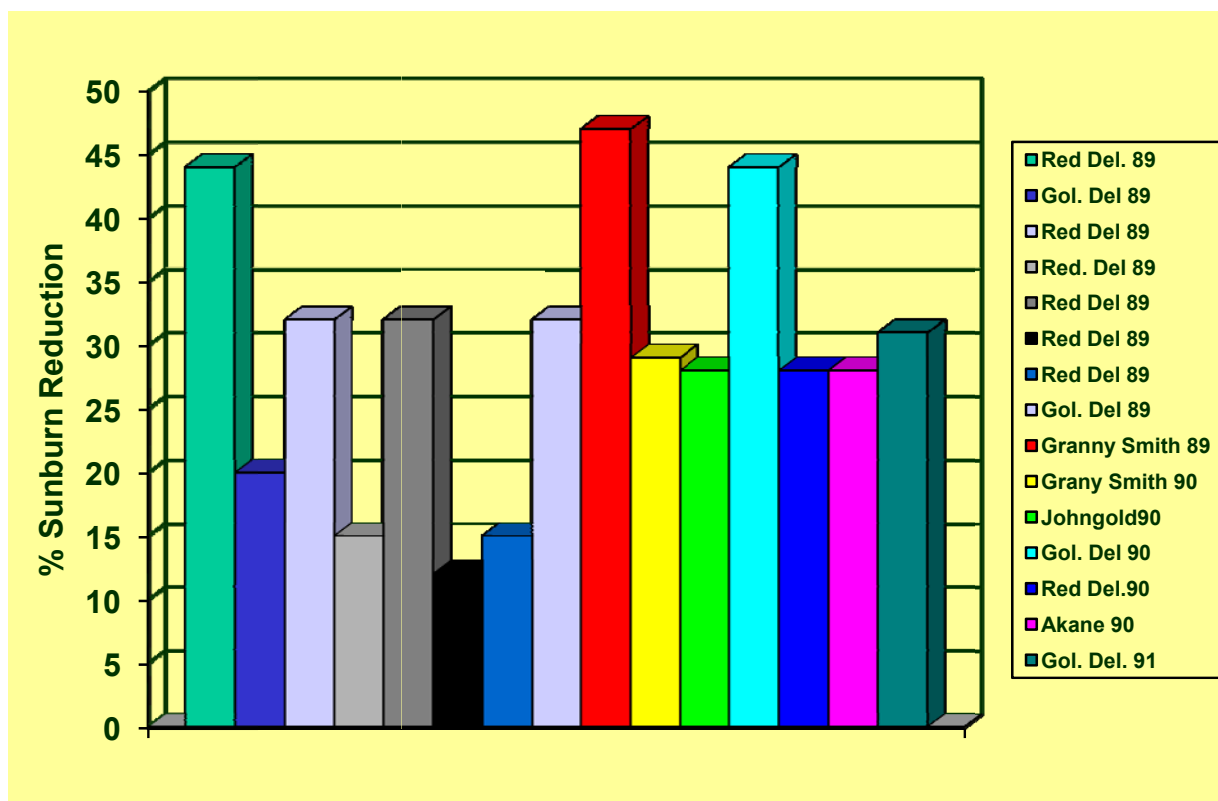
Field differences may not always be visually apparent. And results are best measured at the end of the season through pack outs.

## 7. MAJOR USES

### 7.5.1 ANTI-TRANSPIRANT – APPLES - SUNBURN

Vapor Gard has long been effective in reducing the effects of sunburn on fruit and improving pack outs compared with untreated plots. In 1989 and 1990 a number of field trials were conducted to evaluate Vapor Gard's ability to maintain moisture and reduce the incidence of sunburn.

**Vapor Gard Applications  
%Sunburn Reduction in Apples over Control**

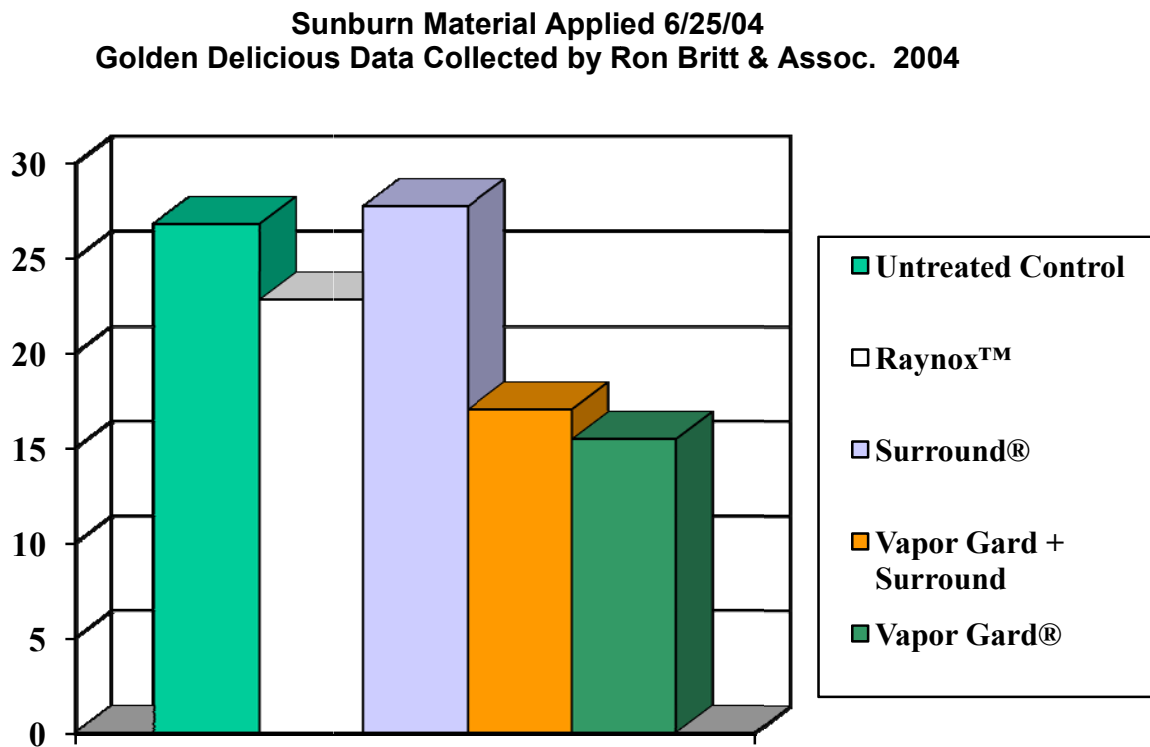




## 7. MAJOR USES

### 7.5.1 ANTI-TRANSPIRANT – APPLES - SUNBURN

#### Apples: Surround & Raynox & Vapor Gard



The above study in Washington State compared a number of methods and compounds for sunburn control.

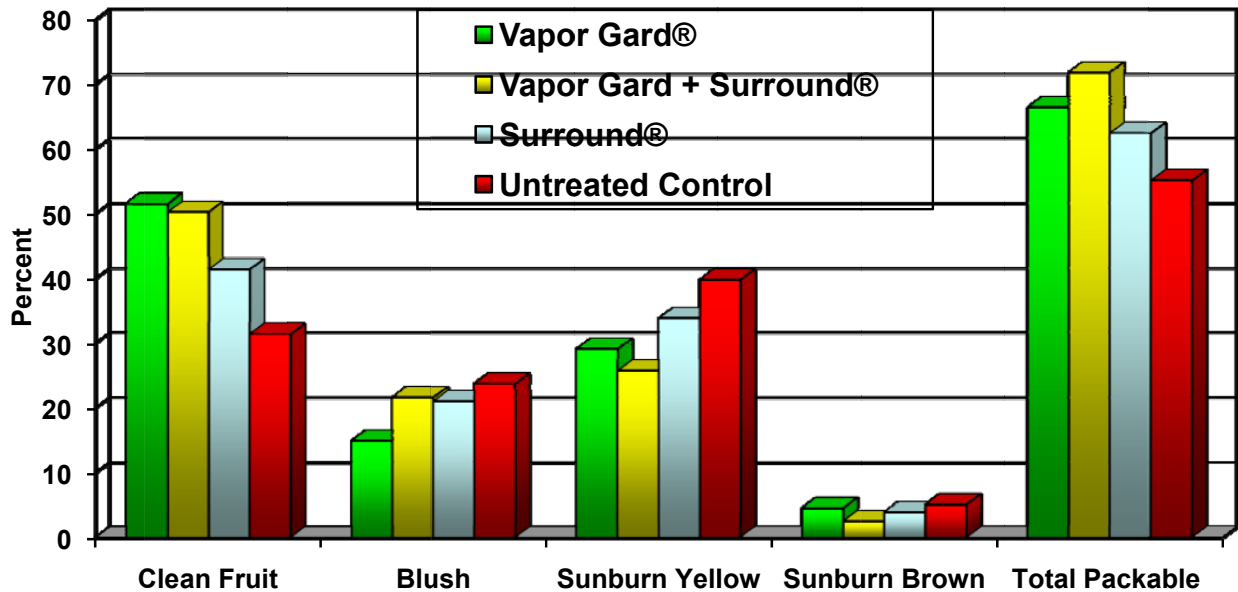
- ✓ Raynox, which is a carnuba wax and clay material
- ✓ Surround, which is a clay
- ✓ Vapor Gard, which is Pinolene.

## 7. MAJOR USES

### 7.5.1 ANTI-TRANSPIRANT – APPLES - SUNBURN

#### Sunburn on Young Granny Smith Trees

The sampling was done by picking all the apples off the trees and rating the amount of sunburn. A minimum of 30 trees was sampled per treatment. This was the first crop to come off of this young block of Granny Smith, and thus the reason for the high percentage of sunburn.



2003 Steve McDonald Royal City WA USA

Surround has been limited by its inability to sustain rainfall events and also fruit clean up has been an issue. Raynox is a similar issue in removing the clay from the fruit at a later date.

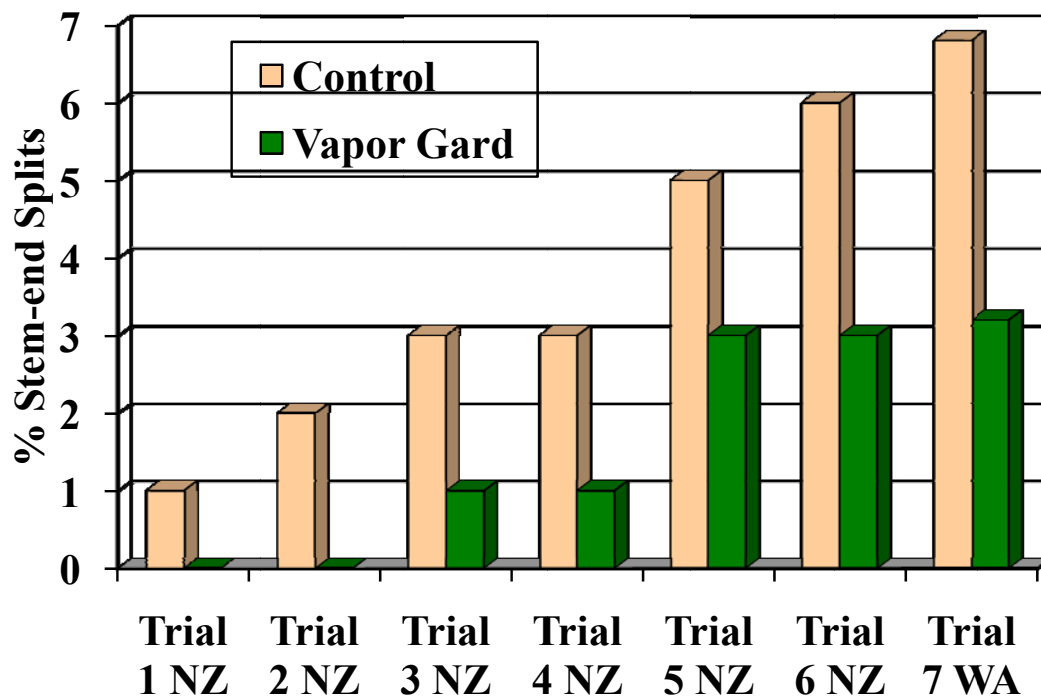
Vapor Gard has always given a fruit finish that is superior in terms of a shiny fruit and has never posed a problem in the brush baths.



## 7. MAJOR USES

### 7.5.2 ANTI-TRANSPIRANT – APPLES – STEM END SPLITS

Vapor Gard® helps to control the movement of moisture in fruit trees as the crop load is ripening. The control of this moisture helps to control the cracking phenomenon in many apple varieties.



**Vapor Gard® for Reducing Stem-End Splits  
Royal Gala**

Key Industries NZ 1984

## 7. MAJOR USES

### 7.6 ANTI-TRANSPIRANT – IMPROVED FRUIT COLOURATION

Improve fruit colouring (e.g. peaches, apples etc.)



The above pictures show the improvement in both fruit size and colour through the use of Vapor Gard.

Applications of Vapor Gard at 1% 4-6 weeks prior to harvest can assist with both size and colour improvement.

**Note: Not all red fruit varieties will respond the same ways as found with Kent variety mango studies in Australia. A small area should be tested first.**

## 7. MAJOR USES

### 7.6 ANTI-TRANSPIRANT – IMPROVED FRUIT COLOURATION

#### Vapor Gard trials – Tunisia 2005

##### I. Peaches

<b>Trial Description</b>	Variety:	Summer Rich
	Area treated:	1.5 ha
	Irrigation:	Drip
	Age of trees:	6 years
	Bud burst:	30/3/05
	Expected harvest:	25/7/05

**Trial Objective:** To improve the fruit size and colour.

**Treatments**

- 3 sprays at 0.6%-0.8%
- First treatment June 24<sup>th</sup>
- Second treatment July 7<sup>th</sup>
- Third treatment July 22<sup>nd</sup>

**Results**

- Average diameter of treated fruits: 57 mm
- Average diameter of untreated fruits: 53.3 mm
- Improved colouring of the treated fruits (see pictures 1&2)



Picture 1: Improved size of the Vapor Gard treated peaches.

Picture 2: Improved colour of Vapor Gard treated vs. non-treated peaches.



## 7. MAJOR USES

### 7.6 ANTI-TRANSPIRANT – IMPROVED FRUIT COLOURATION

#### Vapor Gard trials – Tunisia 2005

##### II-Nectarines

<b>Trial Description</b>	Variety:	Venus
	Area treated:	1.5 ha
	Irrigation:	drip
	Age of trees:	6 years
	Bud burst:	27/3/05
	Expected harvest:	22/8/05

**Trial Objective**      **to reduce fruit cracking, improve fruit size and colour**

**Treatments**

- 3 sprays at 0.6%-0.8% 30 days before harvest
- First treatment July 10th
- Second treatment July 25th
- Third treatment August 5th

**Results**

- Average diameter of treated fruits: 64.3 mm
- Average diameter of untreated fruits: 60.6 mm
- Fruit cracking with treatment: 2.14%
- Fruit cracking without treatment: 4.5%
- Improved colouring of the treated fruits (see pictures 3, 4 and 5)



## 7. MAJOR USES

### 7.7 ANTI-TRANSPIRANT – IMPROVED FRUIT STORAGE

Improve shelf life of fruit, vegetables and ornamentals

#### Vapor Gard trials – Tunisia 2005

##### III-Stored Nectarines

Nectarines were dipped with a 0.7% concentration before storage.

Physical characteristics of fruits stored at 3° C

<i><b>Sample</b></i>	<i><b>Fruit Weight before storage</b></i>	<i><b>Weight after 1 week storage</b></i>	<i><b>Weight after 2 weeks storage</b></i>	<i><b>Weight after 3 weeks storage</b></i>	<i><b>% rotten fruit</b></i>	<i><b>% overripe fruit</b></i>	<i><b>Fruit colour and aspect</b></i>
Case – treated Nectarines	9.5kg	9.5kg	9.5kg	9.5kg	0%	5%	Slight fruit dryness
Case – untreated Nectarines	9.5kg	9.5kg	9.0kg	8.5kg	7%	12%	Very dry & wrinkled

Treated nectarines were found to have better storage qualities.

## 7. MAJOR USES

### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

#### Vapor Gard trials – Tunisia 2005

EL MOUSSEM Agricole SA Tunisia 2005

##### Apples

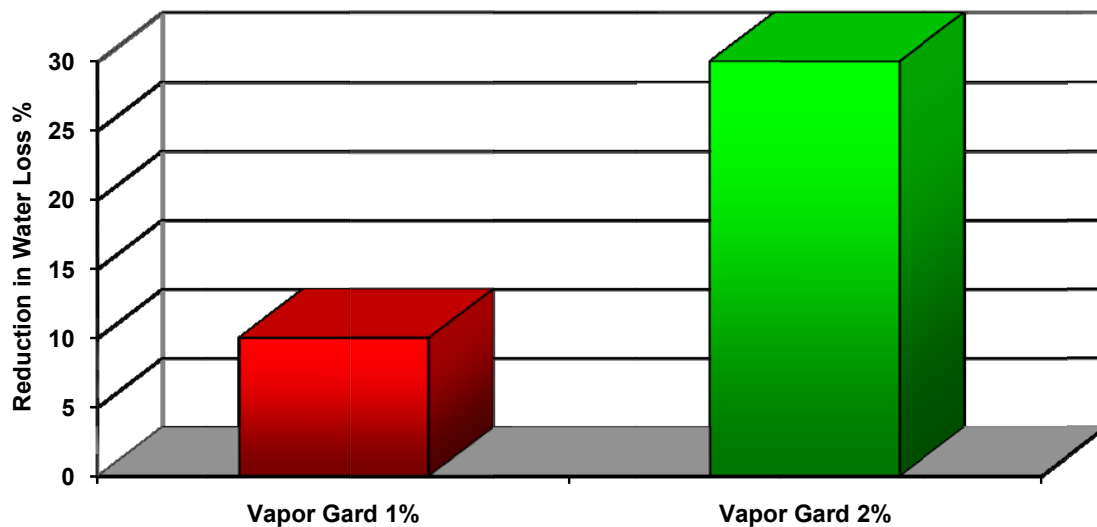
<b>Description</b>	Variety:	Anna	
	Treated Area:	1 ha	
	Irrigation:	Drip	
	Age of trees:	6 years	
	Bud burst:	15/3/05	
	Expected harvest:	End of July	
	Area:	Tébourba (North West)	
<b>Trial Objective</b>	To reduce sunburn, dry wind effect (sirocco), fruit cracking and early fruit fall.		
<b>Treatments</b>	<ul style="list-style-type: none"><li>- 4 sprays at 0.6%-0.8% 45 days before harvest</li><li>- First treatment June 6th</li><li>- Second treatment June 27th</li><li>- Third treatment July 10<sup>th</sup></li><li>- Fourth treatment July 25th</li></ul>		
<b>*Results</b>		Treated	Untreated
	-Healthy fruits	89.4%	78.9%
	-Fallen fruits	3.6%	7%
	-Sunburnt fruits	7.7%	14.1%

## 7. MAJOR USES

### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

#### Water Conservation

VAPOR GARD covers a sufficient area of the leaf surface reducing critical moisture loss from excessive heat, drought, wind or irrigation loss. Reducing moisture stress on plants improves crop photosynthesis and metabolism which supplies energy and nutrients to developing fruit. In extreme cases of irrigation loss on trees a VAPOR GARD application or two may make the difference between a sustainable tree and one that is lost.



Conclusion: Vapor Gard application could reduce the number of irrigation cycles by 40-50% and still achieve equivalent or higher yield than watered crops under dry conditions.



## 7. MAJOR USES

### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

## Vapor Gard Trials – Tunisia 2005

EL MOUSSEM Agricole SA Tunisia 2005

### V-Table grape

<b>Description</b>	Variety:	Red Globe
	Treated Area:	1 ha
	Irrigation:	Drip
	Vine Age:	5 years
	Bud burst:	23/3/05
	Expected harvest:	Mid-August
	Area:	Tébourba (North West)

**Trial Objective\*Goal** To reduce the negative effects of hot dry winds ('Sirocco')

**\*Treatments**

- 4 sprays at 0.6%-0.8% 45 days before harvest
- First treatment July 2nd
- Second treatment July 17<sup>th</sup>
- (Remaining two spraying dates unknown)

**\*Results**

-10% of untreated bunches situated on the field's edges under direct sunlight and wind exposure have dried up whereas treated bunches in same location have not (see pictures 7 and 8)



Untreated bunches showing the effects of the hot dry wind



Vapor Gard treated bunches showing no effects of the hot dry wind

## 7. MAJOR USES

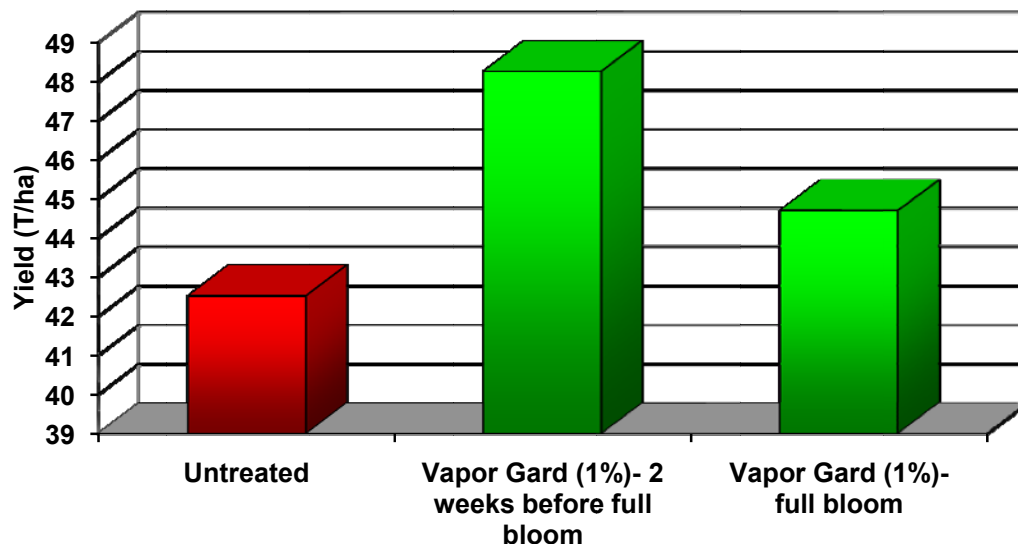
### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

#### Vapor Gard in Potatoes:

Vapor Gard has been proven over many years to reduce the effects of moisture stress on potatoes and improve the size distribution to the larger size and improve yield allowing the plant to perform better under droughty conditions. Texas Agricultural Experiment Station has shown yield increases of 28-64%. Timing for the application of Vapor Gard should be at or just prior to bloom. Following is some testing work conducted in South Africa on potatoes.

#### The Effect of Vapor Gard, applied at different times, on the yield of potatoes (cv. Van Der Plank), Western Cape, South Africa, 1998

Trial: Johann van der Vyver & Wouter Schreuder  
Note: Water Rate- 250L/ha; Vapor Gard rate- 2.5L/ha



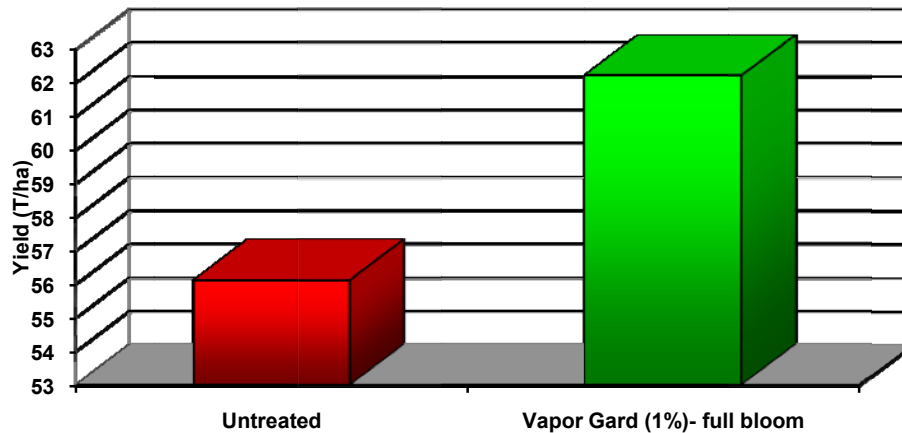
## 7. MAJOR USES

### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

#### The Effect of Vapor Gard, applied at different times, on the yield of potatoes (cv. Herta), Western Cape, South Africa, 1999

Trial: Johann van der Vyver & Wouter Schreuder

Note: Water Rate- 300L/ha; Vapor Gard rate- 3.0L/ha



#### Anti-Transpirant Test Potatoes CWT/Acre

	Rep 1	Rep2	Rep3	Average
*Vapor Gard	630.0	545.7	560.0	578.5
Check	430.0	421.6	425.1	425.6

Applied June 4 and July 20 Oregon State University

## 7. MAJOR USES

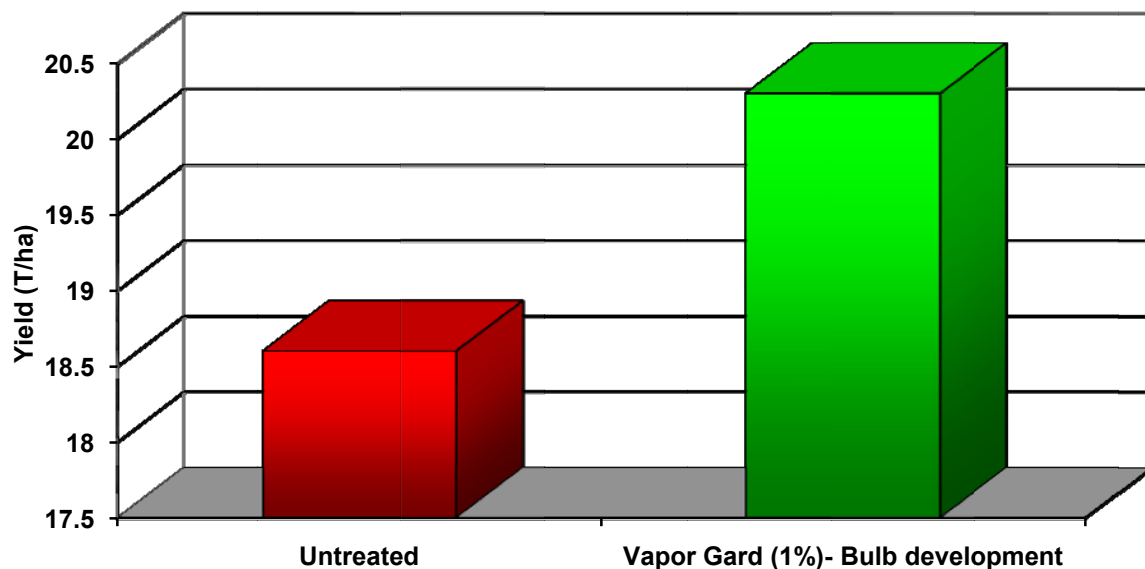
### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

#### The Effect of Vapor Gard on the yield of Onions, Western Cape, South Africa, 1997

Trial: Johann van der Vyver & Wouter Schreuder

Note: Water Rate- 310L/ha; Vapor Gard rate- 3.1L/ha

The trial was conducted 100 days after the onion seedlings were transplanted. This is normally a period at which leaf development has peaked, root numbers begin to decline and bulb development is at a maximum level. During this stage onion plants are very susceptible to water shortages. The level of susceptibility increased during this trial due to the increasing day temperatures and irregular irrigation of the trial plot. Onion plants usually close stomata and terminate growth under periods of water shortages.



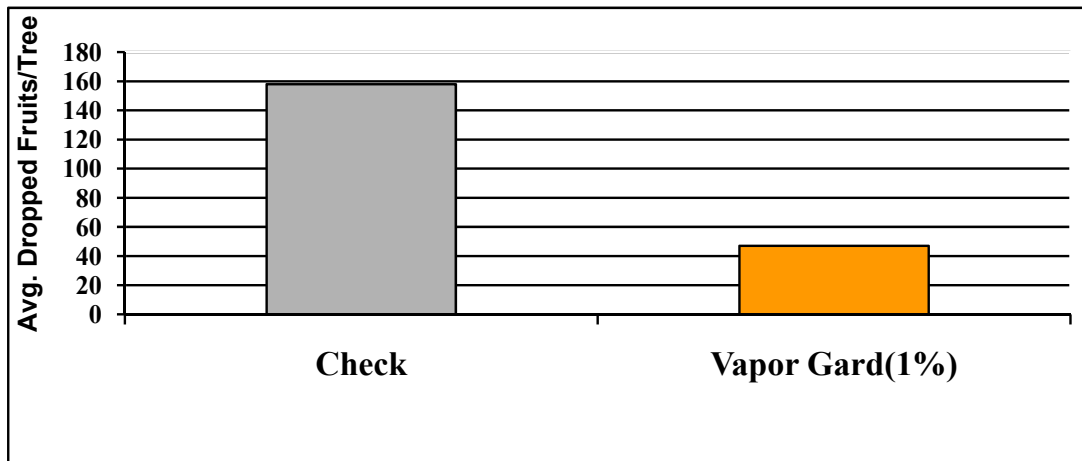
Growth termination or even an inhibition of growth will inevitably result in smaller bulbs causing a loss in yield. Vapor Gard has the ability to reduce moisture loss of plants by reducing transpiration, which mainly occurs through the stomata. By reducing moisture stress of onion plants, growth inhibition will be reduced, resulting in bigger bulbs and an increased yield. Bearing in mind that this Vapor Gard application was conducted after the plants had already started to bulb, the results could have been more advantageous if the applications were conducted at the start of bulbing.



## 7. MAJOR USES

### 7.8 ANTI-TRANSPIRANT – HEAT & MOISTURE STRESS

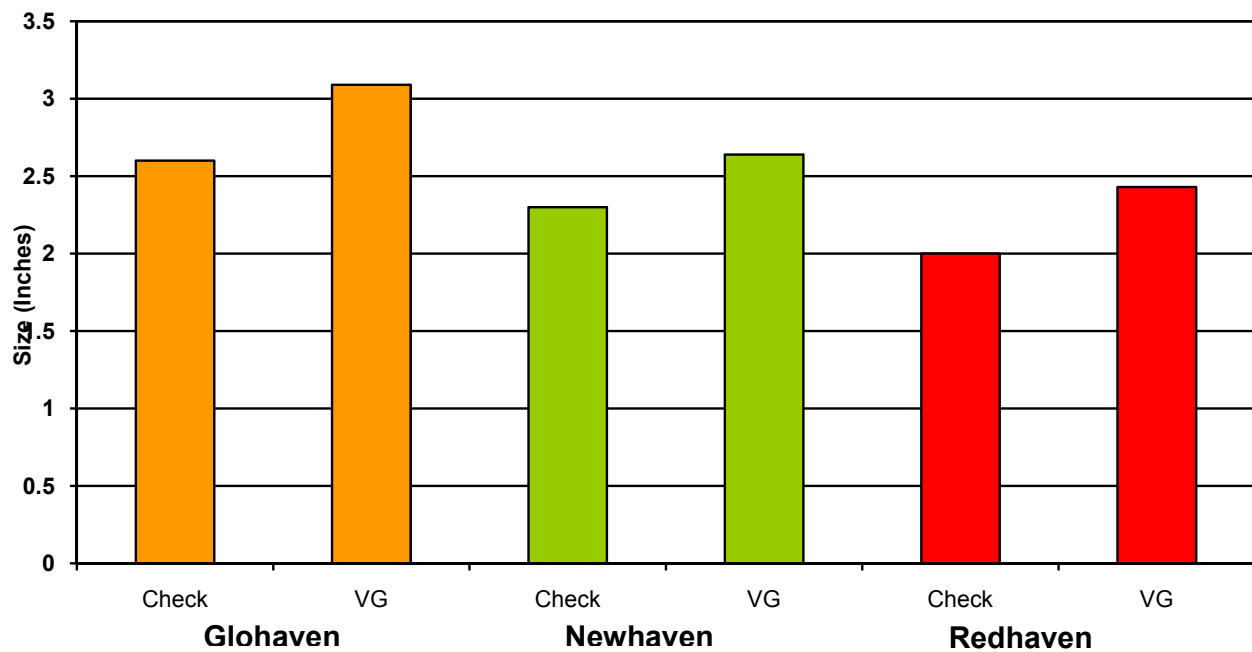
#### Reduction in Avocado Fruit Drop under Heat Stress and Limited Irrigation Mundubbera Australia 1982 Golden Mile Farms



#### Vapor Gard Effect on Peach Size under Limited Irrigation

Vapor Gard applied 10l/ha 2 weeks prior to harvest

VPI University USA



## 8. DIRECTIONS FOR USE

CROP	PROBLEM	RATE OF USE	COMMENTS
Evergreens (winter protection) including Azalea, American Holly, Pines, Rhododendron and Yews.	To reduce winter damage caused by desiccation.	Spray to ensure full coverage using a mixture of 50ml Vapor Gard per Litre of water. Water should be applied to the point of runoff for full coverage of the plant	<b>Note:</b> - One autumn application lasts the entire winter. - Vapor Gard will not enable a warm season variety plant to survive the winter in a cold area. - Do NOT use for winter protection where temperatures drop below - 3 °C. - Before using Vapor Gard on a large number of plants, test under local conditions.
Evergreens; Flowers; Turf; Vegetables (such as tomato, pepper, melons, cucurbits, celery, cabbage, lettuce), Tobacco, Coffee and fruit transplants; Flowering plants; Evergreen and Deciduous Trees and Shrubs.	To reduce transplanting shock.  Use on established plants during the growing season to reduce summer scald.	Spray or dip plants using Vapor Gard at the rate of 1 part per 40-50 parts of water before transplanting.  Spray the plants for full coverage using 100ml (2% solution) of Vapor Gard per 4-5 Litres of water.	- Ensure good spray coverage to cover the tops and bottoms of leaves.
POME FRUITS (Apples and Pears)	To improve size, reduce pre harvest fruit drop, reduce sunburn incidence, reduce Stayman cracking and to improve colour in some varieties.	Apply Vapor Gard at the rate of 1% solution per hectare in enough water for good coverage (950-4800 litres per hectare) pending tree size.	Apply Vapor Gard before cracking or sunburn conditions are likely to occur. Usually when the apple is approximately golf ball size or has lost its hair like structures on the fruit
STONE FRUITS (Peaches, Nectarines and Apricots)	To improve colour, fruit size and flavour.	Apply Vapor Gard at the rate of 0.5 – 1% solution, 2 to 3 weeks before harvest.	Apply in at least 2000 litres of water per hectare to ensure good coverage.
Cherries	To improve colour, size and to reduce cracking or splitting.	Apply 0.5 – 1.0% solution of Vapor Gard per hectare, 3 to 4 weeks before harvest.	Apply in at least 1000 litres of water per hectare to ensure good coverage.
Grapes (Table)	To improve size, colour, flavour and storage life.	Apply 0.5 – 1.0% solution of Vapor Gard per hectare in approximately 1000 litres of water.	Apply just before bunches close.
Citrus	To improve storage life through moisture conservation, reduce peel desiccation and increase size.	Apply 0.2 – 0.3% solution of Vapor Gard, 2 to 4 weeks before harvest.	Apply in at least 1000 - litres of water per hectare to ensure good leaf and fruit coverage.
Subtropical and Exotic fruits (such as Avocados, Kiwi, Papaya, Persimmons)	To improve size and moisture conservation and reduce fruit drop.	Apply 0.5 – 1.0% solution of Vapor Gard in adequate water for full coverage.	Due to varietal differences test Vapor Gard on a few plants before starting large scale usage.

CROP	PROBLEM	RATE OF USE	COMMENTS
Mangoes	To enhance red fruit coloration and to improve storage and shipping quality through moisture conservation.	Apply a 1 – 2% solution of Vapor Gard approximately 2 to 4 weeks before harvest.	Apply at least 950 - 5700 litres of spray per hectare depending on tree size.
Asparagus	To reduce moisture loss and fern desiccation under hot conditions.	Apply a 1% solution of Vapor Gard per hectare in enough water to ensure good coverage.	Water Rates 950 – 2000 Litres/hectare
Potatoes and Beet.	To improve yield and larger tuber sizing.	Apply a 1% solution of Vapor Gard in adequate water for coverage, approx 1000 litres per hectare.	Optimum timing for potatoes is from full bloom to 2 weeks after full bloom, or just before the vines drop in the row.  Optimum timing for Beets is midway through the growing season, usually when 60% or more of the foliage is present.
Vegetable Crops (such as Tomatoes, Peppers, Beans, Melons and other cucurbits).	To help increase fruit size and reduce sunburn.	Apply a 1% solution of Vapor Gard in adequate water for a good coverage.	Application should be made early in the fruiting season.
Row Crops (such as Cotton).	To relieve drought stress.	Apply a 1% solution of Vapor Gard in adequate water for a good coverage.	Apply when 60% or more for the foliage is present.
Water Saving Tool.	To relieve drought stress.	Apply a 1% solution of Vapor Gard in adequate water for a good coverage.	Apply when 60% or more for the foliage is present if only one application is to be made.

**Cold Desiccation (All crops):** Plant damage frequently occurs during growing seasons when cold weather fronts pass through crops areas. Damage occurs due to cold desiccation and freezing temperatures. VAPOR GARD® will reduce the effects of cold desiccation, but will not prevent damage from freezing temperatures. To reduce the effects of cold desiccation, apply VAPOR GARD® at the rate of 1 – 2% solution in a full coverage spray, at least a few hours before a cold front arrives, while there is still adequate sunlight for the film to set.

**CAUTION.**

- DO NOT use VAPOR GARD® on any variety of Arborvitae, Cedar, Cypress, Chamaecyparis, Juniper, Sequoia, Dwarf Conifers, or any other similar plant species.
- VAPOR GARD® will turn blue evergreen species such as Blue Spruce, green on application. The blue appearance will return with new season's growth.
- For dip applications, maintain agitation by stirring the dip emulsion during the entire dipping period.
- Do Not apply to stressed plants Do Not apply under hot conditions Do Not apply in low water volume applications
- **DO NOT DIP PLANT ROOTS.**

**DO NOT** mix VAPOR GARD® with any pesticides.

Vapor Gard needs to be applied to the point of runoff so high water rates will delivery the best results.

## 9. MIXING INSTRUCTIONS

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Vapor Gard pre mixed in Water



Vapor Gard applied directly to the tank

1. Half fill the spray tank with water and commence agitation.
2. Pre-mix Vapor Gard in a bucket with water and then add this to the tank. Vapor Gard can be added to tolerance exempt materials. Add Vapor Gard after you have added the pesticides.  
**WARNING:** Vapor Gard should not be added to pesticide materials due to MRL issues and visible residues may be entrapped in the water insoluble film and may prove difficult to remove.

3. Fill the spray tank with water and keep agitating.

**NOTE:** For the best results, always pre-mix Vapor Gard in a bucket of water before adding to the spray tank, especially if the spray water is very cold.

### **Product Storage Requirements:**

At ambient temperatures, the shelf life of the product is unlimited. For good stock control management, the preferred shelf life is 5 years.

### **Packaging Requirements:**

Vapor Gard is not classified as a dangerous good for transportation purposes.

## 10. FREQUENTLY ASKED QUESTIONS

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### **HOW LONG DOES THE VAPOR GARD LAYER LAST?**

When used at 10 l/HA or 1%, the Vapor Gard layer breaks down (degrades) in a controlled manner over a period of 3-6 months. This process is referred to as polymerization and it is influenced by ultra-violet light and oxygen. Polymerisation is the weathering of the Pinolene layer over time as it's degraded by UV light and oxygen. This weathering process results in the powdering away of the film surface over time allowing surface active compounds to be slowly released over time providing maximum protection to the plant. This process can take between 3-6 months pending the amount of sunlight it's exposed to.

### **WHAT HAPPENS IF VAPOR GARD GETS INTO THE SOIL?**

Vapor Gard degrades very rapidly in soil due to microbial activity.

### **WILL VAPOR GARD WASH OFF TREATED SURFACES?**

No. Once the Vapor Gard layer has dried it is rain fast. It is important that the spray solution is exposed to at least 1-2 hours of sunlight for the product to complete the polymerization process on the plant surface.

### **WILL VAPOR GARD GET HARD AND KEEP PESTICIDES FROM TRANSLOCATING INTO THE PLANT?**

Vapor Gard never fully hardens but retains its elasticity; leaves can grow and the film will expand with it. That's why it's called a soft-film former. CO<sub>2</sub> and O<sub>2</sub> can still move freely through the film, so photosynthesis and respiration are not affected. Acrylic films are referred to as Hard Film stickers. The movement of CO<sub>2</sub> and O<sub>2</sub> can be reduced and this will affect photosynthesis and respiration.

### **WHAT MAKES VAPOR GARD DIFFERENT?**

Vapor Gard is a Pinolene based terpenoid formulation and because of its similarity to other plant waxes, actually bonds with the waxy leaf and stem surface of plants.

### **CAN I MIX PESTICIDES WITH VAPOR GARD?**

Under no circumstances should Vapor Gard be mixed with Pesticides. Tolerance exempt materials are permitted but consideration should be given to visible residues as Vapor Gard will retain them on the plant or fruit surface.

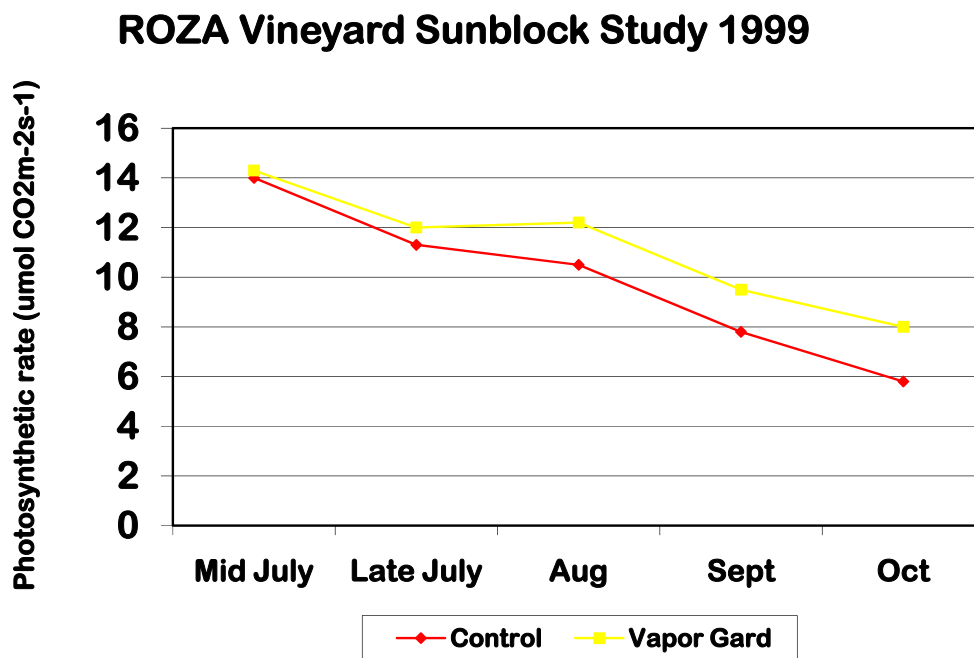
These visible residues when combined with Vapor Gard may prove difficult if not impossible to remove later when the crop is harvested. Vapor Gard may also extend the residual life of some pesticides resulting in MRL's that exceed acceptable limits.



### WILL VAPOR GARD SUFFOCATE THE PLANT?

No. When used at the correct rate of application Vapor Gard will not suppress photosynthetic rates or growth of the crop when used correctly. The enclosed graph shows the effect of Vapor Gard on grape leaf over time. Vapor Gard does not slow photosynthetic rate but actually improve leaf performance when applied to the crop.

Failing to follow the label directions will cause the plants treated to yellow or be suppressed in this instance the use of Vapor Gard should be stopped until plants recovers. Always refer to label directions for correct use. Do not exceed 9.5l/ha within a 6 week period.



## 11. PRODUCT MARKETING MATERIALS

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- ✓ Trial reports database
- ✓ Cherry leaflet
- ✓ Vapor Guard leaflet with Directions for Use
- ✓ In store display

## 12. DISCLAIMER

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Use this product in accordance with good agronomic practice, which include utilizing proven spray equipment set for proper coverage. Do not make applications when temperatures are too hot. Applications should be made at temperature levels and when other environmental conditions in your area are such that your experience indicates the application will be compatible and will accomplish the desired result.

The use of this material being beyond our control and involving elements of risk to human beings, animals and vegetation, we do not make any warranty, express or implied, as to the effects of such use, when this product is not used in accordance with the directions as stated on this label.

**CAUTION – KEEP OUT OF REACH OF CHILDREN.  
NOT A PLANT FOOD PRODUCT.**

**Manufactured by: MILLER CHEMICAL AND FERTILISER CORPORATION.  
Hanover, Pennsylvania 17331, U.S.A**

**Distributed in Australia by AGSPEC AUSTRALIA PTY LTD, LOT 1 WANDILO  
ROAD (PO BOX 1006) MOUNT GAMBIER SA 5290**

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