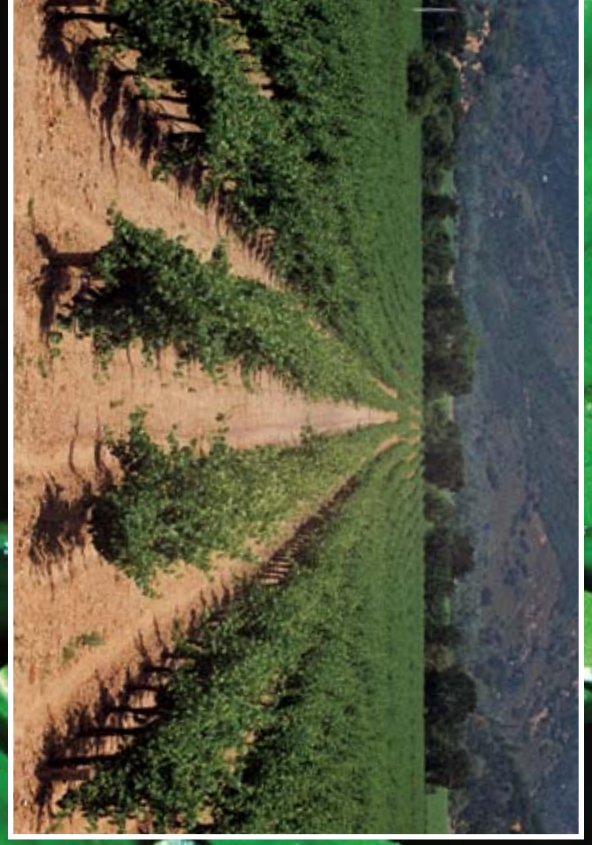


Vigor-Cal™

THE NATURAL CALCIUM MICRONUTRIENT℠

AGRO-K®

Science-Driven Nutrition℠

History

Agro-K Corporation has been developing science-based nutrient solutions for a wide range of cropping systems for nearly 40 years.

We have developed tools to helps growers produce food efficiently while being sensitive to the environment. Vigor-Cal™ is just one of our developments.

- **Bio-Available Calcium**
- **The IPM Answer To Healthier Plants**
- **Compatible With Most Fungicides**
- **Improves Plant Vigor, Structural Cell Wall Integrity and Supports Resistance Management**
- **Formulated To Correct Or Prevent Calcium Deficiencies**
- **Safe For People And The Environment**
- **For Foliar Application Only – Allows Placement Of Calcium Precisely Where Needed**

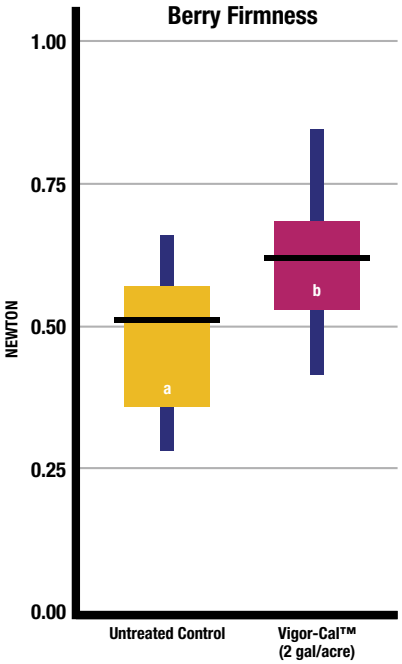
Calcium's Role In Plants

Calcium is one of many important nutritive elements that plants need to grow and remain healthy. Deficiencies in calcium cause many well documented fruit and vegetable disorders such as bitter pit in apples, blossom end rot in tomatoes and soft bottom in melons.

The significant role of calcium in a plant's inherent ability to resist the establishment and proliferation of plant diseases is well documented (Biggs et al., 1997; Marchner, 1988; Palta, 1996).* Calcium's ability to reduce or prevent infection comes from its ability to increase cuticular thickness and cell turgor. Plants with thicker cuticles and more cell turgor are less susceptible to infection and, if infected, these plants are better able to fight off infection.

Nitrogen And Its Role In Fungal Infection

Nitrogen is a critical element for plant growth. But excessive nitrogen is known to predispose plants to fungal infections. Furthermore, low levels of calcium in plant tissue relative to nitrogen levels have been shown to increase a plant's susceptibility to fungal infections.



Different letters are significantly different at 5% level.

Research conducted by Dirk Uys, Ph.D., 1997, University of Stellenbosch, South Africa.

Mean for Untreated Control = 0.483 and Vigor-Cal™ = 0.629. Std. Error for Untreated Control = 0.0287 and Vigor-Cal™ = 0.031. A significant increase in firmness was recorded.

The Balance

Proper nutrient balance is important for a plant to complete its development process. Adequate nitrogen and calcium, in the proper ratio, will lead to increased plant vigor and cuticular thickness – establishing a natural barrier to fungal infections. Growers experiencing an imbalance in the ratio must increase calcium levels quickly to correct the problem and avoid increasing risk of fungal infections.

Foliar application is the quickest method to increase a plant's calcium level because it delivers the element directly to the effected areas – plant tissue, leaves, and fruit.

*References on back page.

Research Results

The ability for the grape plant to increase its natural disease tolerance is, in part, due to the increase in cell wall thickness and cell turgor. This is confirmed by characterizing berry firmness by measuring the magnitude of deformation caused by a finite pressure. These results are measured in Newtons.

One application of Vigor-Cal™ at 2 gal/acre was made to 12 vines of Barlinka table grapes. Six cartons per treatment were packed and stored in cold storage for 4 weeks at 0.5°C and then one week at 10°C. After removal from cold storage, twenty berries were drawn at random from the six cartons (each treatment) and measured for firmness. A significant increase in firmness was recorded.

In another trial conducted by Dr. Uys with Agro-K's Foliar Calcium significant increases (at 1% level) in berry skin thickness and berry skin cell layers were observed.

	Control	Calcium Treated
Berry skin thickness	185 µm	218.5 µm
Berry skin cell layers	4.65	5.13

Research Results

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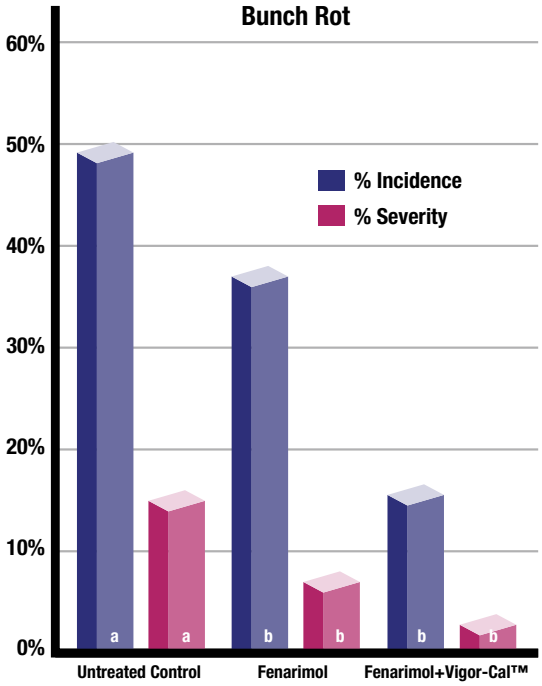
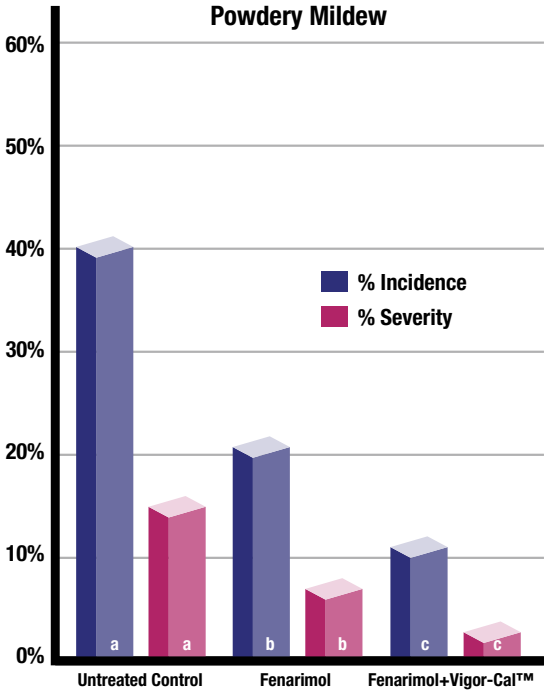


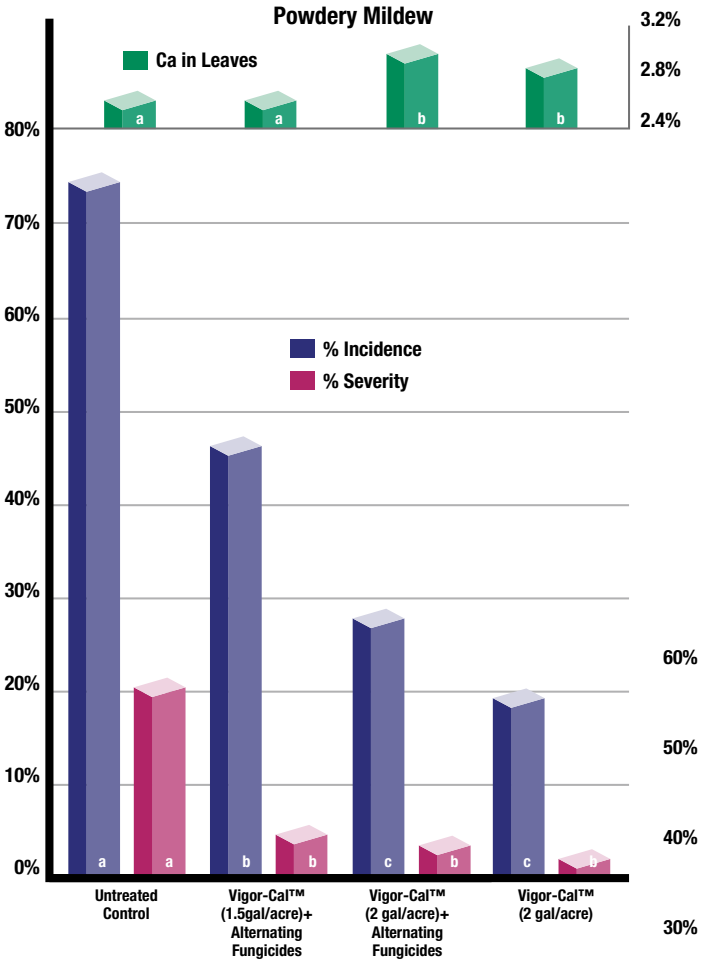


Different letters are significantly different at 5% level.
Roy and Elaine Hale, Hale Research and Environmental Consulting, Santa Maria, CA.

The chart at the left shows the impact of the addition of Vigor-Cal™ (1 gal/acre) to fenarimol (0.383 oz. a.i./acre). Management of grape powdery mildew, *Uncinula necator* in **Chardonnay** winegrapes was significantly enhanced over fenarimol alone. Management of *Botrytis cinerea* was also enhanced with the addition of Vigor-Cal, but not significantly when compared to fenarimol alone.

Santa Maria, CA. **1996**

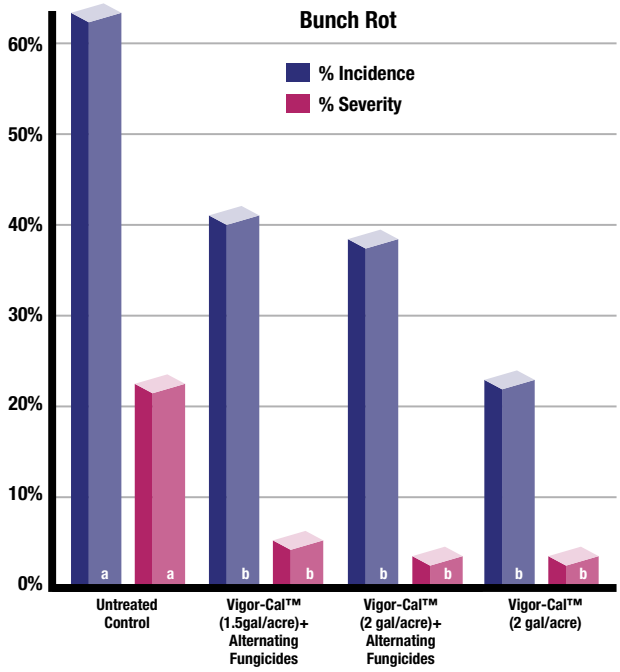
More Research Results



Different letters are significantly different at 5% level.
Roy and Elaine Hale, Hale Research and Environmental Consulting, Santa Maria, CA.

The chart above shows the impact of various treatments on the management of Grape Powdery Mildew, *Uncinula necator*, and on **calcium levels** in leaves in **Chardonnay** winegrapes.

Santa Maria, CA. Evaluated **9/1/97**.



The chart above are the evaluations of the same treatments for management of Grape Bunch Rot, *Botrytis cinerea*.

Science-Driven Nutrition℠

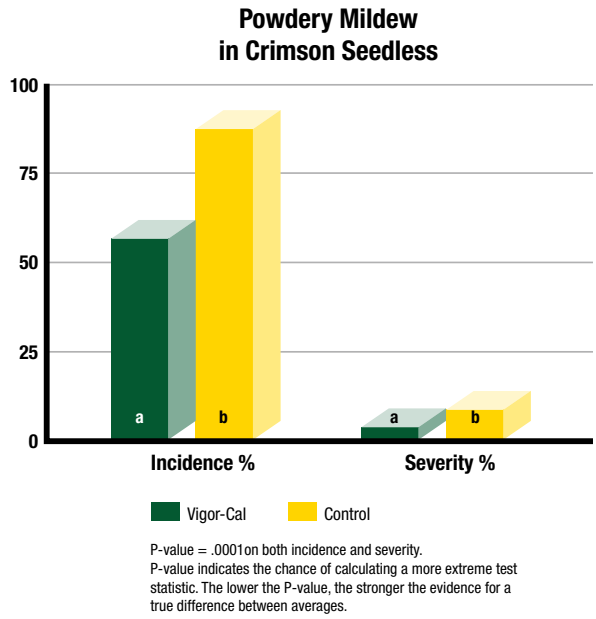
More Research Results

Treatment	% Severity	% Incidence
Vigor-Cal™ 1.5 gal./acre Rubigan EC 4 oz./acre	0.2% b	1.5% b
Vigor-Cal™ (2 gal./acre)	1.4% b	30.6% c
Untreated Control	98.8% a	100% a

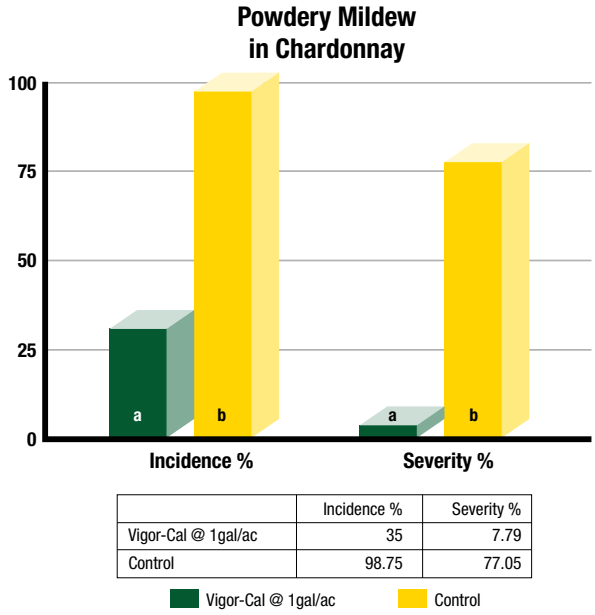
Different letters are significantly different at 5% level.

Doug Gubler, Ph. D./Ken Dell Ph. D.
Plant Pathology Department
U.C. Davis, CA 1997

Impact of Vigor-Cal™ on the Management of Grape Powdery Mildew, *Uncinula necator* in **Chardonnay** winegrapes.

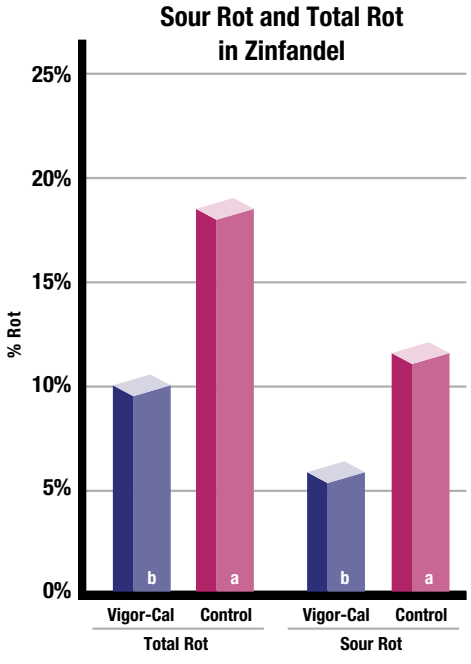


Research conducted by Dr. Michael Costello
Sanger, CA 1998



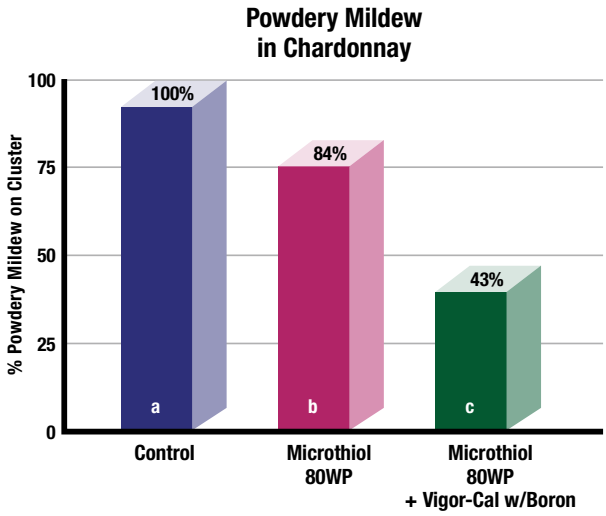
	Incidence %	Severity %
Vigor-Cal @ 1gal/ac	35	7.79
Control	98.75	77.05

Research conducted by Dr. D. Gubler, UC Davis, 1999
Different letters are significant at the 5% level



Different letters are significantly different at 5% level.

Research conducted by Roger Duncan,
Viticulture Farm Advisor,
Stanislaus County, CA 2000



Research conducted by W. F. Wilcox & D. G. Riegel
Cornell University, 2003
Different letters are significant at the 5% level

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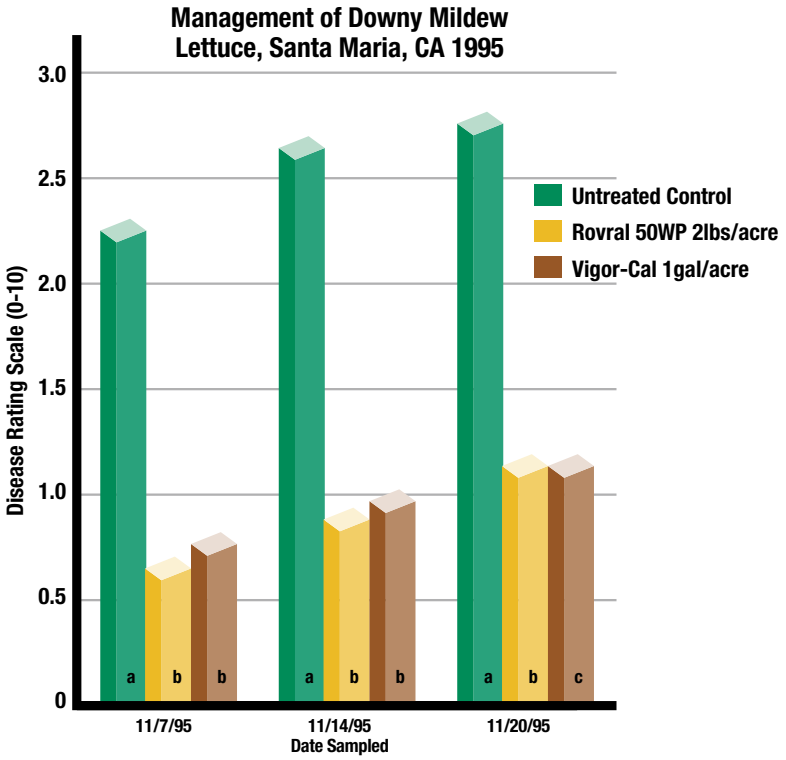
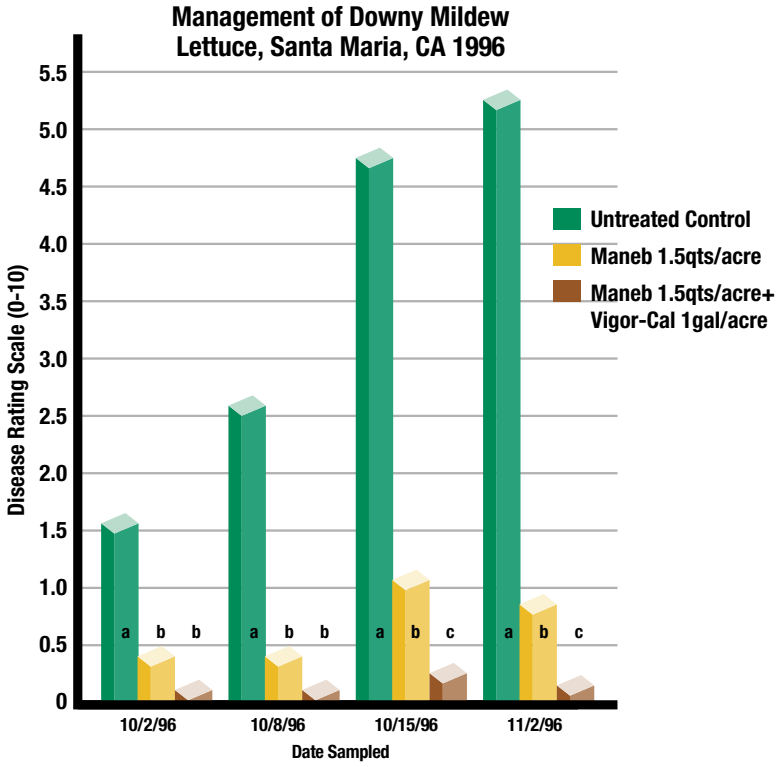
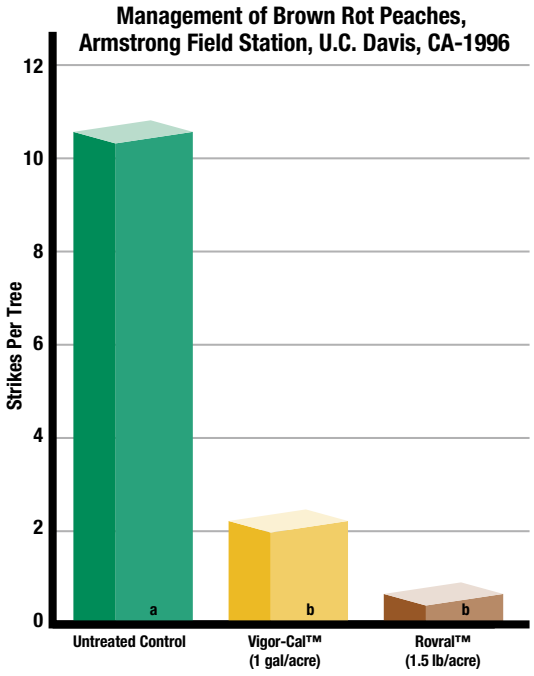
Research On Other Crops



Different letters are significantly different at 5% level.
Both lettuce trials conducted by Roy and Elaine Hale,
Hale Research and Environmental Consulting,
Santa Maria, CA.





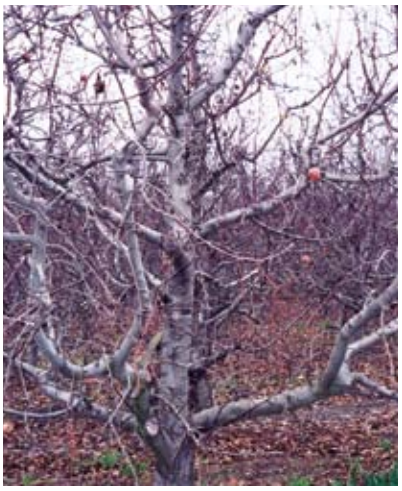
Different letters are significantly different at 5% level.
Research Conducted by Doug Gubler, Ph.D.
Plant Pathology Department, U.C. Davis, CA

Maneb is a trademark of ELF ATOCHEM N.A. Inc.
Rovral is a trademark of RHONE-POULENC Ag Co.

Management By Growers

Streptomycin

Jon Tecklenburg grows Fuji apples in Lodi. In **1997** when Fireblight attacked his apple trees, he sprayed Streptomycin alone in one block and Streptomycin with Vigor-Cal™ in the neighboring block. 1997 was a bad fireblight year. The block sprayed with Streptomycin alone had several strikes per tree which led to losses of entire branches. The block treated with Vigor-Cal™ and Streptomycin had only one strike per several trees. This showed Jon that Vigor-Cal™ could strengthen cell walls and improve tolerance.



Vigor-Cal™ + Streptomycin

Cal Rose Nursery in Wasco California, produces nursery stock for cut rose operations. Dave Anderson, Manager of Production, had a Downy Mildew problem in **1997**, that exploded in the rose fields and the plants lost all the foliage.

Since he had not had very good results with fungicides in the past when the problem was this bad, Dave decided to tank mix Vigor-Cal™ with his standard fungicide and began weekly treatments.

Within two weeks the plants were putting out uniform new growth. Downy Mildew was gone and the plants were strong. He had never seen recovery from such an infection so quickly.

He had more canes at harvest translating into better grades and a higher price for the crop.

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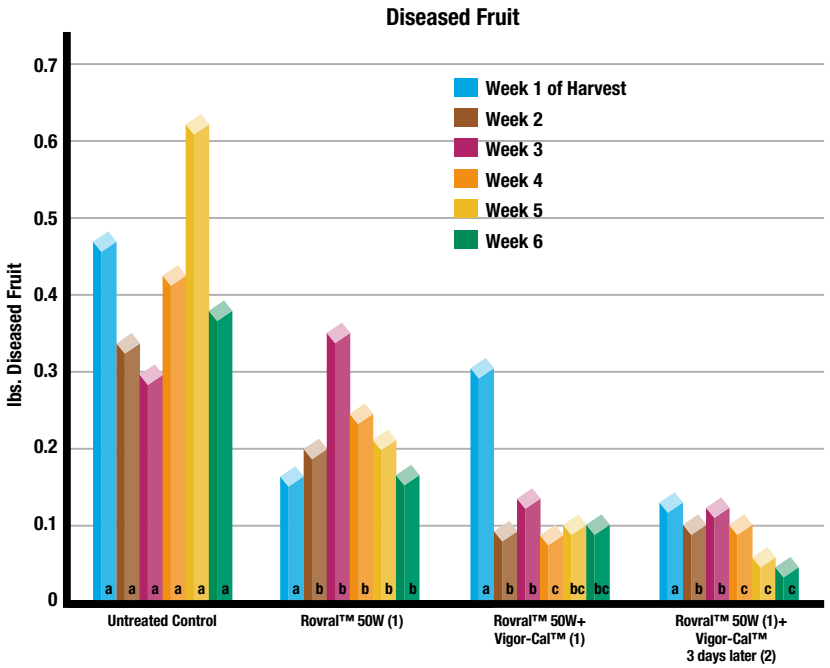
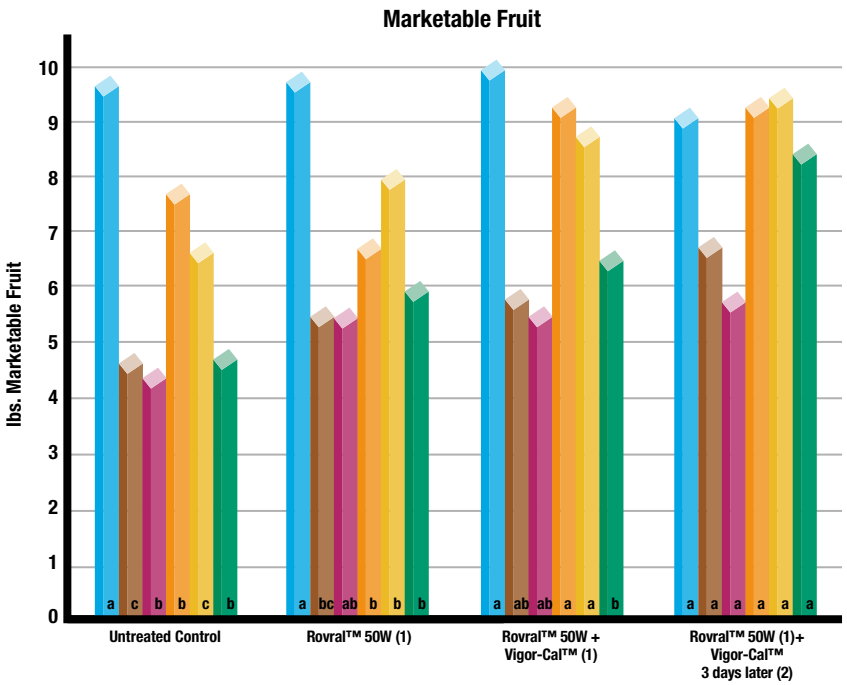
Management of Botrytis in Strawberries
Santa Maria, CA 1997



Treatments	Rate/Acre
Rovral™	1.5 lbs.
Rovral™ Vigor-Cal™	1.5 lbs. 1.0 gal.
Rovral™ 3 days later Vigor-Cal™	1.5 lbs. 1.0 gal.

Different letters are significantly different at 5% level.

(1) Applied on: 5/24, 5/31, 6/10, 6/20 and 6/30/97.
(2) Applied on: 5/27, 6/3, 6/13, 6/23 and 7/3/97.



Different letters are significantly different at 5% level.

Conducted by Roy and Elaine Hale,
Hale Research and Environmental Consulting,
Santa Maria, CA.

The first three applications showed no response to the Vigor-Cal™ spray. Fourth, fifth and sixth harvests showed a steady decline in infected fruit. The data showed that the invigoration needed "time" to strengthen the strawberry plant. The systemic invigoration needed several sprays of Vigor-Cal™ before showing the effects. Vigor-Cal™ with Rovral and in sequence with Rovral were significantly better than Rovral applied alone.

Conclusions

Vigor-Cal™, in combination with fungicides used for the management of Powdery Mildew, Bunch Rot, Peach Brown Rot, Lettuce Downy Mildew or Botrytis significantly enhanced the quality and yields of these crops.

Vigor-Cal™ alone was very effective in improving the plant's tolerance to powdery mildew and bunch rot in grapes. There was no reduction in yields where Vigor-Cal™ was used alone in comparison to treatments containing fungicides.

The color of the wine produced from grapes treated with Vigor-Cal™ alone was clearly lighter in color than that of the wines produced from two (2) treatments containing fungicides. Vigor-Cal™ also significantly increased the firmness of grape berries.

Calcium nitrate – This product increases nitrogen levels as well as calcium. However, if the tissue nitrogen/calcium ratio is already out of balance, (i.e., too much nitrogen), then calcium nitrate will do little to prevent or reduce fungal infection and may even exacerbate the problem.

Calcium chloride – This commonly used product contains chlorine which is harsh on plant tissue and may result in phytotoxicity and scarring.

1. Biggs, A. R., M. M. El-Kholi, S. El-Neshawy, and R. Nickerson. 1977. Effect of calcium salts on growth, polygalacturonase activity and infection of peach fruit by Monolimia fruticola. Plant Di. 81:399-403.

2. Marschner, H. (1988). Relationship between Mineral Nutrition and Plant Diseases and Pests. IN "Mineral Nutrition of Higher Plants", pp. 369-390. Academic Press Inc., San Diego.

3. Palta, J. P. 1996. Role of calcium in plant responses to stresses: linking basic research to the solution of practical problems. HortScience 31(1):51-57.

4. UYS, D. C. 1996. Firmness meter for grape berries. How firm are our grapes really? Deciduous Fruit Grower, South Africa. 46, 379-383.

Vigor-Cal™ is not a pesticide and will not control fungal infection. Systematic use of Vigor-Cal™ in a nutrient program will enhance the plants vigor and allow the growers to use approved fungicides to get optimum results.

BIOLOGICALS

Activates the soil's existing microbe base, releases soil-bound nutrients, enhances root zone environment

- Bio-Mulch
- Symbex

Seaweed based soil stimulant to increase crop quality and yield

- Symbooster 10X
- K-Booster

Foliar seaweed and micronutrient sprays to enhance crop quality and mitigate plant stress

- Symspray 20X

Seaweed and micronutrient based seed coating to speed emergence, seedling development and increase yield

- Super Symcoat

Seed piece coating to improve tuber set

- Symcoat (potatoes)

PHOSPHITES

Sysstemic phosphite based foliar sprays designed to balance nutrient status leading to enhanced crop quality and overall plant health.

- Sysstem-Cal
- Sysstem-SeaCal
- Sysstem-ZN
- Sysstem-MG
- Sysstem-MN
- Sysstem-K
- Sysstem-ZMag
- Sysstem-Moly Z
- Sysstem Ready
- Sysstem-Pecan
- Sysstem Advance

DEXTRO-LAC BASED NUTRIENTS

Unique process that complexes the nutrient cation to a sugar molecule for rapid uptake and maximum availability

- Calcium DL
- Cal-Mag DL
- Copper DL
- Iron DL
- Magnesium DL
- Manganese DL
- Micro-Mix DL
- KDL®
- Potassium Finishing Solution
- Zinc DL

VIGOR ENHANCED NUTRIENTS

Value-added processing builds on the Dextro-Lac base to further enhance product efficacy

- Vigor-Cal
- Vigor-Cal w/Boron
- Vigor-Cal-Bor-Moly
- Vigor-Copper

MACRONUTRIENTS (N-P-K)

Built with 100% food grade, low salt index materials, including ortho phosphoric acid

- 3-18-18
- 9-18-9
- 9-24-3
- 0-18-25 + 1% Boron

A lignosulfonate multi-trace mineral solution for soil use

- Multipurpose Micronutrients

SPECIALITY PRODUCTS

Effectively controls a wide variety of insects and powdery mildew on contact

- Super Insecticidal Soap

Soybean oil emulsifier/adjuvant that works as a spreader, sticker and drift retardant. Also encapsulates pesticides to minimize odor and volatilization

- SprayTech Oil

Hydrophilic based polymer that reduces evapo-transpiration helping to minimize transplant stress, sunscald, frost damage and winter kill.

- Hytech Polymer

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