ProTone®

PLANT GROWTH REGULATOR

For Maximizing Production of
High Quality Red Table Grapes

VALENT BIOSCIENCES® CORPORATION

ProTone® Plant Growth Regulator for Table Grapes
Technical Bulletin

Introduction

ProTone® plant growth regulator is an exciting new product with a unique active ingredient that can enhance color development over a wide use period. Using ProTone®, table grape growers can maximize production of high quality red table grapes throughout the season.

Unlike other table grape coloring products, ProTone® utilizes a compound found naturally in red table grapes to enhance color development. Therefore, ProTone® treated grapes have a natural appearance and maintain good quality at harvest and throughout storage.

Depending on the objective of the color management program within a particular block, ProTone® can be used to initiate earlier harvest, increase overall marketable yield, and/or reduce the number of picks. ProTone® has been found to be efficacious applied from around the time of veraison to late in the season. The optimal timing for a particular block will depend on the cultivar and the harvest management objective. While most early season applications of ProTone® are effective in developing marketable color, late season applications are also very effective in most cultivars, even after sugar development has occurred.

'Crimson Seedless'

'Flame Seedless'

'Red Globe'

Enhances Color

ProTone® contains the same naturally occurring compound that grapes produce to enhance color, resulting in more uniform, natural looking color, without negatively impacting berry or cluster quality

Increases Flexibility

ProTone® can be easily adapted into existing coloring programs and has a broad application window, meaning ProTone® can be applied as early or late applications.

Improves Packout

ProTone® treatment of grapes results in earlier, more uniform color resulting in fewer picks and more marketable packout.

ProTone® is available as a 20% soluble granule formulation that is optimized for use with conventional spray application equipment. In countries where electrostatic spray equipment is more commonly used, a 10% liquid formulation has been developed to meet the additional needs of this application method.

ProTone® has a low toxicity profile resulting in short re-entry and pre-harvest intervals (e.g. four hours and zero days, respectively, in the US). ProTone® is also exempt from tolerance in most countries where it is registered.

Abscisic Acid – the Technology Behind ProTone® Plant Growth Regulator

The active ingredient in ProTone® is S-abscisic acid, or more commonly denoted as S-ABA, a naturally occurring plant growth regulator produced by plants and commonly found in fruits and vegetables (Cutler and Krochko, 1999; Finkelstein, 2002; Schwartz and Zeevaart, 2004). Abscisic acid is typically found as a racemic mixture of both the active isomer S-ABA and the much less active isomer R-ABA. Through a proprietary manufacturing process ProTone® has been developed using only the pure, highly active S-ABA form of abscisic acid.

Levels of S-ABA in plants range from a few parts per billion in some aquatic plants to 10 parts per million in avocado fruit (Milborrow, 1984). S-ABA is involved in many major processes during plant growth and development including dormancy, germination, bud break, flowering, fruit set, general growth and development, stress tolerance, ripening, maturation, organ abscission, and senescence. S-ABA also plays an important role in plant adaptation to environmental stresses such as drought, cold, and excessive salinity.

In red grape varieties, S-ABA is responsible for the development of pigments within the fruit skin that give them their distinctive color (e.g. Han et al., 1996; Lee et al., 1997; Kondo et al., 1998; Peppi et al., 2006; Peppi et al,. 2007). S-ABA enhances color development in mature berries by stimulating the production of an enzyme known as UDP-glucose-flavonoid 3-O-glucosyltrans ferase (UFGT; Boss et al., 1996a and 1996b). This enzyme speeds up the conversion of anthocyanidins into red pigments known as anthocyanins that give red grapes their color.

Under optimal environmental conditions grapes produce sufficient S-abscisic acid so color development occurs rapidly and with adequate pigment to produce red grapes of significant commercial value. Unfortunately, environmental conditions in many growing regions are not always optimal for good color development. During these periods of suboptimal coloring pigment levels in fruit may not be sufficient to meet commercial standards resulting in significant financial losses. When such conditions exist, ProTone® can be used to supplement naturally occurring S-abscisic acid resulting in faster, more complete coloring and better yields of high quality red grapes.

Economic Importance of Color Development in Table Grapes

Global table grape markets demand high quality fruit with size, firmness, sugar and color attributes that meet local and export market requirements. Commercial standards for red colored grapes place great emphasis on the intensity and uniformity of color in both the berries and the overall cluster. Bunches with poor or uneven color are commercially of low value while those that are well colored receive premium pricing.

With harvest and processing costs comprising 55% to 65% of the annual operating costs for table grape production, it is important that picks only be made when enough fruit is colored in a block to cover the cost of the harvest. Typically this will mean approximately a quarter of a crop must be colored before a pick will be economically justified. Letting fruit hang and not harvesting them can be a difficult decision, particularly late in the season when fruit are still of good commercial quality but lack color.

By investing in a coloring program containing ProTone® losses due to poor color development can be decreased. ProTone® increases color development allowing more fruit to be harvested at each pick. This often results in earlier and fewer picks, lowering the overall seasonal operating costs.

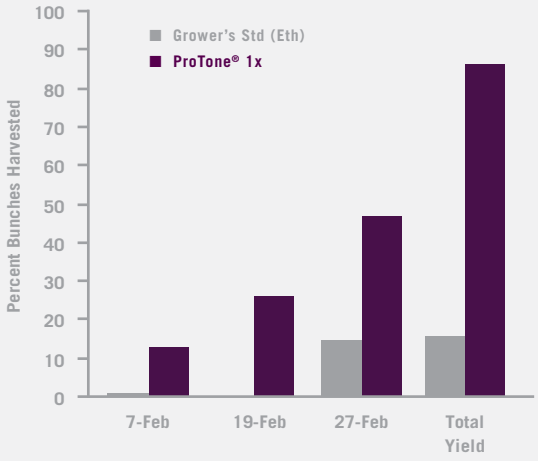
UNITED STATES STANDARDS FOR GRADES OF TABLE GRAPES – COLOR

Color Terms	Red Varieties
Well colored (U.S. Extra Fancy)	Each bunch shall have not less than 75 percent, by count, of berries showing good characteristic color.
Reasonably well colored (U.S. Fancy)	Each bunch shall have not less than 66 2/3 percent, by count, of berries showing good characteristic color.
Fairly well colored (U.S. No. 1)	Each bunch shall have not less than 60 percent, by count, of berries showing good characteristic color.

More Harvestable Bunches
'Crimson Seedless', Aconcagua Valley, Chile

In the Aconcagua Valley of Chile, coloring of Crimson Seedless table grapes can be challenging. Use of ProTone™ can significantly increase the number of harvestable bunches, as is shown in this example.

Even after sugar development has begun ProTone® can be applied to good quality grapes and produce marketable color. ProTone® is also exempt from the requirement to have a tolerance, making it ideal for grapes destined for export markets.



PROTONE® TREATED CRIMSON SEEDLESS COMPARED TO A TRADITIONAL COLORING PROGRAM, ACONCAGUA VALLEY, CHILE.

ProTone® (1x)

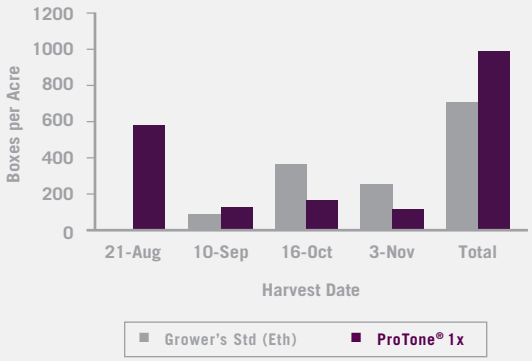
Grower Standard

VALENT BIOSCIENCES CORPORATION

Early Color = Increased Flexibility
'Crimson Seedless', Kingsburg, California

Early color development gives flexibility in harvest scheduling. By being ready to meet market demands earlier in the season more opportunities for selling at a premium price exist. In addition, by reducing crop loads early in the season better coloring of the remaining crop can occur.

In Kingsburg, California use of ProTone® significantly increased the number of boxes that this grower was able to pick early in the season. In addition, he was able to harvest nearly 300 more boxes than he had with his standard coloring program, netting an additional $4,500 per acre.



ECONOMIC ANALYSIS OF PROTONE® USED IN KINGSBURG, CALIFORNIA.

		Grower Std		ProTone®	
Harvest Date	Price USD/ 19lb box	Boxes/Acre	Gross Income	Boxes/Acre	Gross Income
Aug. 21	$ 16.00	0	$ 0	574	$ 9,184
Sept. 10	$ 16.00	86	$ 1,376	128	$ 2,048
Oct. 10	$ 16.00	362	$ 5,792	164	$ 2,624
Nov. 3	$ 16.00	251	$ 4,016	118	$ 1,888
Total		**699**	**$ 11,184**	**984**	**$ 15,744**

EXAMPLE OF PROTONE® USED IN TULARE COUNTY, CALIFORNIA. PICTURES WERE TAKEN ON THE SAME DAY.

Untreated

Grower Standard (ethephon)

ProTone® (1x Full Rate)

ProTone® (1x Full Rate) + ethephon (1x 16 oz.)

Untreated

Grower Standard – ethephon (Veraison & Veraison + 7 days)

ProTone® 1/2x & 1/2x (Veraison & Veraison + 7 days)

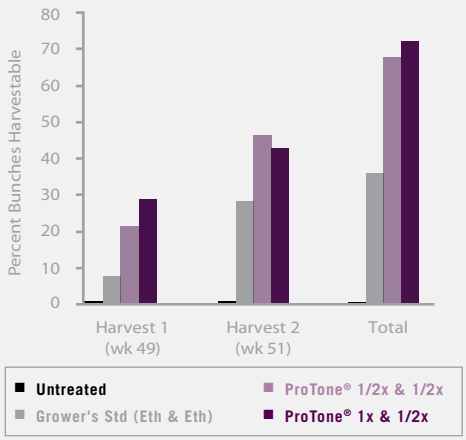
ProTone® 1x & 1/2x (Veraison & Veraison + 7 days)

Early Color = Increased Flexibility

'Flame Seedless', Augrabies area, Northern Cape, South Africa

Early color development gives flexibility in harvest scheduling plus allows capitalizing on premium prices that normally exist earlier in the market. In addition, by reducing crop loads early in the season better coloring of the remaining crop can occur. In certain years, growers can have as much as 15% to 25% of the crop not harvested due to poor coloring.

The use of ProTone® in the Augrabies area, Northern Cape, significantly increased the percentage of harvestable bunches that this grower was able to pick early in the season. The various ProTone® combinations resulted in approximately 70% harvestable bunches (accumulated) at Harvest 2, compared to the grower's ethephon reference of 36% harvestable bunches. This will result in premium prices on the early market and significant increase in income per hectare.



Factors that Influence Color Development in Table Grapes

Given the commercial significance of color development much research has been conducted looking at the environmental and cultural factors that may influence color development in red table grapes. By understanding these factors and how they may be relevant within a production program cultural practices can be modified to better meet the financial and management objectives of a vineyard.

Regional Climate and Weather Conditions

Of all the factors that influence color development in red table grapes the ones that have the greatest impact and are least controllable are the regional climate and weather conditions. Regional climatic conditions can have a dramatic effect on the degree and rate of natural grape coloration. Conditions for producing a high quality berry with good flavor intensity often are not conducive to producing a berry with good color. Based on the growing characteristics and color development of various red grape varieties within different climacteric zones, three distinct grape growing regions have been defined: Desert, Early Temperate, and Late Temperate.

Desert Region

This region has a long bloom period, depending on environmental conditions (10 to 18 days). There is a relative short time between veraison and the first pick. The temperatures at maturity / harvest are very high, between 95° to 113° F (35° to 45° C) (day) and 73° to 82° F (23° to 28° C) (night). Color development is typically very poor in this region and requires intense cultural practices to obtain good coloring.

Table grape production in the Atacama Desert region of Chile

Early Temperate Region

This region has a more concentrated bloom period, depending on environmental conditions (five to seven days). Therefore, the development of crop maturity is more uniform. There is also a longer time between veraison and the first pick. The temperatures at maturity / harvest are moderate, between 89° to 91° F (28° to 33° C) (day) and 59° to 73° F (15° to 23° C) (night). Color development is typically good and only moderate cultural practices are required to obtain good color.

Establishing an overhead trellis system for table grape production in Petrolina, Brazil

Late Temperate Region

This region has the most concentrated bloom period, depending on environmental conditions (five to seven days). Therefore, the development of crop maturity is more uniform. There is also a much longer time between veraison and the first pick. The temperatures at maturity / harvest are moderate, between 79° to 91° F (26° to 33° C) (day) and 59° to 73° F (15° to 23° C) (night). Color development is typically very good and for a large part of this segment and only light cultural practices are required to obtain good color.

The most common weather related issue that limits color development is elevated day and night temperatures after veraison. Research has shown that high temperatures appear to have their greatest negative effect on berry color development during the first three weeks after color break (Yamane et al., 2006). When night-time temperatures remain greater than 86° F (30° C) during this period less coloring will result in berries than when night-time temperatures are 60° to 70° F (15° to 20° C) (Fukushima et al., 1990; Mori et al., 2005a and 2005b).

Site and Preparation

The interactions of cultivar, rootstock, trellis system, and soil composition have a profound effect on color development in red table grapes. Once a block is established, these factors will ultimately determine whether it is a “good” coloring block or a “poor” coloring block relative to the rest of the vineyard. Cultivar and rootstock selection requires consideration of many factors, well beyond the scope of this bulletin. It should be noted however that selection of vigorous cultivars and/or rootstocks promoting vigorous growth will tend to make for more difficult to color fruit.

Trellis systems are designed to maximize the light interception by leaves but also to allow easy fruit thinning and harvest. A dense canopy indicates maximum light interception but also results in less light to the fruit which can result in poor coloring.

Deep, fertile soils encourage excessive vegetative growth, especially if soil moisture is ample in early season. Left unchecked this lush growth can result in reduced color development.

Changing these factors once a vineyard is operational is difficult, costly and will often result in lost production time. When designing the layout and operational objectives of a new vineyard these interactions should be carefully considered before construction begins.

Management Practices

Once a table grape vineyard is established the cultural and management practices utilized during production will also influence the timing and amount of color development. Cultural practices that influence color development include canopy management, crop load, nutrition, irrigation and plant growth regulators. In addition, weather conditions during the growing season can minimize or enhance the influence that a coloring program will have in a particular block requiring further modifications. Given such unpredictability it is best to have a number of cultural practices available for modifying color development to increase the likelihood of success.

In general, enhancing color development is more difficult and costly than delaying color development and normally involves a more active management program. For example, managing canopy density through cane pruning and foliage removal is a laborious but effective way to manipulate color development and harvest management (Archer & Strauss, 1989). The more aggressive a canopy is pruned and foliage removed, the greater the amount of light is able to penetrate into the fruiting zone resulting in better color development. Conversely, a dense canopy or use of

Techniques to manipulate color development in table grapes include vine pruning to increase light penetration and enhance color (top) and rain covers to create shade and delay color (bottom).

shade cloth will decrease the rate at which color develops (del valle Leguizamon et al., 2008; Perez et al., 1998) and therefore delay harvest.

Another effective way to manipulate color development is through crop load management. If all clusters are left on a vine they will usually develop into small, poorly colored fruit. By removing some of the clusters on each vine the remaining fruit will develop commercially acceptable size and color. By leaving more clusters on a vine than is optimal color development can be delayed.

Additional methods commonly used to modify color development are girdling and management of nitrogen and irrigation levels. Girdling involves cutting the phloem and cambium layer around the trunk or cane to limit translocation of endogenous plant growth regulators and nutrients within the plant. Girdling at fruit set can result in increased berry size and reduce color development. However, in some table grape cultivars girdling at the beginning of fruit ripening can enhance color and sugar development on mature vines (Peacock, 1998). It is important not to cut too deeply and injure the xylem when girdling. It is also important that crop loads be optimized for girdling to be effective.

From the beginning of veraison through harvest, table grape management practices should aim to minimize stress without stimulating vegetative growth. Excessive irrigation or nitrogen use at this time will increase vegetative growth resulting in reduced light penetration into the fruiting canopy and poor color development (Wample and Smithyman, 2002). Use of deficit irrigation practices during this period will increase color development. This increase in color is due in part to reduced vegetative growth, which allows more light into the fruiting zone, as well as increased plant stress, which stimulates the production of endogenous abscisic acid. Abscisic acid is the plant growth regulator that red grapes naturally produce to stimulate color development.

In some table grape cultivars girdling at the beginning of fruit ripening can enhance color and sugar development on mature vines.

Applications of gibberellin or cytokinin plant growth regulators are often used to increase berry size, but these treatments may also reduce or delay color development. Whether both size and color are impacted depends on both the rate and timing of use of these products. When these products

PGR products such as ProGibb®, Activol®, Berelex® and Caplit® are very effective at increasing fruit size, especially in cultivars such as 'Red Globe'. High rates and late application of these products can delay color development if not used in conjunction with a good coloring program.

are applied at high rates, late timings or a combination of both, color development can be delayed. Careful consideration needs to be taken to balance the need for increased berry size with the risk of delayed color.

Application of products containing ethephon ((2-chloroethyl) phosphonic acid)) may increase grape berry color development. Breakdown of ethephon releases the gaseous plant growth regulator ethylene which is associated with fruit ripening. The positive aspects of the use of ethephon for color development must be considered along with potential negative effects. Berry softening of some varieties is associated with the use of high rates of ethephon for color development which may have implications for storage of the fruit. Further, ethephon has a pre-harvest interval (PHI) of 14 days in most countries. Therefore, use of ethephon is typically reserved for early applications in the ripening process to minimize these negative effects. Use of ethephon has been affected by a reduction in the maximum tolerance limit (MRL) established by some countries importing table grapes. For example, in the European Union (EU) the maximum residue limit has recently been reduced. This change impacts all fruit exported to the EU and may result in adjustments to current use rates and timings being utilized in these export countries. See the "Use with Ethephon" section for information regarding the use of ProTone® with ethephon.

Application Considerations for Using ProTone®

The general use guidelines presented here are the result of several years of extensive research, development and semi-commercial programs conducted by Valent BioSciences Corporation. Studies with ProTone® for grape coloring were conducted in conjunction with regional university and industry experts in the US, Chile, Australia, South Africa and other table grape producing countries. These guidelines represent "best practices" for using ProTone® on 'Flame Seedless', 'Crimson Seedless' and 'Red Globe' cultivars. Use of rates, application timings, or spray volumes outside of these recommendations or on other cultivars may result in inconsistent and/or less than desired product performance. This guide should be used only to supplement information found on regional product labels and not as a replacement for these labels. **Always read and follow all regional label directions and precautions before using ProTone®.**

Block Preparation

The use of ProTone® is part of a good coloring program. Blocks to be treated with ProTone® should be of high quality and managed to maximize color development at the time of application. For optimal product efficacy ProTone® needs to be applied directly to the fruiting cluster; complete coverage of berries is essential. Removal of foliage from both the front and the back of the cluster prior to application improves spray coverage and increases light penetration.

Application Timing

ProTone® improves berry color over a broad application window. In most regions, applications can be made from the beginning of veraison to late in the season, even after marketable sugar has developed. Veraison is defined as the initial stage of grape ripening and is marked by changes in color and/or softening of the berry. Specific indications of veraison vary from region to region.

While specific timing recommendations for ProTone® vary based on cultivar, regional climate, orchard history and harvest management objectives, typically the first application is made near veraison. For example, short season varieties such as 'Flame Seedless' often benefit from applications made just prior to or at veraison while long season varieties such as 'Crimson Seedless' benefit from applications starting one to two weeks after veraison.

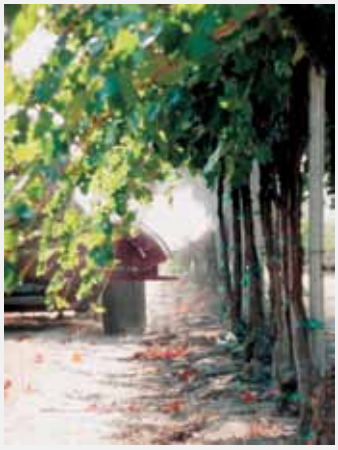
Always apply when conditions favor slow drying for maximum absorption. Low wind speed, moderate relative humidity and moderate air and fruit temperature all favor slow drying. Apply in early morning or at night if daytime temperatures are over 85° F (30° C) or other daytime conditions are not conducive to slow drying.

Depending on market conditions, cultivar, as well as expected weather patterns, multiple applications can be made at one to three week intervals. Multiple applications allow for a progressive increase in berry color and enable the spray program to be adjusted in response to environmental factors that either favor or delay color development. Strong market demand or the threat of late season rains may provide reason to employ a more aggressive coloring program to accelerate coloring.

General Guidelines for Using ProTone®

- Prepare blocks for application
- Determine application timing
- Prepare and calibrate spray equipment
- Apply ProTone® at proper rate, timing and conditions to optimize performance
- Monitor performance and reassess if additional applications are necessary

In most table grape growing regions residue limits and a PHI (pre-harvest interval) do not apply to ProTone®. Applications made after an initial harvest can enhance the color development of later harvests, even after marketable sugars have developed. When assessing the crop for repeat applications consider the proportion of marketable clusters showing green color. If a significant proportion of the remaining fruit are lacking marketable color, additional applications should be considered. Fruit may require up to three additional weeks for harvestable color to develop. Therefore, fruit must have acceptable berry firmness at the time of application with the potential to remain firm until harvest.



Conventional spray application

Electrostatic spray applications

Good Efficacy Requires Good Coverage

Application studies conducted with luminescent dyes and ProTone® have directly correlated ProTone® efficacy with good spray coverage of fruit. Always use calibrated sprayers and adequate spray volumes when using ProTone®.

Sprayer Set-up and Calibration

Sprayer set-up and calibration is essential for getting the best performance from ProTone®. Valent BioSciences Corporation has worked for several years on sprayer configurations and calibration to optimize ProTone® applications. These studies have evaluated several types of sprayers in various vineyard training systems in the US, Chile, South Africa, and Australia. In addition, an extensive two-year program was undertaken in conjunction with specialists in agricultural spraying from the University of Queensland (Australia) Centre for Pesticide Application and Safety to determine the optimal spray methods for ProTone®.

These research studies show optimum ProTone® efficacy is achieved with the following high volume spray equipment guidelines:

- High water volumes are better than low water volumes.
- Low tractor speeds are better than high tractor speeds.
- High air volumes are better than low air volumes.
- Using low-flow nozzles and increasing the number of nozzles improves coverage.
- Adjust nozzle positions and airflow direction to target the clusters on the near side of the cordon and through the canopy to the backside of the clusters on the opposite side of the cordon.

Low volume, electrostatic sprayers have also been shown to be effective for ProTone® application. Environmental conditions at the time of application are especially important for good response to ProTone® applications with a low-volume sprayer. Only apply when conditions are favorable for slow drying.

ProTone® Rates

Color response to ProTone® application increases with increased dose rate. In most cultivars only one spray application per season is sufficient. In general, 150 grams active ingredient per acre (approximately 400 grams active ingredient per hectare) is the standard recommendation. If additional color is required, multiple applications can be made at one to three week intervals at a rate of 75 to 150 grams active ingredient per acre (200 to 400 grams active ingredient per hectare).

Application Water Volume

After application rate, thorough and complete coverage of the clusters with spray solution is the single most important factor in establishing good performance with ProTone®. Using high volume spray equipment, spray volumes of 80 to 150 gallons per acre (750 to 1400 liters per hectare) have been shown to be effective, although with some trellis systems higher application volumes are needed. When using low-volume electrostatic sprayers coverage is equally important.

Always be sure units are functioning properly and checked often during application. Uniform coverage throughout the front and back of clusters is essential as ProTone® does not effectively translocate from the leaves or even within the cluster. Coverage on the backside of clusters can be especially difficult in blocks with trellis training systems that have not been opened up with shoot and leaf thinning. With electrostatic equipment application volumes of 10 to 18 gallons per acre (90 to 170 liters per hectare) have been shown to be effective. Check with your local Valent BioSciences representative for recommendations for your area.

These photographs show the same cluster with advanced color development on the front (left) and very little color on the back (right). To avoid uneven coloring, remove foliage from the fruiting zone and ensure that sprayers are set-up to equally cover both the front and the back of clusters.

Spray Tank Solutions

Always use clean filtered water with a final pH between 4.0 to 9.0 when preparing spray solutions containing ProTone®. Use of a non-ionic surfactant has shown to increase spray coverage and aid in the uptake of ProTone®. Tank mixing ProTone® with agrochemical products other than those listed on the product use label have not been thoroughly investigated and are not recommended. Always make a new use solution of ProTone® each day.

Excessive surfactant or spray volume can cause ProTone™ to form rings on berries. Ensure that sprayers are calibrated to deliver the appropriate spray volume for the foliage and clusters on the vines without excessive runoff.

Use with Ethephon

ProTone® is very effective as the sole coloring agent in a coloring program but can also be used in programs that include ethephon. The modes of action of ProTone® and ethephon are very different. Ethephon is an ethylene-releasing compound that can be translocated in the plant. ProTone®, by contrast, contains S-ABA and is a contact material. ProTone® applications should be made as if the product were being "painted" onto the fruit. Due to their unique modes of action, these two products can be used in a combined program with positive results.

'Crimson Seedless' grapes treated with ProTone® (left) develop color at the point of contact with the spray solution. In contrast, color development in berries treated with ethephon (right) originates close to the stem end and progresses down to the tip, indicating translocation of the effect into the berry.

Frequently Asked Questions

What can growers expect from ProTone® Plant Growth Regulator?

ProTone® colors red table grapes earlier and more evenly for a greater packout and more flexible yield without compromising pre-and post-harvest quality. In most cases ProTone® will begin to color grapes within one to two weeks after application.

How is ProTone® different from other coloring agents?

ProTone® contains S-abscisic acid (S-ABA), a plant growth regulator found in grapes that stimulates red color production. This unique, naturally-occurring active ingredient allows ProTone® to have a broad application window and minimal tolerance requirements

What is the mode of action of ProTone®?

In red grape varieties S-ABA is responsible for the development of pigments within the fruit skin that give them their distinctive color. S-ABA enhances color development in mature berries by stimulating the production of an enzyme known as UDP-glucose-flavonoid 3-O-glucosyltransferase. This enzyme speeds up the conversion of anthocyanidins into red pigments known as anthocyanins that give red grapes their color.

When should ProTone® be applied?

ProTone® improves berry color over a broad application window. In most regions, applications can be made from the beginning of veraison to late in the season, even after marketable sugar has developed. For late season applications, fruit may require up to three weeks for harvestable color to develop. Therefore, fruit must have acceptable berry firmness at the time of application with the potential to remain firm until harvest.

What is the recommended dose rate of ProTone®?

In general, 150 grams active ingredient per acre (approximately 400 grams active ingredient per hectare) is the standard recommendation. If additional color is required, multiple applications can be made at one to three week intervals at a rate of 75 to 150 grams active ingredient per acre (200 to 400 grams active ingredient per hectare).

Can ProTone® be used in a coloring program with other coloring agents?

Yes, ProTone® can be used alone or with other coloring agents in a program approach.

What varieties of table grapes benefit most from ProTone® application?

Field studies conducted with growers globally showed an excellent return on investment in ‘Crimson Seedless’, ‘Flame Seedless’ and ‘Red Globe’ table grapes. Other colored varieties are currently being investigated.

How long has ProTone® been tested in the field?

ProTone® has been extensively field tested in major table grape producing countries since 2003.

What application factors are important for ProTone® performance?

Ensure even and thorough coverage of all bunches to achieve maximum color development. For best results, proper pruning, leaf removal, sprayer configuration and spray volume should be implemented.

What spray volumes are needed to apply ProTone®?

Apply ProTone® in a sufficient amount of water to ensure thorough coverage of all bunches without excessive run-off. Use calibrated spray equipment to ensure uniform coverage to both sides of all bunches. Avoid droplets forming at the bottom of berries. Do not use a coarse droplet size. Apply as a bunch directed spray. Adjust spray volumes based on canopy structure and spray equipment. With conventional sprayers volumes of 80 to 150 gallons per acre (750 to 1,400 l/ha) have been shown to be effective. In the case of electrostatic sprayers volumes of 10 to 18 gallons per acre (90 to 170 l/ha) have been shown to be effective.

Can ProTone® be tank mixed with other agrochemicals?

When considering tank mixing with other agrochemicals always consult and follow label recommendations. If warranted conduct a compatibility jar test prior to mixing a whole tank. Before using a mix that passes the jar test for compatibility it is recommended to test the mixture on a small area as it may result either in phytotoxicity or ineffectiveness. Avoid using ProTone® with any products containing metal ions such as copper or zinc.

Should a wetting agent be used with ProTone®?

Apply ProTone® with a non-ionic surfactant to increase spreading and uptake. To minimize foaming, add surfactant last.

Does pH affect spray solutions containing ProTone®?

Extreme pH in the spray tank may affect the performance of ProTone®. For best results, keep the pH of the spray solution between four and nine.

What time of day should ProTone® be applied?

For best results with ProTone®, apply when conditions favor slow drying for maximum absorption. Apply early in the morning or at night if daytime temperature is over 85° F (30° C) or otherwise not conducive to slow drying.

Can ProTone® be used in an organic program?

ProTone® is OMRI Listed in the United States.

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