

Welcome to the start of another season and our 7th edition of *In Viticulture*. During the past few months we have experienced further consolidation within the crop protection arena in which Bayer CropScience participates. In addition some opportunistic new players have entered sectors of the market.

It is important to reflect on this for a moment, as the significant growth of the industry has been assisted greatly by the research and development capabilities of companies like Bayer CropScience to ensure a continuous pipeline of new products – products that provide solutions to management issues in the vineyard - and ultimately in the winery.

Think for a moment about the solutions provided over the years by Bayer CropScience; brands such as Rovral®, Basta®, Bayfidan®, Scala® and the newer products including Flint®, Teldor® and Prosper®. It is important to understand who is investing the time, money and resources into the research and development which will provide solutions to new management challenges such as mealy bug. It is important to know who has the knowledge to assist with information about residues and compatibilities and to provide the resources to extend additional label claims.

Companies such as Bayer CropScience not only develop new products but also invest heavily in backing our products in the field with extensive support coverage across all growing areas through a network of experienced and dedicated research and development specialists and area managers. This network of knowledge and experience is important in consulting with, advising and receiving feedback from agronomists, consultants, industry researchers, liaison officers and growers

> **Viticulture by** Bayer CropScience

 people who you work closely with to help produce your desired crop outcomes.

Bayer CropScience is committed to local production with three formulating plants in Australia, ensuring product availability to quality expectations when and where required. Our environment is unpredictable and flexibility of supply is important, as is the capability to trace all input components to their source.

In this volume we take a look at local product development, talk to a range of growers about their powdery mildew and weed control programs, and comment on a meeting facilitated by Hugh Armstrong our Viticulture Specialist, with key industry personnel to consider Eurepgap and local implications. In addition we consider compatibility, review the BCS community program from 2003/04 and touch on some thoughts about botrytis programs for 2004/05.

Recent independent research found that 91% of our readers found the information contained in *In Viticulture* valuable to their business, so please continue to provide your feedback to brendan.white@bayercropscience.com

I hope that you continue to find this publication valuable to your business!

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Srenden White



WHAT ARE OUR EUROPEAN WINE BUYERS ASKING FOR?

Australian wine is exported to numerous countries however Europe is still our largest market, annually purchasing approximately 55% of the exported volume from Australia.

In Europe, wine sales are dominated by the large supermarket chains, who include wine displays alongside other everyday groceries. The major retailers including Tesco, Sainsbury, Carrefour and Coop, have multiple stores across many countries and are expanding through Europe, Asia, America and even in Australia (eg Aldi).

Importantly, approximately 80% of wine sales in the UK are through supermarkets. Increasingly these food retailers are requiring assurances from growers and processors that the food is safe, clean and produced without harm to the environment.

Bayer CropScience has dedicated teams of people actively working with these retailers to understand their needs and to help producers comply with the protocols which are being implemented.

In March, to assist with enhancing local industry awareness, **Hugh Armstrong** (**Bayer CropScience Viticulture Specialist**) convened two key industry seminars where Dr Alfons Sagenmuller, from the Bayer CropScience Issues and Strategy Management Team in Germany, provided first hand insights on the developments in Europe and Asia.

One of the most prominent protocols is EUREPGAP[®] which is a list of requirements that growers must meet (Refer table). To date these protocols are focussing on fresh fruit including table grapes, vegetables, ornamentals and grain. Wine is not yet included.

The Australian wine industry has proudly promoted "Wine Brand Australia" based on a number of features of our climate, wine quality and production techniques. The industry, through the Winemakers Federation, has now recognised that to keep this good reputation within the global market it must proactively demonstrate what is in place to give consumers confidence in buying more of our wine. To this end we will see the development of a National Environmental Management Framework and over the coming seasons, growers can expect to be learning more about how to implement on-farm processes. Bayer CropScience, through its existing global networks is committed to supporting these initiatives.

L to R: Gioia Small, Peter Hayes, Russell Johnstone. Dr Alfons Sagenmuller.



EUREPGAP GROWER REQUIREMENTS

- 1. Traceability.
- 2. Record keeping.
- 3. Varieties and rootstocks.
- 4. Site history and site management.
- 5. Soil and substrate management.
- 6. Fertiliser usage/crop protection.
- 7. Harvesting.
- 8. Post-harvest treatments.
- 9. Waste and pollution management, recycling and reuse.
- **10.** Worker health, safety and welfare.
- **11.** Environmental issues.



For free subscription to this newsletter call the Bayer CropScience technical information line on 1800 804 479

Community money back guarantee update.

2003 / 2004 saw the continuation of the money-back guarantee for the 3rd consecutive season - a guarantee of money being put back into the local community in partnership with specific Bayer CropScience viticulture resellers. This season saw just on \$28K going to local organisations bringing the 3 year total to over \$90K.

Bayer CropScience would like to thank those resellers and growers who supported this program during the season and trust that your local community has benefited in a tangible manner.

Cheque presentations to recipients continue to be conducted in conjunction with Bayer CropScience distribution partners throughout the winter months with the final cheques to be presented at pre-season meetings in July and August.

Selected community organisations received 10 cents per litre or kilogram of selected Bayer CropScience viticulture brands sold during the 2003/04 season.





Some of this year's recipients

- Birdwood CFS SA for radio equipment \$401
- Canteen South Australia -Kids with cancer - \$2677
- Southern Districts War memorial hospital, McLaren Vale new hospital beds \$1725
- Padthaway CFS rescue gear (lighting) \$759
- Margaret River Sea Search Rescue Group 4WD equipment \$644
- Wandin CFA safety protection equipment \$1031
- National Heart Foundation, Griffith research project \$1176
- Search and Rescue, Shepparton contribution to new vehicle \$1500
- Mooroopna Matters, Gemmill swamp development fund \$819
- Royal Flying Doctor Service, Tasmania transfer stretcher \$547
- Royal Flying Doctor Service, Vic \$3197

The cost of spraying.

As we start to plan for another season, we thought it would be a worthwhile exercise to revisit the true cost of spraying.

The table below estimates the cost of spraying in vineyards and is based upon the use of a 50 kilowatt tractor without allowances for finance or depreciation. Chemical costs have also been excluded as have time allowances for preparation, refills, mixing and wash down. The information has been summarised from government publications and averaged against our own estimates. These figures are a guide only and are calculated for a single row operation.

The calculations show a cost of about \$30/ha before chemicals for the "owner operator" using existing labour resources.

This compares to \$45/ha for a contractor based on a rate of \$90/hr covering 2 ha/hr for a single row machine, or a twin row machine at \$150/hr covering 3.3 ha/hr.

These costs may be considerably higher than many growers realise, so it is vitally important to ensure that spray product choice is made correctly and that careful adherence to correct rates and timings is maintained to ensure optimum performance of chemicals used therefore maximising costeffectiveness of the spraying operation.

So when planning your spray program for 2004/05, remember that once you are satisfied with efficacy, consideration should also be given to the required re-treatment intervals. After all, a cheaper product that needs to be applied every 7 days may turn out to be more expensive in the long run than a more expensive product (based on the price per drum or per hectare).

	Cost per hour	Cost per hectare
Fuel: (\$0.90/L)	12.00	7.20
Tractor: Oil, tyres, filters, repairs & maintenance.	4.00	2.40
Sprayer: R&M and depreciation	12.00	7.20
Labour (operator)	22.00	13.20
Total	\$50.00	\$30.00





Craig Hudson, Waikerie, on powdery mildew.

We found Craig Hudson, vineyard manager of Caudo Vineyard near Waikerie poring over detailed contour maps while surrounded by computers downloading data. Craig was planning the next expansion to complement the growth of the vineyard from about 12 hectares in 1994 to the present 106 hectares. He is among a group of leading edge managers who are contributing to the growing reputation of quality Riverland wines.

"Technology has always been a large part of this vineyard," said Craig. "We've got soil moisture monitoring devices through to the latest grapevine harvesters, multi-row sprayers and multi-function machines."

He stressed that their goal was to achieve optimum yield and still produce good quality. Caudo vineyards grow major varieties such as chardonnay, shiraz, cabernet sauvignon, and merlot with smaller areas of petit verdot, verdelho, san giovese, semillon and tempranillo.

Craig is proud to have been a member of the Southcorp Bin Club for 2 years and also produces quality fruit for Taylors, Hardy, Peter Lehmann and Cellarmasters.

According to Craig, the disease with the greatest impact for Riverland growers is undoubtedly powdery mildew. "Losses could be horrendous if we don't catch it immediately." Even small traces can result in downgrading or rejection so Craig approaches his powdery control "very seriously, indeed."

"Before we found out about Prosper fungicide and Flint fungicide we used a program of sulphur and Topas for powdery mildew and mancozeb for downy mildew protection. "Now we use early season sulfur and then spray Prosper back to back and aim to follow with consecutive applications of Flint over flowering," Craig explained.

"In the past, it didn't matter how good our program was, the infestation would always start in the verdelho and radiate out into the chardonnay. I really wanted to make sure that it was cleaned up and controlled."

"We've had really good results on our verdelho with the Prosper and Flint spray program. Every year, we have had powdery mildew to some degree except for the last two years when we used Prosper followed up by Flint. We've had zero powdery mildew at all" continued Craig. "That's not just my opinion. We are checked by the Fruit Doctors every fortnight and they cannot find any powdery on the whole property," Craig added. That was despite the

Powdery mildew snapshot

The Spread of powdery mildew

- Rapid spread around flowering
- Spreads mainly between vines by wind
- Temperature driven
 - Optimum 25°C
 - Spores killed 12 hours
 @ 35°C
- Secondary spread does not require rain
- New spores produced in 5 days
- Spray coverage critical for control.

Agrilink weather station indicating a high disease pressure index!

Because Craig had an effective early season program, the only late season spray he used was a post-harvest sulfur.

Craig believes it is important to use the new tools to enable him to rotate away from the older chemistry to avoid the build-up of fungicide resistance. In fact he hasn't used DMIs for the past two seasons.

"The first year I used Prosper and Flint was the first year I had no powdery whatsoever in that block and the fruit we delivered to the winery was 100% clean."

Prosper was described to Craig as a "very effective systemic fungicide for powdery mildew."

"That immediately caught my attention," said Craig. "If weather conditions are such that your spraying isn't 100% or it rains soon after application, it will certainly give much better protection than just a contact spray like sulphur."

"It's very simple, really. In those years just prior to using Prosper and Flint, I'd always had powdery problems and since I've used these products I've had no problems whatsoever. The spores were definitely out there but it was a clean block for the rest of the season, so it's a program that definitely works."





Bill Hendry

Powdery not a problem with Prosper at Margaret River.

While powdery mildew has caused headaches at Wulura Farm in the past, a well-planned spray program has resulted in a clean vineyard for the past couple of seasons. Wulura Farm assistant vineyard manager Bill Hendry says the key to the success of their program is early application of Prosper, a fungicide launched by Bayer CropScience two seasons ago.

The vineyard is 11 km south of Dunsborough in the Margaret River region of WA. The 85 ha vineyard includes plantings of chardonnay, cabernet sauvignon, shiraz and merlot.

Bill said one of the major disease pressures they face each year was powdery mildew, but a preventative spray program, featuring the fungicides Prosper and Flint, kept the threat at bay. "In our productive area of 70 hectares we've had no outbreaks of powdery mildew this season at all."

Early sprays start with sulphur followed by consecutive applications of Prosper at 8 leaves separated and again during early flowering with an application of Flint at fruit set.

"One of the things I like best about Prosper is that it is systemic and is taken up very quickly. This means we don't have to do 'rescue sprays' after a rain event like we have to with sulphur. Sometimes we would have to be back spraying in three days. With the systemic we can keep it out to two weeks."

Bill said the effectiveness of their spray program was due to getting in early and minimising risks before the disease had a chance to establish itself. "For the past couple of seasons we've had no powdery of any consequence and I believe that this is due to our spray program; Prosper and Flint are very effective!"

'Christmas disease' under control.

It may be comforting to know that Hugh Hamilton, one of McLaren Vale's highly regarded winemakers, must battle to control vine diseases such as powdery mildew each season, just like any other wine producer.

Hugh Hamilton Wines is a family business focused on both local sales and export, so quality control and clean fruit is critical. There are 20 hectares of vines over three vineyards, all slightly south of the township of McLaren Vale. Varieties are chardonnay, verdelho, viognier, shiraz, cabernet sauvignon, merlot, sangiovese, tempranillo, petit verdot and saperavi.

Season 2003 - 2004 was quite typical for McLaren Vale, with good winter rainfall and no frost events due to the region's proximity to the sea. The major disease pressure each year is powdery mildew, not so fondly referred to as the 'Christmas disease' by Hugh.

Hugh controls powdery with religious fortnightly spray applications from budburst onwards. He starts with wettable sulphur sprays at budburst and then applies Prosper fungicide at about eight leaves separated. He reverts back to sulphur during early flowering and at 80% capfall applies Flint fungicide. He has used these products for the past couple of seasons.

South-eastern South Australia horticulture area manager for Bayer CropScience Craig Jackson says Prosper is a popular choice for powdery control in the McLaren Vale region as, unlike sulphur, it is systemic and stays active in the vine through the early part of the season, protecting new growth. He says Flint is also popular for powdery control as it provides long lasting disease control and has low impact on a range of beneficial insects. "And Flint offers the double benefit of also acting as a downy mildew protectant."

Fungicides are applied at a water volume of 250-300 L/ha early in the season, 500-550 L/ha at flowering and 550 L/ha later in the season. Early season chemical applications are made at dilute volumes, whereas fungicides used after flowering are applied at a concentration factor of '3X'.

"I have found that a program of sulphur on its own is insufficient, so I have added in to my program fungicides like Prosper and Flint which, when applied correctly and at the right times, are more effective at controlling powdery mildew and complement sulphur use." The most susceptible varieties at Hugh Hamilton Wines are the verdelho and chardonnay, which are thin-skinned grapes. Hugh said while in previous seasons he struggled to control powdery in these varieties, since using Prosper he had seen no evidence of powdery mildew infection at all. "I'm sure that's due to my dedicated spray program which incorporates the use of Prosper and Flint," he said.

Hugh said powdery mildew was a manageable disease if the right chemicals were used at the right times. "To me, application timing is critical. If I spray at the right times, I get optimum protection."

Craig agreed saying that sticking to a 14-day program was ideal for optimal powdery mildew control. "Powdery mildew is a manageable disease, but problems occur when growers start lengthening their application intervals or when they skimp on coverage to get around the blocks quicker without having to refill. The cost of the chemical is insignificant when compared to the cost of spraying, so if you're going to spray you may as well spray properly."

Hugh said he thought the use of Prosper was also economical when the fungicide was applied correctly and Craig estimated that in Hugh's vineyard, using Prosper twice during pre-flowering "would cost only \$1 per hectare more than using sulphur during the same period yet be more rainfast than sulphur and move throughout the leaf."

Hugh's view on disease control is clear and comes from experience. "Many years ago I was caught out with powdery mildew and suffered some damage, but never again. The game now is so competitive that unless you finish up with absolutely clean fruit at crushing time, you run the risk of not making the best wine. It's critical to have the best possible fruit in the crusher and therefore if a bit of disease gets in, you are falling behind in your quality control."



POWDERY MILDEW SPRAY PROGRAM

	Shoots 10 cm E-L 12	8 Leaves Separated E-L 15	Early Flowering E-L 19	80% Capfall E-L 25	Pre Bunch Closure E-L 32	Veraison E-L 35	Pre-Harvest E-L 38
S	SULPHUR SULPHUR						
	PROSPER						
FLINT (also a p			FLINT (a	so a protectant against downy mildew)			
					BAYFIDAN		

Don't let powdery impact your bottom line.

At Aquila Vines, near Euston, they have a theory about growing grapes. If they feed the crop, water it, and give it the right protection from disease, they should be able to achieve the same quality but with yields much higher than the district average.

Drew Gorman explained that his father Tony began growing vines to supplement their potato income. They now have 68 hectares of winegrapes including chardonnay, semillon, cabernet sauvignon and viognier as well as 60 hectares of dried fruit from sun muskat and shirana grapes. In the next few years Aquila will be putting in a significant shiraz development.

Most of the winegrapes go to Southcorp and Aquila's dried fruit goes to Angas Park in Mildura.

Like most growers, Drew doesn't like pests and diseases eating away at his bottom line. Every year he expects to have to deal with some light brown apple moth (LBAM) and plague thrip infestation but "powdery has got to be the one big one that can cause the most concern."

"If it's still there at harvest then you're likely to lose money. If you can knock it out early, you're laughing."

"In recent years we had a fair bit of powdery but we didn't have any last year. The conditions for powdery weren't really right. But even when they supposedly weren't right for it in other years, we had it really bad."

"The losses were big, nearly \$60,000 one year," Drew lamented. As a result, the Gormans upgraded their sprayer and their spray program. Drew told us that the money they lost could have paid for the new unit.

Aquila's chardonnay spray program begins early with sulphur and is followed with 2 sprays of Prosper fungicide another sulphur and then Flint fungicide with Scala (for botrytis) and insecticides (for LBAM) at about 80% capfall.

"After the Flint we use Legend, then copper and sulphur and follow up with a couple of DMIs including Bayfidan."

"We just don't want to take any chances," explained Drew.

Drew told us that his old spray program used a lot more sulphur and DMIs and he really appreciated the value of Prosper and Flint. The most important thing for him was the excellent control of powdery mildew but he saw other factors as bonuses, too.

"The thing I really like is that they are both easy to use" he said referring to the small amounts of Flint water dispersible granules or Prosper liquid needed for the spray tank.

"Another benefit is that you are not using the same product over and over and building up resistance. With Prosper, it's systemic and even if you don't get full coverage you've got that extra chance that it's going to get into the vine."

Last season, Drew had several weather and insect events conducive to downy mildew and botrytis so he used products to control those diseases in tank mixes with his powdery arsenal.

"With Flint, however, we can use it to get that extra cover for downy mildew; we're saving on an extra cover spray really."

Drew finds using Prosper and Flint gives him a bit more leeway with crop safety compared to sulphur if the temperature is high- especially once it gets over 30°C.

Coverage is critical for the Gormans. They start off the season with water rates around 500 L/ha, over flowering spray at 850 L/ha and move to 1000 L/ha at full canopy.

"We grow pretty high quality fruit and get the same high yields every year now. It's due to our preventive spray program and the foliar fertiliser we use. The proof is in the pudding."



Flint beats powdery on verdelho and chardonnay.

Forty kilometres north from where the dog sits on the tucker box at Gundagai is a small township called Jugiong. The area is best known for its fine wool production however nestled amongst the undulating sandy loam country is "Wirrilla" vineyard, a 190 ha property managed by George Jessett.

"Wirrilla" produces on average yields of 3 to 4 tons per acre growing shiraz, cabernet sauvignon, chardonnay, semillon, verdelho and sauvignon blanc grape varieties. Grapes are grown under contract for use in the production of quality table wines.



According to George, one of the biggest challenges at "Wirrilla" is managing outbreaks of the fungal disease, powdery mildew. Between early October and mid November, the Jugiong area is subject to periods of overcast, mild to warm days ideal conditions for outbreaks of powdery mildew. George said, "The best defence strategy against powdery mildew is a comprehensive early season preventative spray program."

"The verdelho and chardonnay varieties are more susceptible to powdery mildew and need more stringent supervision, particularly at certain times of the year when weather conditions develop which are just perfect for the disease to really take off. We monitor these conditions, and as early as possible, implement a protection based spray program which includes an application of sulphur, two DMIs and Flint fungicide at 8 weeks after budburst or 80% capfall."

Flint has the added benefit of downy mildew protection, which is great because downy mildew can be a problem if we get a couple of days of rain. "We need to have some protection on new growth and bunches at all times. Flint will give us this protection, and if intervals get stretched due to wet weather, we will use a curative product like Ridomil[®] or Phosphorous acid."

George said he tank mixes Flint with Scala fungicide to combat botrytis. "Fortunately botrytis is not as big a problem for us as powdery mildew. The climate in our area is such that whenever we do receive rainfall it is combined with a fairly stiff breeze, thereby lessening the risk of botrytis. When conditions have favoured botrytis in the past, Scala applied to bunches during flowering has given excellent protection from latent infection.

"It's a huge benefit that Flint and Scala can be tank mixed and applied at the same time. It reduces time and machinery costs and in the end it's these little things that add up and make a difference.

"We mix Flint at 15 g/100 L water and Scala at 200 mL/100 L water. The water delivery rate [water volume] varies depending on vine development. Earlier sprays are applied at 150 to 200 litres per hectare via standard quantum mist nozzles. As the canopy develops the water volume increases to 500 litres per

Why spray for botrytis at 80% capfall?

Last year we included part of the following article, however we believe it is timely to again revisit why the 80% capfall spray timing is critical for successful botrytis management.

Botrytis cinerea is an opportunistic fungus that takes advantage of environmental conditions to establish infection. Successful botrytis control is based on

- a complete understanding of the disease
- choosing the right fungicide at the right time
- ensuring a thorough coverage of the target area when spraying
- applying the Avcare fungicide resistance strategy.



hectare and eventually 1000 litres at bunch closure to ensure the vines are thoroughly wet to the point of run off.

"Scala and Flint are both good, safe chemicals that, when combined, offer excellent control of botrytis, powdery and downy mildew. We only started using them because they aligned so well with what we were trying to achieve, and could be mixed and used at the same time," George said.

Wirrilla vineyard will be replacing one of the DMI sprays pre-flowering with Prosper fungicide next season to help prevent powdery mildew resistance developing to the DMIs. We have never used Prosper before, but like its systemic properties and its different chemical group."

To further assist with disease management "Wirrilla" uses a variety of trellising systems. "We use different trellising systems for different varieties. Most of the vines are trained into Vertical Shoot Position (VSP) but varieties like shiraz are trained to Smart Dyson and Ballerina to ensure adequate air flow around the vines and help prevent any build up of disease." The flowering stage is critical for the development of botrytis in grapes. It is often difficult to observe infection at this point but botrytis can be present from early flowering, and although it can infect the developing berries early in the season, it often remains dormant (latent) within the berry until after veraison. When wet and humid conditions occur, the latent infection can become active, developing into devastating grey mould on the berries (bunch rot).

The fungus that causes grey mould (Botrytis cinerea) can enter the berry through the pollen tube during fertilisation. The scar which is created when the flower cap is released is also an entry site for botrytis. Dead flower parts, (stamens and filaments) and other 'trash' such as aborted berries, provide a nutrient source for botrytis and can remain trapped within the bunch as it fills, or attached to berries acting as a harbour for the disease. Later in the season with enough moisture the fungus can move from these sources to the grapes themselves and in severe cases initial infection from the flowering period can result in entire bunch loss before the vine reaches pre-bunch closure stage.

A secondary problem with early infection is the production of the laccase enzyme. Laccase and other chemicals are produced by the fungus in response to the natural defence mechanisms of the developing berries and can cause severe reductions in wine quality even without the progression to a grey mould outbreak.

It is clear that there is still much to be learnt about the behaviour of botrytis in grapes. However studies and research across Australia, Europe and North America are conclusive in demonstrating the importance of a specific botryticide application during flowering to reduce early infection and the harbouring of the disease in a dormant, non-visible phase. Early preventative measures will substantially reduce the risk of a preharvest outbreak and also greatly reduce the production of the laccase enzyme during berry development.

View the 80% capfall spray as your botrytis insurance and make applying specialist botryticide such as Teldor or Scala your policy.

Factors which predispose vines to botrytis attack.

- High humidity (>96%).
- Prolonged rain in conjunction with cool or mild temperatures (15-20 hours at 15-20°C).
- Wet, windy spring conditions followed by pre-harvest rain.
- Leaf, berry and stem damage including that from:
 - Pruning (particularly in wet weather).
 - Mechanical damage from various sources
 - Light Brown Apple Moth.
 - Rain-split berries.
 - Storm, hail or frost damage.
- Persistent moisture on berry surfaces.
- Thin skinned varieties.
- Tight bunches.
- Dense canopies.
- High nitrogen content of grapes which encourages bunch rot.

Product Development a ten year investment.

Developing a new crop protection product for the Australian viticulture market is a long process that usually begins at one of our European research facilities with the discovery of a new molecule. Each year hundreds of thousands of potential molecules are identified by various techniques, but only a handful of these ever make it through all the development hurdles to become a commercial product. The path from discovery to registration is explained in this article, with reference to the local development activities leading to the registration of Teldor[®] fungicide.

Discovery

Discovery involves the identification of molecular structures that may have activity on key target proteins in plants, insects or fungi. One of the processes involves generating computer models of molecules that will fit the binding sites of target proteins (Fig.1), which requires detailed knowledge of the structure of the target site. Once a "fit" has been virtually created, the molecule can be synthesised into a real compound and tested against actual targets through a process known as screening.

Screening

Once a candidate structure has been identified, it is tested to confirm its effect against various targets. In recent years screening has become automated and miniaturised, allowing the testing of minute chemical quantities (2 milligrams or less!) against specific target proteins. The High and Ultra High Throughput Screening methods allow between 30,000 and 150,000 compounds to be tested per day for activity on key proteins. Successful compounds are tested against a range of living targets (weeds, insects, fungi etc). For a new insecticide approximately 30,000 insecticide compounds undergo primary testing per year. Ten percent of those compounds progress to the secondary testing stage. Similar screening processes occur for herbicides and fungicides.

Mammalian and Environmental Safety

From early in the second year of development, toxicological and environmental evaluations begin and continue for the duration of the development period. At this point approximately 1% of the originally discovered molecules remain in development, with 99% rejected via the screening processes.

European Field Trials

Field trials commence after about two years of screening trials. Now only one in five thousand (0.02%) of the originally discovered molecules remain, due to rejection through screening or on toxicological or environmental grounds.

Several seasons of European field trials are completed before any trials begin in Australia. During this period about 80% of the remaining candidate compounds are rejected, leaving only 2 of every 50,000 original molecules still in development. One in every two remaining compounds will be rejected during the field development process.

Australian Development

If the preliminary European results are favourable and the compound is thought to have potential for the Australian market, our local development program begins.

Field trials are conducted over several seasons, in the major crop growing areas, in order to define and refine the optimum use pattern. The simplest development program occurs when only one crop and target is under consideration. Teldor development trials began in grapes in 1994 incorporating trials in SA, NSW, VIC and WA. Parallel development occurred in strawberries from 1995 to 2000. Almost 10% of grape trials were abandoned during the development stage due to lack of disease pressure or other site problems.

Crop safety is evaluated in the most important or sensitive varieties. Issues such as compatibility with other agricultural chemicals, different types of application equipment, effects on following crops and beneficial species are all examined. Trials are also required to measure residues in the crop and crop products for example in dried fruit, juice and wine.

Fourteen dedicated Bayer CropScience research and development specialists conduct the majority of the Australian trial work, although government and contract research trials may also be required. All trial results contribute to the development of the "directions for use", which are incorporated into a product label.

Obtaining a Registration

When the proposed use pattern has been sufficiently tested (which typically takes about four to five seasons), the trial data and other information about the product are submitted to the Australian regulatory body, the Australian Pesticides and Veterinary Medicines Authority (APVMA). Experts within the APVMA and the State governments carefully review all aspects of the application over a period of about 18 months, following which the product is registered and launched into the Australian market. If everything has gone smoothly, the process has taken about 10 years from the discovery of the molecule!



Susan Cross - Product Development Manager Horticulture, Bayer CropScience



Fig 1:

The Pathway to Product Development via Protein Structure Determination



To mix or not to mix - this is the question!

Many different types of agricultural chemicals are applied to most crops in a single season. The application costs can form a significant part of the production costs and it is tempting to minimise those costs by combining two or more products in the spray tank at various times. However, this can result in a variety of problems if the products that are being tank mixed are not compatible.

The types of incompatibility can be **physical, chemical** or **biological** and can result in difficulties in actually applying the product through the spray equipment, reduced effectiveness against the target pest(s) and/or damage to the crop being sprayed.

Bayer CropScience regularly conducts **physical compatibility** tests between products that are likely to be tank mixed in commercial situations. The products in question are mixed together in a volume of water that is representative of the ratios used in a field application and observed for the following:

Uniformity of mix: Observations of creaming or rapid settling indicate the formulations are incompatible.

Foaming: Excessive or persistent foaming is recorded but does not necessarily mean the products are incompatible.

pH: The pH of the spray solution is measured as pH can have a deleterious effect on the chemical stability of some active ingredients. This can be particularly important when tank mixing with liquid fertilizer type products.

Viscosity: The "thickness" of the spray solution compared with a solution containing any of the products alone. This is particularly important for products applied at low volumes and high concentrations such as products to be applied by air or controlled droplet applicators.

All the above tests are conducted with two different water sources, representing different water hardness (80 and 1000 ppm), and can also be done at a range of water temperatures if this is considered likely to affect compatibility.

After standing for 24 hours the mix is rechecked. Product will normally "settle out" after standing without agitation for this length of time - this is not a problem as long as the product can easily be redispersed when agitated.

If the mixtures pass all the above tests, they are generally considered to be physically compatible¹ and therefore growers should not experience any application problems as a result of the products used in the tank mixture. **Chemical compatibility** refers to the stability of the active ingredient in the solution. If left standing in a tank, the level of active ingredient in any solution declines over time as a result of normal degradation pathways. The rate of degradation varies with different active ingredients, but sometimes the combination of active ingredients in a tank mixture can cause this rate of degradation to increase.

The only way to measure this accurately is by conducting a chemical analysis of the level of active ingredients over time and comparing it to the rate of degradation of the active ingredient of the individual components of the tank mixture.

Chemical compatibility is only occasionally tested in the laboratory, as any problems will normally be identified in the biological testing of the tank mixture - as it will result in a reduction in control of one or more of the targets compared with the level of control achieved by the individual components of the mix.

Biological compatibility testing also encompasses evaluation of any crop damage that may arise from an application of the tank mixture that was not evident following application of any of the components of the tank mixture by themselves.

It should be noted that when a compatibility claim is made between two or more products, the claim is specific to the formulations tested and cannot be extrapolated to include other formulations of the same products without testing. Additionally, unpublicised formulation changes may also affect the compatibility claims between products. Consequently it is always safest to conduct a small jar test² prior to mixing commercial quantities of products, to observe any obvious physical incompatibility between the products. Remember to follow the label for mixing directions. As a guide, the sequence for adding products to the spray tank is as follows, unless otherwise specified on the product labels:

- 1. Wettable powders (pre-mixed to a slurry) [WP]
- 2. Suspension concentrates [SC]
- 3. Water dispersible granules [WG or WDG]
- 4. Water soluble powder or granules [SP or SG]
- 5. Emulsifiable concentrates or emulsions of oil in water [EC or EW]
- 6. Soluble concentrates [SL]
- 7. Wetting agents / oils / adjuvants

Finally, remember that compatibility does not only relate to products applied in a tank mixture! Products applied in close succession but in separate tank loads may also be **biologically** incompatible that is the application of one product may affect the performance or crop safety of the preceding or succeeding product application.

- ¹ Occasionally the mixtures perform differently when subject to the pressure and shear that occurs in a spray tank.
- ² Half fill a clean glass jar with a known volume of water and add the products to be tank mixed in the appropriate ratio and in the recommended order. Attach a tightly fitting lid and invert the jar several times to mix the contents. Look for signs of immediate creaming or separation of layers or settling of product as an indication of incompatibility.



The **BEST** program.

As a reminder to new users and existing users of Basta herbicide, the BEST program highlights the key elements to ensure that Basta delivers effective weed control in vineyards.

Benchmarks

Basta is excellent value when used correctly for effective, long-lasting control of a large range of weeds.

Environment

For best results, Basta must be applied when the temperature is below 33°C and relative humidity is over 50%. This is generally in the morning or evening.

Spray Coverage

Spray equipment needs to be correctly calibrated on a regular basis.

Timing

The excellent crop safety of Basta allows it to be used at all crop stages. The most consistent and cost-effective weed control is achieved when young weeds are targeted.

Frequently asked questions on Basta.

Q: Can I spray Basta around young vines?

Yes. Basta is registered for use around young vines including those under two years of age. However, until two years of age there may not be complete lignification of bark on all vines. Therefore it is recommended not to apply Basta under young vines until they are two years old, if contact with lower canes and vine cannot be avoided.

It is safe however, to use Basta around young vines, even newly planted ones, provided they are shielded from spray or spray drift eg via vine guards or sleeves.

Q: Can Goal be used as a spike with Basta for different weeds?

Commercial experience suggests this can be a useful mixture. Goal can be mixed as a 'spike' at 75 mL/ha for the control of large capeweed, willow herb and marshmallow.

Q: Do I need to add a wetter with Basta?

No. Basta contains 30% wetter in the formulation and therefore does not require the addition of a wetter. However, if water volumes in excess of 500 L/ha are used, or if the target weeds are particularly hard to wet, then 25 to 50 mL/100 L of non-ionic wetting agent may be used.

Q: What effect does humidity and temperature have on efficacy?

Basta works better under conditions of high humidity (>50%) because leaf uptake of the herbicide increases. In southern Australia during summer, the best application times are early morning or early evening. It is also important to avoid application when the temperature exceeds 33°C.

Q: What water rate should I use?

For boom and directed spraying application of Basta, a minimum of 300 L/ha is desirable. Higher rates of water and herbicides will be required if weed density is high. The best results will be achieved when thorough coverage of the target weeds is achieved. It is desirable to use spraying equipment that delivers droplets in the range of 150 to 300 microns to minimise large droplet bounce or fine droplet drift.

Basta Tamar trial confirms recommendations.

Understandably at around Olympic Games time Michael Wilson, vineyard manager at the St Matthias Vineyard at Rosevears on the Tamar River about 15 km north west of Launceston, has a wistful look in his eye.

Michael represented Australia in the Cycling Team at the Moscow Olympics in 1980, an event that opened up a professional cycling career with some of Europe's most competitive teams.

He was a five time competitor in the Tour of Italy, winning one gruelling 226 km, six hour stage. He was also twice selected for the Tour de France, achieving a best stage finish of third.

Inspired by his experiences in Europe and exposure to the wine industry, Michael returned to Australia to undertake the viticultural studies that have eventually led him to St Matthias.

The vineyard takes its name from Dr Matthias Gaunt, a 19th century pioneer of viticulture in Tasmania.

With fourteen hectares of vines established since the first plantings in 1983, St Matthias in recent years has become a member of the Moorilla Estate group. Its pinot noir and chardonnay grapes in particular contribute to the production of the Moorilla Estate Brut Cuvee - regarded as one of Australia's finest sparkling wines.

As vineyard manager, Michael pursues the quest for high quality grapes targeted for the boutique red and white premium markets. An important contributing factor towards quality grape production is an effective weed control program.

The weed control program at St Matthias presents Michael with a number of challenges, not least achieving long term control in a timely and efficient manner without compromising vine safety.

Michael is prepared to concede that his program against hard to kill weeds such as wire weed, fat hen, marshmallow, willow herb and nightshade, has been less effective in recent vintages than he would have wished.

The completion of a Basta demonstration trial in the vineyard, in mid January, 2004 however has addressed his concerns.

The trial has successfully demonstrated the fundamental issues of weed control with Basta, especially timeliness when weeds are young and actively growing, selecting appropriate vineyard conditions for application, particularly temperature and humidity, and adherence to the recommended label application rate (1 to 5 L/ha) determined by the weed growth stage, weed density and weed mix. The rate is selected for the hardest to kill weed.

"I think we had perhaps forgotten how to implement our weed control program effectively," Michael said. Accurate calibration of the spray equipment was another issue confirmed by the trial. To ensure thorough coverage of target weeds, the spray volume used at St. Matthias is 400 L/ha.

Michael said, "The trial confirmed the efficacy of Basta under local conditions, particularly when the weather is warmer and humidity is higher, as is the case when the weeds are actively growing in January.

"The trial was successful and we now have a better understanding of the importance of the correct rate under optimum seasonal conditions." Michael Wilson



John Barry (Jim Barry Wines) -Why they use Basta.

If you want to find out some of the secrets of the success of Jim Barry wines then you could do worse than bail up his son John for a chat. Getting a spare minute with John is a challenge so we were pleased to be able to catch up over a glass of the famous McCrae Wood chardonnay.

John's dad Jim came to Clare in 1947, Roseworthy College Diploma No. 17 in hand, to work as a chemist for a local co-operative winery. Over the next 25 years, working as chief winemaker, he bought parcels of land throughout the Clare Valley and planted them to riesling, shiraz and malbec.

"The first patch of land he bought was in the Armagh Valley where our flagship "The Armagh" shiraz comes from. It's highly prized and regarded in the top super premium wine bracket," John told us.

"We have always been a family company, totally in control of all our own vineyards and winemaking which makes us unique. We control everything we do from the pruning we use to set our yields, to pest and disease control."

"We have 260 ha of our own vineyards producing up to 1600 tonnes of fruit yearly. My job is to make sure each tonne is disease free and the vineyards aren't suffering from anything," John explained

"We are here for the long term. Being able to look after your vines for the next generation is important. That can mean making things easier for yourself by using products like Basta herbicide to control your summer weeds," said John.

The summer weed that causes John the most concern is caltrop. It is a particularly nasty weed because of its amazing ability to deplete soil moisture, its short period from germination to setting hard seed and its ease of spread on machinery thanks to a large, dangerous prickle.

"There's heaps of other weeds but caltrop is the bad one. Any other weeds we spray with Basta in the process of controlling caltrop die anyway."

"You know with Basta that if you use label rates you can knock it over and if it's used according to the label, you are not going to get any major damage to vines," John explained.

John began using Basta about 5 years ago to get away from using glyphosate based herbicides.

"We used CDA with glyphosate and found that if our vineyards weren't completely clean of water shoots up the trunk, the vines would suffer. I found too many vines distorted from glyphosate uptake because of this, so I only use glyphosate in winter. So we use Basta during the growing season and occasionally we'll use Spray Seed purely for rotation of herbicide groups. But our worker's preference is always Basta."

John's experience with Basta means he knows how to get good results.

"Use high water volumes, say a minimum of 200 L/ha, and droplets fine enough to give good coverage at label rates." John added that slowing down for better coverage pays off.

The optimal timing for spraying caltrop is as it flowers and certainly no later.

Although he has had good results in hot weather, John tries to spray in cooler periods of higher humidity such as night or early morning if possible. "We always get a good weed kill when we use it that way."

John takes standard precautions when handling all farm chemicals but commented that he believed Basta is a relatively safe herbicide to handle. "The blue colour is good as well for identification and there is no strong smell."

"The use of Basta is a factor in our resistance management program as well. We use glyphosate in winter, SpraySeed at times we really need to and Basta for our summer weeds from budburst through to harvest."

John buys his Basta in 100 L Agreturn packs which hook straight onto his Hardi mixer, forming a closed system.

"No one touches any chemical. It's handy to have the drums returnable and you don't have to wash them out. That's a big bonus."

At Jim Barry Wines they strive to produce a quality drop that stands out from the rest. Basta herbicide is one tool that helps them achieve their goal.

Why vineyard managers use Basta

- Safe to use around young vines if non-lignified crop parts are shielded from contact.
- Can be used mid-season without affecting vines.
- Outperforms other knockdowns in the spring summer period.
- Low toxicity to spray operators, low OH&S risk.
- No sign of resistance, so works well into a program where ryegrass resistance exists.
- Effective on hard to kill weeds such as clover and willow herb.
- No offensive odours.
- Longer acting effect than paraquat based herbicides making it cost effective when you consider the costs of application such as labour and fuel over a season.

• Good value for money. Source: Axiom market research, 2002



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