

Future Orchards Article for the Australian Fruitgrower

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Achieving Better Black Spot Control

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During the drought years, black spot was not very prevalent in Australian apple and pear orchards and became less important than powdery mildew on many orchards. However, with most apple districts experiencing two recent wet summers, black spot is back and it's worth revisiting the disease and how to control it.

Black spot is a disease that can very quickly progress from less than one percent of leaves infected that go unnoticed to over 25 % of fruit infected (that are certainly noticed). The implications on profit of 25 % reject fruit are enormous. Powdery mildew and Alternaria take a bit longer to damage fruit as infections are usually evident on leaves and controls can be increased before they affect fruit. Most insect pests develop slowly - it often takes several generations for populations to increase and for a crop loss 'disaster' to occur (except dimple bug which can fly into an orchard in damaging numbers).

Black spot is a very old and well understood disease. Apple growers and their advisors know a lot about its lifecycle, the weather that is required for infection, the fungicides we have to control it and good hygiene practices. But despite this knowledge dedicated and experienced growers sometimes have black spot issues. Why is this so? What has changed in the past 10-15 years that mean we are seeing black spot again? I've listed the Top Ten reasons I see for black spot appearing unexpectedly.

1. **Farm sizes are increasing.** Where an orchardist once grew 10 hectares and had one spray machine, we now have 60 hectare farms that have just 2 sprayers. This is enough machinery when the weather cooperates, but sometimes it rains for 2 days, blows a gale for 2 days and there is just 1 day left to apply a curative fungicide with a 5 day reach-back over the whole orchard. Likewise when a well predicted rain front is approaching there may not be enough time to get a protectant fungicide on the whole farm with limited machinery. The answer? During spring you should aim to always have a third of the farm that was just sprayed with protectant fungicide, a third sprayed in the past week and a third that was sprayed 7 – 10 days ago. So when wet weather arrives some of the orchard is always covered.
2. **Mixing rates need revisiting.** Most orchardists have reduced their spray application water volumes in the past 10-15 years. The reason for these reductions has been two fold; better droplets and less fill-ups. When the diameter of a droplet is halved there are eight times as many of them for a given water volume. More, smaller droplets can be more easily carried to more parts of a canopy. If a 2,000 L spray mix covers 2 hectares rather than 1 hectare the dead time spent on travelling to fill-up points and mixing sprays is halved. But, if water volumes are reduced then chemical mixing rates must be increased proportionately or you are under-dosing. It may have been true 30 years ago that registered rates had a built in 'fudge-factor', but not now. There are environmental and economic reasons not to register a fungicide at any more than the rate it works at. The amount of fungicide to apply on a hectare of trees should always equal what you would have applied if you were mixing at dilute rates and spraying to 'the point of run-off'. If you are putting out half the dilute water rate then mix the product at double concentration (2X). If you only mix at 1½X you are only applying 75%



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of the fungicide needed to do the job. Expect a 75% job under testing conditions. Under non-testing conditions a reduced rate may work ok, it will save you money on fungicide and will lead you into a false sense of security. Is anyone deliberately dropping rates or is it just because we forgot what a dilute rate should be? A bit of both I think. I have done registration trials with almost all the fungicides apple growers presently use and know that the label rate works and that it's not far from the rate that doesn't work. Registered rates from the 1970's were a long way up the response curve, but these days registered rates are a lot close to the 'shoulder'. Reducing rates, either on purpose or by mistake is false economy.

3. **Speeds are increasing.** Because farms are larger there is a need to drive spray machines faster to get the job finished. This is fine most of the time, but if you travel too fast your coverage will suffer. Groundspeed, airflow and canopy depth all need to match or you won't get even coverage. Water carries the fungicide but it is air flow that carries the water droplets. Every spray machine has a set volume of air it can generate. If you drive too fast you could still be putting the right quantity of fungicide per hectare on the trees, just not spreading it evenly. The appropriate speed is directly related to the airflow your sprayer generates and the target leaf canopy. My observation is that orchardists get the speed right most of the time in most of the blocks. But because canopies change from block to block and increase from spring to summer it's sometimes a hassle to change speeds to match the situation. If you are always driving at a speed appropriate for you largest/thickest canopy you will be wasting time and over-dosing. If you are driving at a speed for your smallest canopy the rest of the orchard will get under-dosed. Aiming for a single medium speed is a compromise, but certainly not as good as matching the speed to the block. When assessing and comparing machines remember that air volume and air speed are different things and some sprayers deliver the air at different points up the canopy. Theoretical models of Tree Row Volume can be a guide to the appropriate volume of water and speed, but the important thing is that air (which is carrying the spray droplets) moves completely sideways through and vertically up a canopy.
4. **Decision making.** Has rain weathered my protectant spray? Was there an infection period during yesterday's rain? How many days after an infection can I expect a curative spray to work? What is the best protectant? Should I mix a curative and a protectant fungicide? It is mid December - is the risk of infection over? Orchardists have to answer these questions continually. Sometimes there are not hard and fast rules and judgment calls have to be made. I have two tips; firstly, seek advice from someone. Even if your sounding board tells you nothing different it's good to know you considered all the factors. Having all bases covered is easier with pooled knowledge and experience. Secondly; if the decision on what or when to spray has an economic aspect, ask yourself what your bank manager would say. If you had to weigh up the extra costs and the risk involved in front of him what would he say? Spending an extra fraction of a percent of production costs to eliminate the risk of a major fruit loss would always get the green light from the bank manager! With less Department advisors and extension officers, orchardists have to build up their knowledge and networks of advisers to help with decision making on their specific orchards.
5. **Trees are more prone to disease.** Over the past 25 years we have changed the type of tree we grow. Most orchards are now irrigated, fertigated or have grassed inter-rows and many are hail netted. This changed environment produces 'softer trees' that have young leaves on them longer. Young leaves that are still expanding are more susceptible to black spot than older leaves. Newer varieties are naturally vigorous (Pink Lady, Gala, Fuji) and although we like to see trees settled and with no fresh growth in mid-summer by the use of rootstocks, minimal pruning, Regalis and appropriate crop loads, there are always some blocks or some individual trees that have too much growth. Why are older leaves less prone to black spot? There are physical and biochemical reasons and collectively these mechanisms are called ontogenic resistance. Be aware of ontogenic resistance when assessing

the risk of each infection period, but don't assume your orchard is uniform and that every leaf and every tree is at this stage. Lowering risk is about looking at the weakest links.

6. **A better environment for black spot.** Successful infection relies on adequate hours of leaf wetness. When we install hail netting we increase humidity, lower wind speeds and block some sunlight so leaves stay wetter for longer. This increases the chances of infection. When we stopped cultivating orchard soil we allowed more infected over-wintering leaves to survive till spring and release spores for new infections. We can't do much about reversing the affects of hail netting on leaf wetness but we can look at reducing overwintering infections. Hygiene was a cornerstone of all pest and disease controls before modern pesticides were developed and is still a cheap way of treating pests. If you had black spot in the orchard last season get a leaf sweeper to move leaves from under trees so you can mulch them. Broken leaves will rot and the overwintering black spot lesion will be destroyed. Encourage the bacteria and fungi responsible for leaf rotting by spraying urea at leaf fall and organic brews onto fallen leaves. Promote organic activity on the orchard floor. Intact leaves protect black spot lesions, allow the disease to complete its life cycle and live to infect again.
7. **Fungicide shortages.** There is no better example of how factors beyond the orchard can impact on management than the shortages of fungicides that have occurred recently. The big rains in spring 2010 saw over a hundred thousand hectares of chickpeas unexpectedly needing spraying with mancozeb. This created temporary shortfalls that flowed onto horticulture. Polyram fungicide has been in worldwide short supply for two years due to production limitations and Pristine was in short supply for part of the 2012 season due to increased global demand. The only way to safeguard yourself against shortages is to always have enough fungicide in the shed for at least two month's spraying and keeping your supply topped up. This will tie up working capital but the global supply companies and local resellers have shown they can't always guarantee supply when you need it.
8. **Orchards have got busier.** During spring, orchards are very busy workplaces, and over the past 15-20 years have got even busier. There are less trained staff and more jobs to do. Extra jobs have included pheromone dispensers being put out, bees being moved in and out of orchards, growth regulators applied (Cytolin, Regalis, Maxcel), trickle irrigation lines being checked, pruning being finished and hail netting being unrolled. Most of these jobs require skilled staff that also need to be applying fungicides, insecticides and herbicides. What's the answer? Having more staff, more machinery and/or better management of the team you do have. Getting ahead with your jobs list during late winter is critical. Black spot shouldn't establish because 'we were too busy doing other jobs to put on enough fungicide'.
9. **Confusion over fungicides.** To some extent there are too many fungicides available! Well, at least enough to make the choices not straightforward. There are 11 protectants (Captan, Chorus, Delan, Dithane, Flint, Polyram, Pristine Stroby, Syllit, Thiram and Ziram), 6 curatives (Rubigan, Sapro, Systhane, Syllit, Topas and Viva) and 2 dual purpose fungicides (Syllit and Vision) in the arsenal. There will be another dual purpose (protectant + curative action) available in October 2012 and another curative in 2013 or 2014. The new curatives are very welcome as some tolerance to the DMI curatives (group 3 or C) has been reported recently. There is no 'best fungicide' and each of the listed fungicides has a best fit based on their strengths and weaknesses. I could give you best fit situation for each product and also a reason not to use each of these fungicides in certain situations. Most fungicides are multi-purpose so when choosing what to use its important to consider the other key apple diseases; powdery mildew, Glomerella, Alternaria, sooty blotch/fly speck. Controlling these diseases may take precedence at key times during the season. One area of uncertainty is knowing how much weathering of fungicides has occurred due to rainfall. Even without weathering orchardists often under-estimate the affects of growth dilution when leaves and flowers/fruit are

growing so quickly. To balance getting a good result and watching costs orchardists need to be familiar with the attributes of the listed fungicides and not be afraid to seek advice.

10. **It's a numbers game.** Hundreds of apples per tree, thousands of trees per hectare, millions of leaves, and when infection exists there are billions of spores per hectare all looking for a way to infect these leaves and fruit! If you had black spot on leaves or fruit last season you will have spores carried-over this winter ready to release in spring. Consider the nine points above and tweak your management accordingly. If you have carry-over spores there is no room for risk taking and all management options should be tweaked for the worst case scenario. If you didn't have black spot last season you have options to reduce your inputs. But because every block, every variety and every infection period is different managing your orchard is an ongoing juggle – which is what makes a good manager.

Basics of black spot control;

- The disease overwinters in old dead leaves on the orchard floor.
- Winter spores (ascospores) are released, when mature, in spring with rainfall that occurs in daylight. There is a Day-Degree model that predicts the maturity of ascospores and hence when the largest releases will be.
- Spores sit in a water film on new leaves and fruit and infection is only successful if the leaf and fruit are wet for long enough at threshold temperatures. These are called Mills periods and black spot warnings are based on measuring leaf wetness, temperature and humidity.
- Warnings usually finish in December as the supply of overwintering spores runs out, leaves develop some natural resistance and there are less new soft leaves as fruit growth takes over.
- New black spots are the summer spore (conidiospores) lesions.
- Summer spores can infect leaves and fruit up until leaf fall. The aim is to not get summer infection by stopping winter spores!
- Summer spores don't need daylight to release, they wash onto leaves/fruit and infect after Mills periods.
- There are two types of fungicides; protectant and eradicant/curative.
- DMI curatives do not provide much forward protection so always mix a protectant with a curative. This is also important for resistance management.
- There are normal protectants and 'super protectants'.
- Eradicants have different number of days 'kickback'. Presently we have two groups; the DMIs (group C or 3) and Syllit (Group Y or M7). A new curative coming soon from a new group.

Mills Table

Average air temp.	Minimum hours of leaf wetness for infection	Days from infection to spots first appearing
8° C	13.4	17 days
10° C	11	15 days
12° C	8.3	14 days
14° C	7	12 – 13 days
16 - 24° C	6	9 - 10 days

This is a summary of the 'Revised Mills Tables' of MacHardy and Gadoury.

Five steps for success.

1. Hygiene – help overwintering leaves breakdown with urea and mulching.
2. Anticipate rain and apply protectants before the rain.
3. Act on warnings – apply eradicants after infection periods if no protectant cover existed.
4. Think of the main risk factors: variety susceptibility / overwintering spore load / intensity of infection period / expected weathering of last applied fungicide / your attitude to risk.
5. After each rainfall event in spring ask yourself two questions:
 - Do I need to spray?
 - If I do then what will I use?