Survival of the fittest – fighting fungicide resistance

The use of fungicides is an essential agronomic practice that is critical in ensuring healthy crops, protecting yields, and improving their quality. Like most living organisms, pathogens need to adapt to survive. Surviving control by fungicides is done through a process of mutation resulting in resistance against fungicides. To mitigate and manage the risk of resistance the Fungicide Resistance Action Committee (FRAC), an inter-company organisation affiliated with CropLife International, was established to define fungicide resistance prevention measures. This involves regular reviews of the status of resistance as well as defining testing procedures. In SA, a working group also exists under the auspices of CropLife South Africa.

Resistance (also known as a shift in sensitivity) can develop against a particular mode of action of a fungicide, and is attributed to the following scenarios:

- Repeated applications of a specific fungicidal mode of action
- The more exclusive the treatment with the same high-risk fungicide, the higher the selection pressure will be
- The rate of the fungicide used may influence risk; for example, sub-lethal dose rates can aggravate the risk
- The population of pathogens exposed to the fungicide; if disease incidence is relatively low, the occurrence and selection of possible resistant mutants are reduced
- When a large area is treated uniformly and continuously with a specific fungicide, it will pose a greater risk of resistance
- The use of integrated disease management, including the use of non-chemical methods such as disease-resistant varieties, rotation of crops, or hygienic practices will lower the disease pressure and fungicide selection pressure
- Isolation of pathogen populations (e.g. in greenhouses or tunnels, and isolated agronomic regions), preventing re-entry of sensitive forms, can favour the development of resistant populations.

Risk factors can be differentiated between fungicide-associated risks and pathogen-related risks. With fungicide-associated risk factors resistance develops through a mutation in the pathogen because of regular exposure to a fungicide. When it comes to pathogen-associated risks, there are differences between pathogens and their tendency to build resistance when a fungicide is applied. This can also be called an "inherent pathogen-related" risk.

How to avoid resistance

- Avoid sole use of a single mode of action fungicide
- Alternate fungicidal modes of action
- Stick to the approved rate, sub-lethal rates will aggravate resistance
- Introduce cropping methods to reduce disease incidence, which includes:
  - disease tolerant varieties
  - manipulating the crop environment (through pruning and improved airflow)
  - optimising the crop health.

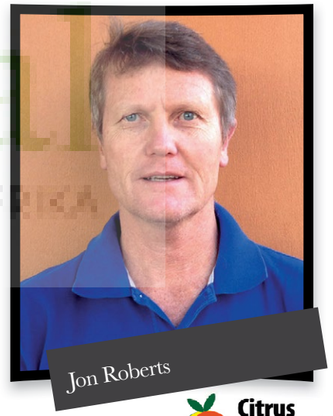
The prevention of fungicide resistance is extremely important for the sustainability of your farming practice. By implementing the correct risk management strategies, you can safeguard your crops this season.

For more information, please visit the Bayer Crop Science website at: www.cropscience.bayer.co.za.

PLANTING NEW CULTIVARS GENERATION

Risk versus opportunity

A recent study group meeting in the Sunday's River Valley revealed significant challenges faced by growers around new generation cultivars. By **Jon Roberts**.



"Jon is going to give us some info on cultivars and will hopefully tell us what not to plant." I discovered that, in his introduction of me, the chairman was referring to the fact that all the growers in the group had been affected by having to remove a failed cultivar in recent times. During our fathers' time things were simpler. One planted either Valencia, grapefruit, navel or lemon and some niche "throwing naartjies" for Loftus.

I'll call these varieties the "old flagships". They took the industry forward from the old clone Valencia, lemon and grapefruit types: cultivars like Eureka Lemon, Washington (early 1800s), Star Ruby (1930s), Midknight (1927) and Clementine Nules (1954) were spontaneous mutations/sports, not bred in a breeding program, mostly discovered by farmers, and improved by evaluation and selection.

They have been around for many years and have undergone significant evaluation. Specific management practices have been developed for them over the years, and optimum conditions of climate, soil type, and rootstock were advised. They were planted so successfully that overproduction and oversupply occurred, with poor returns in the markets.

Therefore, growers started looking for alternatives and began planting new generation (New Gen) cultivars. There is no clear-cut option between the two, but from around the late 70s to early 90s the tempo of development of new cultivars from breeding programmes increased, spurred on by the successes of some of the late mandarins.

Growers appeared willing to bear more risk, for fear of missing out on the next successful cultivar. But these New Gen varieties have not undergone the same extent of evaluation, which resulted in various failures due to, for example, disease susceptibility, climatic suitability and postharvest physiological related issues.

The removal or top working of these mostly young orchards is a significant loss, due to the double input costs, delayed return on productivity, and walking away from the royalties paid as a result of protection clauses in the agreements.

This was why the growers in the study group were asking for advice on what not to plant.

One of the critical issues is to be sure of one's risk versus opportunity: understand the potential risk your company is exposed to and what the actual opportunity is. Then, it is critical that you read the fine print as to who the risk bearer is. If a grower undertakes to plant a cultivar that has had minimal evaluation, for the potential opportunity that a head start gives him, it is highly probable that the owner of that cultivar will not release it unless the grower signs a clause to bear the risk of planting an untested cultivar.

Below from left: Gert Bezuidenhout (MD, Ambrosia Estates, Hoedspruit), Dr Jude Grosser (Professor of Citrus Breeding and Genetics, University of Florida, CREC), the late Dr. Hennie le Roux (Head of Extension at CRI, at the time), Dr Fred Gmitter (Professor of Horticultural Sciences, University of Florida, CREC) and Johan Joubert (Lead Evaluator, CRI Citrus Improvement Scheme)

> The success of "old flagship" varieties resulted in overproduction, oversupply and poor pricing.

It would also be critical to investigate what the cultivar's potential is from objective/neutral evaluation by, say, the CRI evaluators. Then, ask questions like: How long has the evaluation been carried out for? Has it been carried out in your climatic region?

However, this is by no means full-proof and there will always be a level of risk. Take for instance, nova mandarin, a conventional cross bred cultivar: In SA it is regarded as a relatively new cultivar, having only started moderate commercial planting in the 1990s. But it was actually bred in 1942, (Gardner and Bellows, USA), and finally released in 1962 for testing. It then took a further 20 years before we started evaluating it in SA, according to what normally would have been considered extensive evaluation. Meanwhile, issues such as alternaria and granulation continue to arise in specific plantings, as they are planted in climates and soil types (and even under nets), under different conditions to those under which they had been evaluated.

Another example is Swingle rootstock, also considered a relative newcomer in SA. It was evaluated in the 80/90s and bred by W.T. Swingle in 1907, taking a further 40 years to start evaluation. And only in the late 70s in the USA was this rootstock considered to hold potential. Swingle has journeyed 115 years from breeding to the present. It too has come under criticism in recent years, planted in orchards that have now marched out the deep alluvial, loam soils of the valley, and up into the slopes and mountains where it shows stress in high PH and susceptibility to "bosgrond pathogens", as it is now planted in soils for which it was not previously evaluated.

So, what is a suitable evaluation period?

At the same study group, one of the growers asked me why there are so many cultivars being bred. Partly, it could be due to the commercial success of the late mandarin cultivars that I have referred to. Breeders no longer receiving government funding work to repeat the success to sustain their programs, by breeding characteristics that are an improvement on the "old flagships", varieties such as easier peeling, seedless, better production, colour, flavour and earlier or later ones, as the market demands.

A recent additional requirement is for breeders to strive to breed varieties that are resistant to diseases such as CBS, HLB and physiological factors like rootstock tolerance to marginal soil and water quality, as availability declines. We see already that warming climates bring pressure to bear on sufficient dormancy in regions of South America where there is already a fine line in necessary temperature variation to initiate blossom. There is pressure to fast track these varieties through evaluation when growers are struggling with diseases like HLB, or requirements from the market for certain characteristics. Remember, flagships don't occur every day, it may be decades before we have cultivars that tick so many of the boxes as did, for example, Nadorcott, Eureka, Nules, Star Ruby. When a cultivar like these ticks all the boxes, it probably doesn't need much evaluation before release.

> We need to start asking many more questions of a cultivar, and interrogate its evaluation.

These issues bring forward other questions one needs to ask oneself, that our fathers probably never had to consider. If these varieties did undergo "sufficient" evaluation, was that evaluation carried out in the same quality soils, water quality and warming climate that our fathers planted in? Have the cultivars been tested under nets and for the newer stringent "cold steri" conditions, for example?

We are living in a very fast-changing world of impacts on production and consumer requirements and the original criteria for evaluation that were undertaken need to be interrogated to consider whether they include all the new impacts of planning your optimum modern orchard.

In summary, it is probable that an ever-increasing population, demanding land for settlement and more food will result in pressure on agriculture to plant in sub-optimum soils, water quality and availability. And those lucky enough to have secure sources of soil and water quality will also have changing climates to consider. These will continue to test physiological issues and pest susceptibility of even the oldest varieties. We need to start asking many more questions of a cultivar and interrogate its evaluation. Be sure of what you are getting into, what level of risk vs. opportunity your company is able to take on, and read the fine print more carefully in the coming years.

Finally, be sure there is a market for what you are planting, it's concerning to see how much waste and blemish appear in our sales reports in an over-supplied market.

Walter Tennyson Swingle (breeder of Swingle rootstock)