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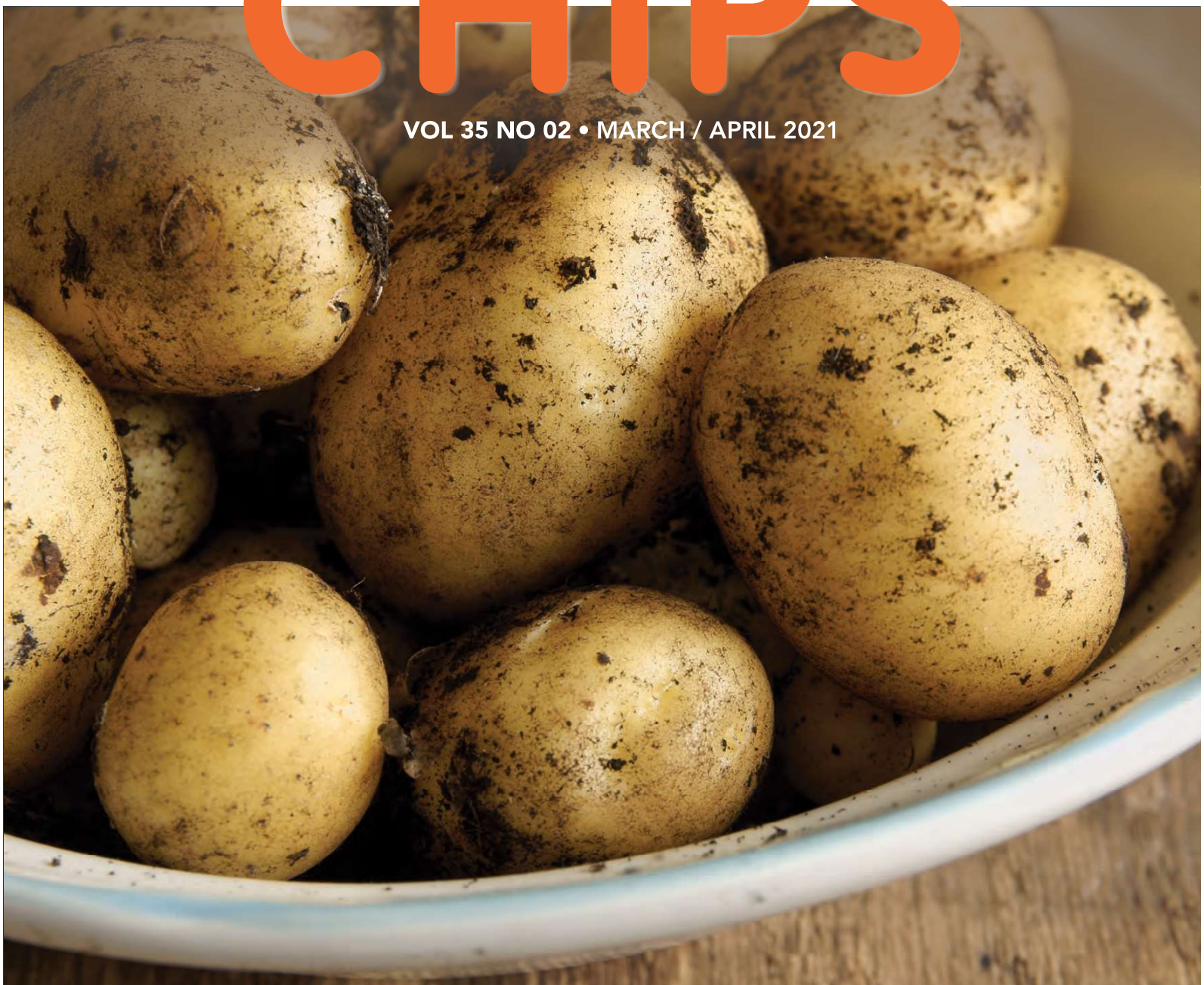

BASELINE AND MARKET DYNAMICS FOR THE COMING SEASON

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The basics of managing fungicide resistance

Article supplied by Croplife SA

Fungicides are used globally by producers to inhibit the growth or development of pathogens that affect a crop's quality or yield. To put the importance of these agricultural tools in perspective, the control of fungal plant diseases can save up to 125 million tons of food each year, which is enough to feed 60 million people. The role of fungicides in producing healthy food is clearly paramount.

However, there exists a threat to the efficacy of these valuable products, namely fungicide resistance.

Fungicide resistance is a naturally occurring, evolutionary process during which individuals of certain species of fungi develop the ability to survive treatment of a certain crop protection product. What happens over time, is that the survivors that are resistant to the action of the chemical lead to the next generation, and the resistant population multiplies.

The evolution of fungicide resistance is, however, more complex because it is influenced by many additional factors, such as the cropping system, climate, and perhaps most importantly, the implementation of resistance management strategies by the farmer. Fungicide resistance can often be demonstrated in a laboratory, and it is a crucial tool in the assessment of resistance, yet it does not necessarily prove that fungicide resistance exists in the field.

Accordingly, resistance in the field does not necessarily mean there is confirmed control failure, referred to as practical resistance. The moment control failure in the field is confirmed, it affects all parties involved in the production of a healthy crop, including the manufacturers of the fungicides. Although resistance cannot be entirely prevented, the proactive management thereof is certainly better than any cure.

Management strategies

Fungicide resistance can be managed by combining diverse management strategies such as avoiding repetitive use of one fungicide or mode of action, mixing or alternating with an appropriate partner fungicide, limiting the number and adapting the timing of treatments, as well as including non-chemical methods in the crop protection programme.

The importance of reading the product label and adhering to those guidelines when developing and implementing a spray programme cannot be overemphasised. The product label contains essential information, such as the minimum or maximum number of applications per season, the spray intervals that need to be adhered to, and the Fungicide Resistance Action Committee (FRAC) group to which the fungicide belongs.

Application and dosage

Producers must ensure that they only apply the product according to the stipulated dosage, as well as the mixing and application instructions. A key objective for producers in managing resistance must be to apply the correct amount of active ingredient to the target; in other words, mixing the correct pesticide volume or mass per application volume and applying the correct application volume per surface area.

The correct application technology must also be considered to ensure the precise dosage of the active ingredient is dispensed on the target. Overdosing removes all the susceptible individuals from the pest species population and leaves no susceptible genetics to maintain a susceptible population, whereas underdosing removes too few of the susceptible and semi-susceptible individuals that will procreate and develop resistance through mutation.

A producer should make use of registered tank or formulation mixtures. Some fungicides are already

available as mixtures in formulations; however, it is sometimes necessary to mix two different resistance group fungicides according to the labels' recommendations in the spray tank for stubborn fungi.

Application frequency

Products should only be applied according to the specified application frequency, as well as the minimum or maximum number of permissible applications per season. The objective is to control repeat infestations of the pest while preventing resistance progression and acceleration.

Not adhering to the spray intervals could allow mutation to manifest in the population or, conversely, not allow sufficient opportunity for the influx of susceptible individuals that maintain susceptibility in the population.

Information and resources

Each fungicide's active ingredient falls in a particular group, with a particular mode of action or similar mode of action indicated by a FRAC group code. The purpose of FRAC is to provide fungicide resistance management guidelines to prolong the effectiveness of 'at risk' fungicides, and to limit crop losses should resistance occur.

The FRAC group codes are indicated on the label and fungicides from different groups should be alternated within the spray programme. The FRAC website, *www.frac.info*, has numerous tools available for producers to ensure they apply the best resistance management practices to their farming operations. An electronic application has also been developed to identify the various FRAC groups and is available for download from Google Play.

Another resource is Agri-Intel (*www.agri-intel.com*), a mobile-friendly platform that contains the product label information of registered crop protection products in South Africa. Producers can search for available products by disease or pest, crop, active ingredient, registration holder, or registration number, thereby ensuring they have all the information at hand to develop an effective spray programme for the season.

Although resistance cannot be entirely prevented, the proactive management thereof is certainly better than any cure, as is clear from this already infected plant.

Integrated pest management

The Food and Agriculture Organization (FAO) defines integrated pest management (IPM) as an approach to agricultural production that "means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures, that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimise risks to human health and the environment".

With regards to controlling disease, IPM refers to the utilisation of all suitable techniques or strategies to keep the disease below levels that cause unacceptable crop losses. These different strategies could include cultural, biological, physical, and chemical methods of disease management. The choice of which disease management method to employ will depend on the crop and disease conditions, as well as the availability of resources.

Methods of control

Cultural control methods aim to help plants avoid contact with a pathogen and to eradicate or reduce the amount of the pathogen in a field or area. Examples of cultural control methods include crop rotation, sanitation, and creating unfavourable conditions for the pathogen.

Biological control methods work by improving the resistance of the host or favouring micro-organisms that are antagonistic to the pathogen. Examples include suppressive soils and trap plants.

Physical methods of control, on the other hand, are aimed at protecting the host from pathogens by using methods such as heat treatment (soil sterilisation by heat, hot water treatment of propagation material, or hot air treatments), drying of products, refrigeration, or radiation.

Chemical control methods include soil treatment, fumigation, disinfection of warehouses and packhouses, and control of insect vectors. These products must be applied according to the label instructions as mentioned.

By incorporating these best practices, a producer can decrease the acceleration of resistance development and ultimately assist in maintaining the longevity of the effective fungicides available as crop protection tools.

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