

Section 4

Volume rate and dose units for spraying application in orchard fields with huge variations in size, shape and density

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Introduction

When spraying 3D row crops like apple trees and strawberry plants, the dose expression on the pesticide label often is difficult for the operator to understand completely. One reason is the difficulty to adapt the dose correctly due to different mass of leaves and sizes of canopy. In some countries, it is used a constant GA (ground area) dose of pesticide in spite of different numbers of trees, tree sizes, differences in row spacing and mass of leaves per ha. This may be caused by different reasons; this is defined by law, this is a problem difficult to solve with the spraying equipment in use or a lack of knowledge by the authorities approving the labels.

Among others, the label dose in 3D row crops often is expressed as a concentration only, without being linked to any specific volume rate of spray. However, this is correct only if the growers apply a similar volume rate to a similar plant canopy and type of application. But frequently this is rather not the case. Thus, the concentration given on the label has to be linked to a certain volume rate, the so called normal rate. When another rate is used at similar conditions, the concentration has to be changed in the opposite proportion. If a dose is written on the label instead of concentration, this could better ensure a correct dose of pesticide than by the use of a concentration.

In older days, the common way of spraying 3D crops was to apply spray fluid with a hand held lance and spray until run off. In this way, the applied volume rate was more or less adapted to the crop size and leaf density. The normal concentration was based on a volume rate of 2000 l/ha for the biggest trees. However, the risk of run off was high, which resulted in environmental pollution. Additionally, the coverage of leaves was poor. The sprayer capacity was also low. Thus we today use methods with a lower volume rate, e.g. by using mist blowers, which cause a better coverage of droplets, minimum risk of run off and have a higher capacity.

Objectives

How can a correct and equal dose per leafcm² surface better be obtained in practice?

How can this volume rate unit ensure a correct dose in spite of variations in tree size and density?

Are the volume rate units used today easy understandable for the growers?

What kind of units may be additionally introduced?

Some volume rate units in use

TRV (Tree Row Volume) unit

In some countries, a TRV value is used with good results. However, such a unit may cause problems where the trees are changing quickly in shape, size and density over time and between fields. For smaller conditions and for more irregular tree shape the TRV-unit may not be that easy to adapt in practical use. When the shape differs strongly from rectangular shape, this value may lead to poorer result. But for uniform orchards and huge areas where the operator almost is spraying throughout the whole season, he may be well skilled to use such a unit and thus ensures a correct dose. In some countries instructive computer programs are made (Planas et al, 2012) as well as modeling (Triloff, 2005) to help the growers to adjust and optimize the sprayer correctly and ensure a correct dose.

LWA (Leaf Wall Area)

As an alternative to TRV, some countries are now using a LWA unit (Koch, 2007). This is a volume rate in liters per ha, but against a vertical wall of leaves and not a horizontal area. In modern orchards, the trees may make more or less a vertical wall of leaves, and then this value is correct to use. But for none rectangular shaped trees, it may give wrong results. Some growers may also have problems when using ha unit as an expression for a vertical surface. However, the value focuses on the tree wall and not the interrow and takes also different tree height into account.

UCR (Unit Canopy Row), e.g. volume rate per 100 m tree row

For smaller orchards like in Norway where the conditions often are changing as well as the type of spraying equipment in use, a more practical and understandable volume rate unit has been missing. Thus, a working group consisting of several fruit growers, evaluated all existing units available and concluded already in 1993 that a volume rate per 100 m tree row would be of most practical and suited use for such conditions. This value is easy understandable, the row spacing is not necessary to measure and a calibration of the volume rate is very easy to execute in the orchard. In combination with a check list, the growers are skilled how to adapt correct volume rate and dose due to variations in tree size, tree shape as well as tree density (Bjugstad, 1993). The procedure of an updated checklist will be shown at the workshop. A calibration of the volume rate per 100 m row may be found within 5 min (only 1 min to run the sprayer stationary the time to go 100 m). The check list also ensures the grower/operator to adjust the sprayer and forward speed optimally due to existing conditions in the field regarding tree size, density, as well as climate conditions. The UCR unit is also studied and used in other countries (Barani et al, 2008; Furness et al, 1998) with good results.

Conclusions

By using a suited volume rate unit like amount per 100 m row as well as adapted concentration factor and by adjusting the nozzle- and air pattern due to the height of trees, the growers are able to apply pesticides adapted to the tree size and density in a practical manner. This means that the pesticide ground area dose could be reduced from 100% to below 40% due to tree size, mass of leaves and also due to differences in row spacing. Most of the countries are obliged to report the use of pesticides expressed as an amount per ground area. However, such a recalculation is easy for the authorities to perform in the after hand. When choosing a volume rate unit in orchards, the level of understanding and simplicity for the growers should be more highlighted than today. Especially where the tree shape and density are differing between the fields and through the season, a UCR unit has proved to be suited.

References

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