Adjuvant

Tip of the Month

January 2018

SALT ANTAGONISM OF HERBICIDES

Salt antagonism occurs when dissolved cations in water antagonize the weed control of herbicides. The cations mainly include calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+}) and potassium (K^{+}) that are naturally found in most water sources. Cations like iron can also have a devastating effect on herbicide activity, but it is normally present at very low levels. These antagonistic cations bind to the herbicide molecule, probably during droplet drying, to form complexes of glyphosate that are poorly absorbed into the weed leaf surface. Ammonium sulphate adjuvants are used widely to neutralize these cations as well as to increase the amount of herbicide that is absorbed. The rate of herbicide absorption is probably also increased by ammonium sulphate, leaving the herbicide less prone to adverse weather conditions while exposed on the leaf surface.

Herbicides that are affected by salt antagonism

Firstly, only post-emergence herbicides are affected by salt antagonism because of reduced absorption. Secondly, it is predominantly the soluble herbicides that are prone to this phenomenon. There are exceptions to every rule, and the -dim herbicides are an example of this. Herbicides like glyphosate, the soluble phenoxy herbicides, certain sulfonylureas and the -dims are just a few examples of herbicides that are prone to salt antagonism. These herbicides react with antagonistic cations in water to form complexes that are very poorly absorbed into leaf surfaces. These herbicide-ion complexes form spray droplet deposits that are often sticky and this prevents them from entering the plant in significant quantities. Because these herbicides are prone to complexing with certain cations, utmost care should also be taken with tank-mix combinations as similar reactions could occur. Only use combinations that have been widely tested.

The South African situation

All four major cation antagonists (Ca^{2+}, Mg^{2+}, Na^{+} & K^{+}) are found in South African water sources. Calcium and magnesium, because they are divalent cations (double positive charge), are more antagonistic per given concentration but sodium is the predominant cation in many areas. Sodium levels reaching up to 3000 mg/L have been measured in certain borehole sources in the Western Cape! With most water sources, enough antagonistic ions are present to warrant the use of a quality ammonium sulphate adjuvant. Firstly, the sulphate ion binds to the antagonistic cation, before the cation can bind to the glyphosate. Secondly, the ammonium cation helps to increase the absorption of the herbicide. Therefore, because of the two-fold benefit of ammonium sulphate, Villa recommends it as a standard practice with all our glyphosate applications. One constantly observes a positive glyphosate weed control response when using the correct ammonium sulphate adjuvants. The same also applies to the other Villa herbicides that are applied with ammonium sulphate.

Must a standard rate of ammonium sulphate be used?

Depending on water source, the concentration of antagonistic cations will vary. Villa has therefore introduced an ammonium sulphate calculation method for glyphosate applications called VillaCalc. This calculation functions according to either the four-cation measurement, or the electrical conductivity measurement. The amount of ammonium sulphate adjuvant is then calculated to both neutralize the antagonistic salts, and to supply some additional ammonium sulphate for its absorption qualities. This calculation method is only applicable to the Villa ammonium sulphate adjuvants.

Villa's stance

Salt antagonism of herbicides can be detrimental to weed control. Glyphosate is the most widely used herbicide that is prone to salt antagonism, but quite a few other herbicides are also influenced by dissolved ions in carrier water. Ammonium sulphate remains Villa's only preferred adjuvant to negate salt antagonism and to increase herbicide absorption. Ammonium sulphate is not registered for use with all the salt sensitive herbicides and the individual labels must be used as a guide.

Contact Brian de Villiers
for more information on
adjuvants and water quality
082 880 0974 or
bdevilliers@villacrop.co.za

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