Farm Chemical Spraying And Mixing Water Quality

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WHAT IS FARM CHEMICAL SPRAYING?

Farm chemicals are used to control weeds, microorganisms (bacteria, fungi) and insects. Herbicides are chemicals used to control weeds, bactericides are used to control bacteria, fungicides are used to control fungi, and insecticides are used to control insects. These compounds are collectively referred to as pesticides.

HOW DO CHEMICAL COMPANIES DETERMINE THE REQUIRED DOSE FOR HERBICIDES?

Herbicides are registered by the Pest Management Regulatory Agency (Ottawa) at rates that consistently provide a reduction in weed biomass of 80% or greater. Many factors are taken into account to determine the application rate, including water quality and water volume. These different factors are then used to predict the effect of non-optimum conditions (such as poor quality water, weather conditions *etc.*) on pesticide effectiveness and to derive a rate which the company believes will be effective under most conditions. Unfortunately, some of the extreme water quality conditions experienced in rural Saskatchewan may not have been fully compensated for. There is therefore a considerable opportunity to increase the efficacy of pesticides used in Saskatchewan.

CAN VOLUME OF WATER USED TO DILUTE HERBICIDES AFFECT EFFICACY?

Yes, the volume of water can affect performance. It has been shown that a reduction of water volume from 100 to 50 L/ha can increase efficacy of: Assert, Assure, Avenge, Ally, Buctril M, 2,4,-D amine, MCPA amine, 2,4-D + Banvel, Hoegrass, Excel, Mataven, Fusilade, Roundup, Rustler, Poast, Glean, Amber, Select and Torch (information from Agriculture Canada). Only Achieve had a lower efficacy when low water application rates were used. The effect of lower dilution volumes may be even more dramatic when poor quality water is used, as discussed below.

CAN WATER QUALITY AFFECT PESTICIDE EFFICACY?

Yes, the quality of mixing water can interfere with the effectiveness of pesticides. The compounds most likely to interfere with pesticide effectiveness in tank mixes are: suspended solids (clay and organic particles), dissolved organic matter, dissolved minerals (calcium, magnesium, sodium bicarbonate, iron) and hydrogen/hydroxide ions (pH). Table 1 summarizes water quality impacts on the efficacy of pesticides, gives reasons/causes for variable effectiveness, and provides some options to counteract some of the negative impacts.

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Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada
Prairie Farm Rehabilitation Administration
Administration du rétablissement agricole des Prairies
Canada

Table 1 - A summary of water quality impacts on the efficacy of pesticides

Compound	Reduces effectiveness	Increases effectiveness
Clay and organic particles	Paraquat (Gramoxone), diquat (Reglone) and glyphosate (Roundup). A better understanding of the effect clay and organic particles on these and other pesticides is yet to be determined.	Use less water to mix pesticides with. Use water with small amount of particles, low TDS, low pH (add an acidifier).
Dissolved organic matter	To be determined. Typical Saskatchewan surface and ground waters contain high levels of dissolved organic matter. Reductions in efficacy are anticipated for many pesticides and this is yet to be determined.	Use water low in dissolved organic matter (coloured water is likely high in dissolved organic matter).
Sodium bicarbonate >300 mg/L	2.4-D and MCPA amines (not esters), Poast, Achieve, Select, and glyphosate (Roundup).	Liquid 28-0-0 (urea + ammonium nitrate) can be effective in overcoming efficacy reduction caused by sodium bicarbonate of the Adim@ group of herbicides (Poast, Select, Assure), but not of 2,4-D amine. Using less dilution may be effective for all but Achieve.
Combinations of Na, Ca, Mg, total dissolved solids	2,4-D, MCPA amine, and glyphosate (Roundup). Generally increasing antagonism. Effectiveness decreased as total dissolved solids increased.	Sulphate concentrations three times the calcium concentration may overcome the antagonism from calcium (liquid ammonium sulphate can be added).
Iron, zinc	Can affect glyphosate (Roundup) efficacy and plugs screens, nozzles.	Use water low in iron and zinc
pH (>8)	Organo-phosphate pesticides, glyphosate (Roundup), sethoxydim (Poast), fluazifop-P (Fusilade), and fenoxaprop-ethyl (Acclaim)	Reduce pH with acidifiers, reduce tank mixing volume (Acclaim), addition of surfactants (Poast)

THE USE OF SASKATCHEWAN WATER AS A MIX WATER FOR PESTICIDES

Saskatchewan water sources (both surface and ground water) present difficult challenges for optimum pesticide use. Particles (clay and organic particles) are often abundant in surface water. Filtration can sometimes be used to reduce the amount of particles in the water. In addition, dissolved organic matter (in surface and ground water) can reduce efficacy of some pesticides. The use of ground water high in salts and hardness (most deep aquifers in Saskatchewan) can also be expected to severely impair the performance of many pesticides. The use of ground water high in salts and hardness (most deep aquifers in Saskatchewan) can also be expected to severely impair the performance of many herbicides. The use of water treatment to avoid some of these problems may be less expensive than the crop loss resulting from reduced pesticide efficacy. Most natural surface and ground waters in Saskatchewan are alkaline (pH above 7.0), and lowering the pH of the water (to less than 7.0) would increase efficacy of many pesticides (this may be simply achieved by adding an acidifier).

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WHERE CAN I GET MY WATER ANALYZED?

Commercial and provincial laboratories that are able to analyze the composition of mixing water include: Envirotest Laboratories (Saskatoon), BDS Laboratories (Qu'Appelle), and Saskatchewan Research Council (Saskatoon).

THE BIGGER PICTURE

There has been only limited work done to determine the negative effects of naturally poor water quality on pesticide efficacy. This is of particular concern in Saskatchewan because large quantities of pesticides are used (more than $300 million/year). Many surface and ground water sources in Saskatchewan naturally contain several compounds that may detrimentally impact the effectiveness of the pesticide (for example, hard water dissolved organic matter *etc.*). The concentration of the blended pesticide can also affect efficacy, with stronger concentrations being more effective than dilute concentrations (when the same amount of pesticide is applied). If water quality and the blend concentration could both be optimized, it is likely that pesticide efficacy could increase significantly. Increased pesticide optimization and crop management would also result in environmental benefits and a more competitive farming product.

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This Fact Sheet is a part of the publication Water Quality Requirements for Saskatchewan's Agri-Food Industry, identifying key water quality needs for each sector. These guidelines were compiled from a variety of references, primarily including extension publications, reports, books and internet sources. Water quality is a vast and complex subject and readers are encouraged to consult with experts and delve into scientific literature for a greater understanding into specific water quality needs.

No Endorsement Given: This report should not be taken as an endorsement by the authors or their agencies of any of the guidelines, products or services mentioned herein.

Information from several different sources was used to produce this fact sheet including:

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