

Getting More Out of Glyphosate

Dr. Harm van Rees

INTRODUCTION

The rise in commodity prices in 2007 and 2008 has seen farmers around the world planting more crop, putting pressure on the price and availability of fertilisers and herbicides. The price of glyphosate increased significantly and it is likely to be in short supply. It is a good time to review our current use of glyphosate and see if we can make some changes to our current practices to make the product work more effectively.

Herbicides most commonly used in PNG for spraying the weeded circle under oil palm are:

- Glyphosate CT - glyphosate 450g/L (*also commonly referred to as Roundup CT*)
- 2,4 D Amine 720g/L
- Metsulfuron Methyl 200g/L (*also commonly referred to as Ally*)
- Paraquat 250g/L (*also commonly referred to as Gramoxone*)

Adjuvants most commonly used to improve the performance of glyphosate are:

- Activator 900g/L (*a non-ionic surfactant - commonly referred to as a 'wetting agent'*)
- LI-700 which is a surfactant (*i.e. wetting agent*) and a pH adjuster (*used in alkaline water*).

GLYPHOSATE

Improving its effectiveness in killing weeds

Herbicides do not all behave the same way and each herbicide has its own set of rules on how to get the most out of the product and maximise weed control for every dollar spent.

Problem conditions for glyphosate:

- Spraying plants with a very waxy or hairy surface – when plants have a waxy and hairy surface (*cuticle*) glyphosate has a problem entering the plant – it is slow to act and in some situations does not act at all (*in these situations glyphosate needs help from adjuvants to strip off the waxy layer and allow the active ingredient into the plant*)
- Rain fastness – because glyphosate is slow to enter a plant it is susceptible to being washed off the leaves during rain. Glyphosate CT has a rain fast period of 2-hours (*minimum*)
- Muddy water - glyphosate will bind to clay and other sediments in water, deactivating

the product

- Alkaline water (*water with a pH above 7.0*) will degrade glyphosate
- Hard water (*water which has a high percentages of calcium and magnesium at levels above 250ppm*) will deactivate glyphosate
- Mixing incompatibility (*glyphosate and 2,4D Amine are NOT compatible, a loss in weed control of between 10 and 20% is commonly observed when these two products are mixed*).



Ameliorants (products or techniques that overcome the problem conditions for glyphosate):

- Waxy / hairy surface on the target weeds
 - Petroleum based crop oils are effective in stripping off the waxy layer on the surface of the plant allowing glyphosate easier entry into the plant
 - Product examples are DC Tron (*839g/L*) and Ulvapron (*855g/L*)
 - For glyphosate use only petroleum oils NOT vegetable oils as the preferred adjuvant

- Rain fastness - the only solution to this problem is to NOT spray if rain is likely. If it has rained significantly immediately after spraying then respraying may be needed
- Muddy water - the only solution is to use clean water, preferably rain water
- Alkaline water - use rain water instead, or add LI700 which contains a surfactant and a pH adjuster (making the water more acid)
- Hard water - Ammonium sulphate (*e.g. ammonium sulphate crystals at 0.8kg/100L*) or the product Liase (*Liase is produced by Nufarm Ltd., it contains 417g/L of Ammonium Sulphate and is used at 2% solution in the spray mix*)

Ammonium sulphate will bind to the Ca and Mg ions thereby reducing the hardness of the water and improving the efficacy of glyphosate.

Note that prilled ammonium sulphate should not be used since it contains some Al ions which will only make the problem worse (*Al ions will increase the hardness of the water, not reduce it*).

Always add Ammonium sulphate to the knapsack before adding glyphosate.

- Mixture incompatibility - glyphosate and 2,4D Amine are not compatible and a loss in weed control will be observed (*of between 10 and 20%*) adding more of each product will reduce the loss in efficacy. The only formulation of 2,4D Amine which is compatible with glyphosate is Surpass300 (*Surpass 300 is an isopropylamine salt, and the product is produced by Nufarm Ltd*).

Under NO circumstances should glyphosate be mixed with paraquat, these two products have a totally different mode of action and are biologically NOT compatible.

Glyphosate is compatible with Ally (*metsulfuron*).

COMMERCIAL PRACTICE

When spraying weeded circles in the plantation you can get more out of glyphosate by observing some simple rules. The following recommendations assume that spraying is done by hand operators using 16L knapsacks.

1. Use rain water. If rainwater cannot be used then at least test the water for pH and hardness. Use the appropriate products listed above (*LI700 for alkaline water at 80ml/knapsack; and Ammonium sulphate crystals for hard water at 120g/knapsack. NOTE: always add these two products to the water before adding the glyphosate*).
2. Always use a wetting agent (*non-ionic surfactant at 30ml/knapsack*) add the wetting

agent after the glyphosate (if you are using LI700 then it is not necessary to use a wetting agent)

3. Use a petroleum based crop oil if spraying weeds with a very waxy or hairy surface (petroleum based oil at 150ml/knapsack, add the oil after the glyphosate and wetting agent)
4. Never use muddy water
5. Do not spray if it looks like it is going to rain and do not spray wet plants
6. If you mix glyphosate with 2,4D Amine, you must expect some loss in efficacy. Increase

your rate of glyphosate and Amine when mixing these products, by at least 20%.

WATER QUALITY IN PNG

Water used for spraying glyphosate was tested during March 2008. Some sites still need to be tested. Preliminary results are presented in the table below.

- Hardness is an estimate of the Ca⁺⁺ and Mg⁺⁺ ions in the solution. Glyphosate is a negatively charged molecule and water with a hardness of above 500ppm is regarded as unsuitable for glyphosate.

- pH is a measure of whether the solution is acid or alkaline. Glyphosate is a weak acid molecule and works best in a slightly acid to neutral spray solution.
- Alkalinity is a measure of bi-carbonates and carbonates in the solution. Glyphosate is generally not affected by the level of alkalinity, however 2,4D Amine does not work as effectively in a solution high in bi-carbonates.

Site sampled	Hardness ppm	pH	Alkalinity ppm	Comment
Poliamba (Nalik)	250-500 (high)	8.4 (high)	Above 240 (high)	Unsuitable for glyphosate without ameliorants
Poliamba (Noatsi)	500-1000 (very high)	8.4 (high)	Above 240 (high)	
Ramu (main workshop)	500 (high)	8.4 (high)	Above 240 (high)	
Milne Bay Estates (Hagita)	500-1000 (very high)	6.2-6.8 (slightly acid)	180-240 (moderate)	Suitable for glyphosate without ameliorants
Hargy Oil Palms (workshop)	100-250 (low)	6.8-7.2 (neutral)	120-180 (low)	
NBPOL (Haella)	100-250 (low)	7.2 (neutral)	120-180 (low)	
NBPOL (Dami)	100 (low)	6.8 (neutral)	40-80 (low)	

PRELIMINARY RESULTS OF TRIAL WORK WITH GLYPHOSATE

A glyphosate herbicide trial using different rates of glyphosate; different water sources; and different adjuvants and ameliorants was undertaken in March 2008 at MBE. The main target weeds were grasses and some broadleaf weeds.

The treatments were (all rates per 16L knapsack):

- (i) glyphosate 120ml no wetter in MBE water
- (ii) glyphosate 120ml plus wetter 32ml in MBE water

(iii) glyphosate 120ml plus wetter 32 ml in rain-water

(iv) glyphosate 120ml plus wetter 32ml plus Ammonium sulphate 120g in MBE water

(v) glyphosate 160ml plus wetter 32ml in MBE water

(vi) glyphosate 160ml + 2,4D Amine 160ml plus wetter 32ml in MBE water

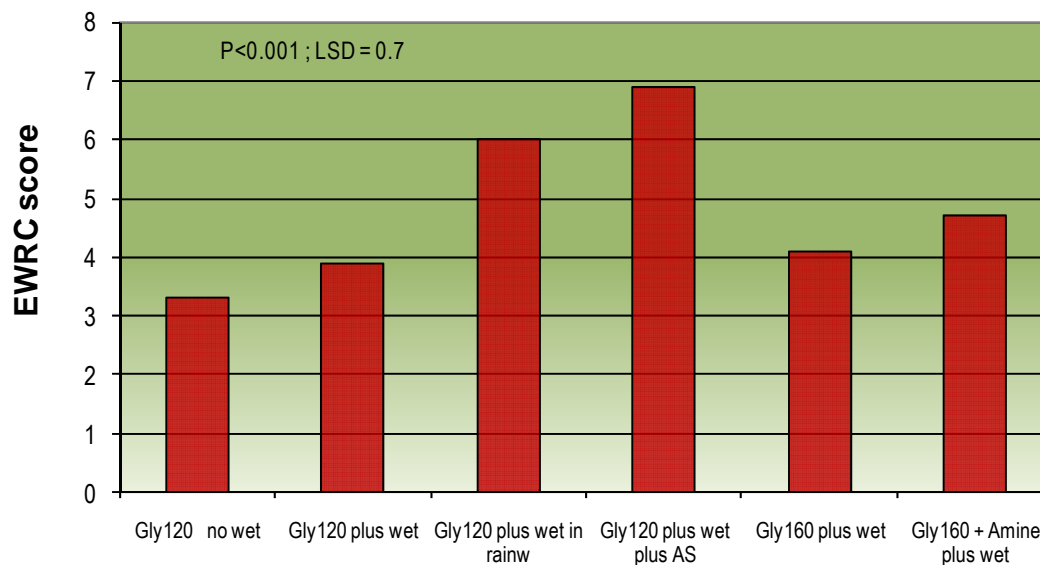
Trial Results:

- Glyphosate at 120ml with wetter was slightly more effective compared to glyphosate

without wetter, but both treatments are not commercially acceptable

- Glyphosate in rainwater or in hard water treated with Ammonium sulphate gave the best results
- Glyphosate at 160ml was more effective than glyphosate at 120ml, but neither was commercially acceptable

Level of Grass Control



Legend EWRC: 1=no effect; 3=visual effect; 5=strong visual effect, plants stunted; 7=commercially acceptable control; 9=dead

Glyphosate 120ml, no wetter in MBE water



PRELIMINARY RESULTS OF TRIAL WORK WITH GLYPHOSATE

Glyphosate 120ml, plus wetter in MBE water



Glyphosate 120ml, plus wetter in rainwater



Glyphosate 120ml, plus wetter + Amm Sulphate in MBE water



For Further Information Contact:

Head of Agronomy

Papua New Guinea Oil Palm Research Association Inc.

P.O. Box 97, Kimbe, West New Britain Province, Papua New Guinea
Tel: +675 9854009 • Fax: +675 9854040 • Email: info@pngopra.org.pg