



Glyphosate herbicide: Friend or foe?

By Prof Charlie Reinhardt

An article in the December 2019 issue of Oilseeds Focus discussed the merits and challenges facing glyphosate as a prime example of a mainstay herbicide for sustainable, profitable crop production.

Within approximately ten years after the launch of glyphosate-resistant (GR) crops in the seed market, reports of the alleged negative effects of the GR gene and/or glyphosate that is applied to GR crops emerged. During this time the former sole patent holder of GR crops, Monsanto, consistently refuted these claims. Since then, numerous independent scientists and academic institutions have conducted scientific studies on glyphosate and GR crops in order to determine the truth.

It is safe to say that no other xenobiotic (herbicide in this case) in the history of synthetic pesticides, which spans approximately 80 years, has attracted as much scrutiny as glyphosate and GR crop technology has over the past two decades.

Contradiction is rife

A substantive investigation was conducted through collaboration

between the Agricultural Research Service of the United States Department of Agriculture, the University of Mississippi, and Mississippi State University.

This field study conducted in 2013 and 2014, aimed to determine whether the transgene encoding for glyphosate resistance and/or applied glyphosate, impaired the nutrient element content – especially magnesium, manganese and iron – seed yield and amino acid content of GR soya beans.

There is consensus among those who are skilled in the art of weed management, that the greatest threat to the continued use of glyphosate is the evolution of herbicide resistance in more weed species.

The study found that glyphosate, the GR transgene, and field crop history (either long-term glyphosate usage or lack thereof) did not affect soya bean yield. The same factors had no consistent

effects on the mineral content of leaves or harvested seed. The effect on mineral elements was small and variable between years and, hence, indicative of false positives. The amino acid composition of harvested seed was also not affected.

Earlier review findings

Five years earlier, a different research group produced a literature review on the effects the GR transgene and glyphosate have on mineral nutrition, disease incidence, and GR crop yield.

They concluded that:

- Although there are conflicting reports in literature, the majority of studies relating to the effects of glyphosate on nutrient element availability in GR crops report that mineral nutrition in GR crops is not affected by either the GR trait or by the application of glyphosate to GR crops.
- Most available data support the view that neither the GR transgene nor glyphosate use in GR crops, increase crop disease.
- The yield data of GR crops do not support the hypothesis that GR crops specifically cause substantive mineral nutrition or plant disease problems.

The literature review confirmed that glyphosate increases the severity of disease on glyphosate-sensitive plants, which would mean there is a bonus in weed control with glyphosate.

A more recent study found that neither glyphosate nor the GR transgene affect disease susceptibility in GR crops, except in a few cases in which glyphosate reduces disease susceptibility in GR crops due to its herbicidal activity on certain fungal pathogens.

On the other hand

A review article reaches contrasting conclusions and makes the following admission: "We have endeavoured to select pertinent experimental studies that, taken together, build a consistent account of the principal ways in which glyphosate-based herbicide products may interfere with crops' disease resistance." This raises the question of whether bias might have been involved in the selection of literature.

Elsewhere in the article the following conclusion appears: "While we cannot conclude that the above impacts will occur in every case because environmental conditions, crop cultivars and individual farming practices will strongly influence outcomes, we can conclude that glyphosate-based herbicide products can cause significant

harm or impairment to the crops that they are employed to protect".

This is a strong standpoint with far-reaching consequences if it should be afforded credibility and if implemented in practice. Judgement on the validity of such conclusions is best left to the reader.

The future of glyphosate

More scientifically sound research by *bona fide* scientists is urgently required to expand knowledge of glyphosate's mode-of-action and GR crop technology. Improvements in this technology are ongoing and involve intensive and expensive research, but the efforts are bound to be rewarded because GR crops remain the most important GM technology in crop production.

Stephen Duke, a world-renowned specialist herbicide researcher, describes glyphosate as the 'once-in-a-century herbicide' and much evidence supports his statement. Some studies from the United States (US) support the importance of glyphosate for crop production. Glyphosate use in the US continued a linear increase after 2008 and reached a plateau in 2012, with no subsequent decrease by 2018.

This plateau in glyphosate usage is ascribed to both market saturation and the use of alternative herbicides due to the need for combating weed

resistance to glyphosate and many other herbicides. Much the same trends and practices involving glyphosate usage and GR crops exist in South Africa.

Counting the cost

In the modern world, humanity's food needs can only be met through sustainable, intensive agriculture; alternatively, a massive amount of land would have to be converted for agricultural use in order to meet this need. Judicious use of herbicides, preferably integrated with other weed control methods whenever practical, will continue to be an integral part of crop production technology for the foreseeable future.

More scientifically sound research by *bona fide* scientists is urgently required to expand knowledge of glyphosate's mode-of-action and GR crop technology.

Loss of glyphosate as a key component of this future will be too costly for farmers and consumers to bear. Robotic weeding and other new weed control technologies may add to or even replace certain herbicides in some high-value crops. However, when it comes to the majority of the world's staple food crops, herbicides are likely to remain the mainstay weed control method for many decades to come.

There is consensus among those who are skilled in the art of weed management, that the greatest threat to the continued use of glyphosate is the evolution of herbicide resistance in more weed species. The countermeasures for preventing and combating herbicide resistance are well-known and widely advocated, but these measures must be implemented at farm level to be effective. 🌱

For more information and references, phone Prof Charlie Reinhardt on 083 442 3427 or send an email to dr.charlie.reinhardt@gmail.com.

