

## GM soybeans: unforeseen effects

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Roundup Ready soybeans benefit less from the addition of sulfur than a closely related, but not genetically modified, variety. This kind of pleiotropic effect has been observed and analyzed before.

A Brazilian study (involving researchers from Embrapa, the Brazilian equivalent of the French public research institute INRAE) compares the agronomic behaviour of two soybean lines from the same breeding programme, one which is genetically modified to tolerate glyphosate-based herbicides (BRS 360RR), the active ingredient in Roundup®, and the other one which is not modified and sensitive to this molecule (BRS 317) [1]. Specifically, the researchers treated these two varieties with sulphur. Sulphur has been used in agriculture for centuries to improve plant growth and to combat certain diseases and fungi. The researchers found that the unmodified variety uses sulfur better than the transgenic variety. They report that “*increased sulfur levels*

*allowed the herbicide-sensitive cultivar (BRS 317) to exhibit the best physiological indices (water use efficiency and chlorophyll content) compared to the herbicide-tolerant cultivar (BRS 360RR), as well as increased grain yield (GY), shoot dry weight yield (SDWY), calcium (Ca), boron (B), NO<sub>2</sub>-N and iron (Fe) concentration in leaf tissue.”*

This study corroborates earlier studies which indicated that the *Roundup Ready* transgene has impacts on plant ecology. For example, Professor Barney Gordon (University of Kansas) pointed out in a study published in 2008 that genetic modification alters the plant's ability to use manganese, one of the elements in the soil that is important for plant growth [2]. And as early as 2001, researchers at the University of Nebraska had already pointed out that the genetic modification linked to glyphosate resistance led to a 5% drop in yield and that the seed weight of non-tolerant lines was higher than that of Roundup Ready (RR) lines.

If we stick to a mechanistic and reductionist interpretation of life, we cannot understand. In fact, the RR gene produces a new protein. This protein can interact with other proteins. So it does not only have the function for which the scientist inserts it! Moreover, the synthesis of this new protein will consume amino acids, which could be rare and therefore lacking in the synthesis of another protein. Clearly, life is not just a Meccano construction set.

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[1] Rafael Petineli, Larissa A. C. Moraes, Reges Heinrichs, Luiz Gustavo Moretti & Adônis Moreira, "[Conventional and Transgenic Soybeans: Physiological and Nutritional Differences in Productivity under Sulfur Fertilization](#), *Communications in Soil Science and Plant Analysis*", 51:15, 2045-2053, 21 September 2020.

[2] Gordon, B., "[Manganese Nutrition of Glyphosate-Resistant and Conventional Soybeans](#)", 2016.

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