Olin College of Engineering

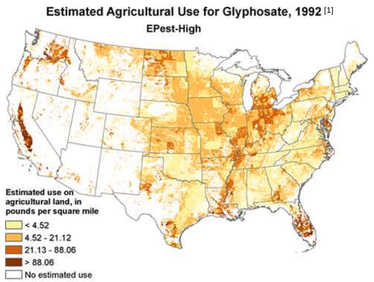
SCOPE

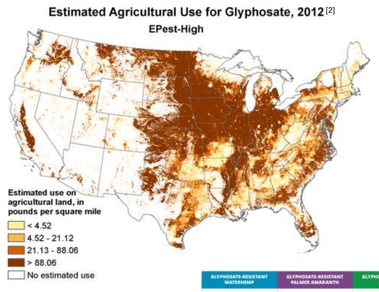
Improving Multi-Point Direct Chemical Injection For Boom Sprayers

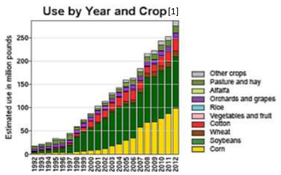
AGCO

This year's AGCO SCOPE team developed a method for quick chemical changeover on boom sprayers to improve pesticide targeting in fields. Most current boom sprayers restrict farmers to spraying a single pesticide cocktail over a large area. This method wastes water, chemicals and time while potentially exposing the operator to dangerous active ingredients during refilling. Furthermore, due to increased pesticide resistances, a single pesticide cocktail is no longer effective against all pests and may in fact be detrimental to crops. Existing direct injection systems have serious latency issues that have prevented widespread adoption. The 2014-2015 AGCO SCOPE team addressed this by designing, building and analyzing a proof-of-concept for a multi-point direct chemical injection system.

Problem: The Glyphosate Gap

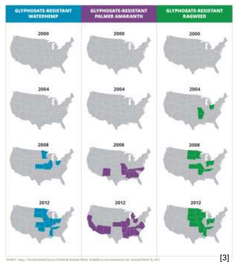




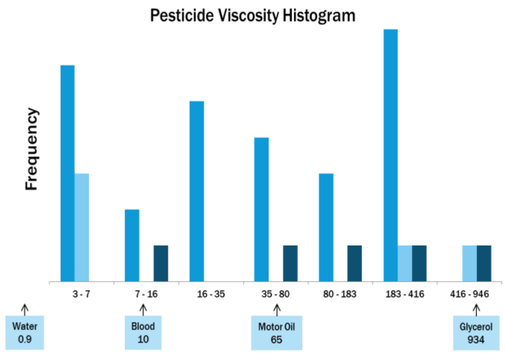


Glyphosate (RoundUp) use has exploded in the past 15 years. The previous strategy of blanket-spraying an entire field has ceased to be effective. No current pesticide is as general-purpose as glyphosate, so targeted spraying technologies must be developed.

This is the problem space that the 2014-2015 Olin -AGCO SCOPE team has explored this year.



Other Pesticides



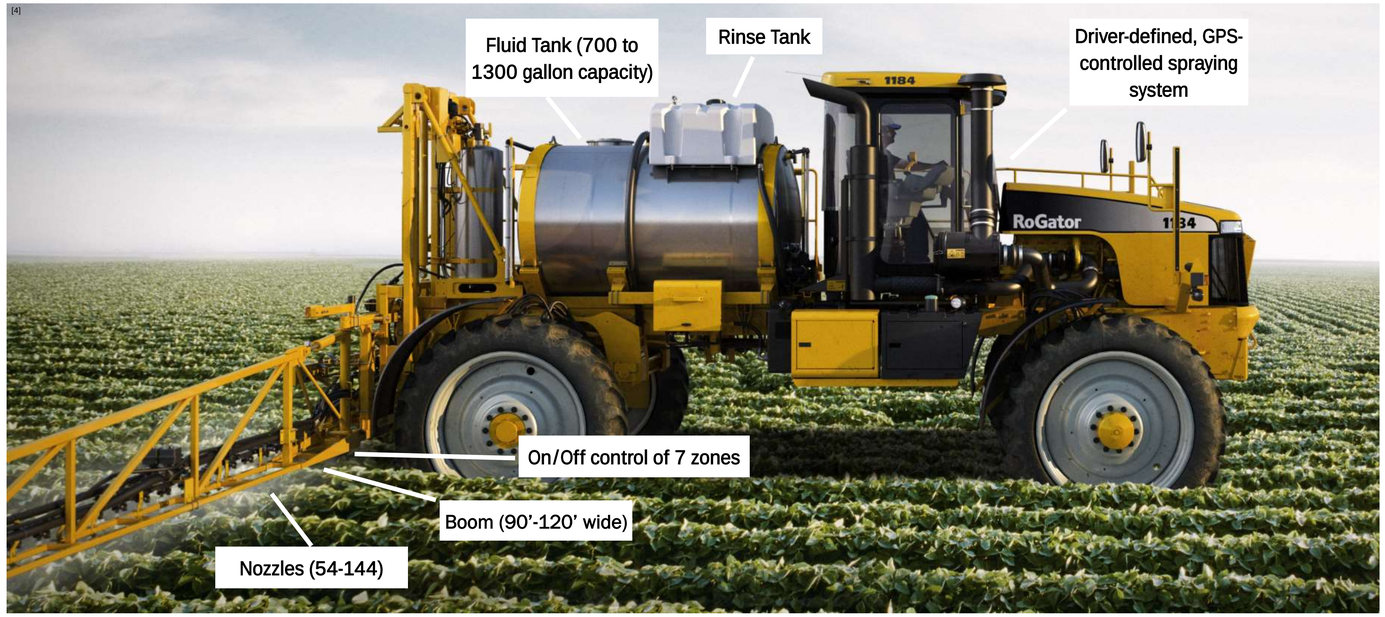
Focus on Herbicides

- Herbicides
- Insecticide
- Fungicide

Glyphosate, as a single chemical compound, has constant fluid properties. Pesticides as a whole, however, are incredibly varied in their chemical makeup, behavior, and optimal application rate.

Developing a system that is capable of handling orders of magnitude across pesticide application rates and fluid properties requires careful analysis. It was not feasible to test every pesticide permutation that could be used. The team had to instead pick critical properties to examine and test across the range of to validate our system.

Boom Sprayer Overview



Direct chemical injection is the process of mixing chemical in with a carrier fluid (typically water) on an as-needed basis, rather than pre-mixing a large tank. This strategy requires a more complex machine, but is far superior from an operating cost, environmental safety, and operator safety perspective. Pesticides are sold in concentrate, and are often highly toxic. By allowing the operator to load a pesticide cartridge rather than dump and mix off-site, human contact with the pesticide is reduced. Mixing the pesticide with water on an as-needed basis also allows unused pesticide to be reclaimed and stored rather than dumped, significantly helping the environment and the bottom line.

THE TEAM

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References:

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[2]http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2012&map=GLYPHOSATE&hilo=L&disp=Glyphosate

[3]https://globalfoodpolitics.files.wordpress.com/2013/12/glyphosateresistance.png

[4]http://www.agcoparts.com/fileUpload/eCommerce/model_images/RG01186.jpg

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