Problem Definition:

Dicamba is a broad spectrum herbicide first registered in 1967. At sufficient concentrations, the plant outgrows its nutrient supplies and dies. According to the EPA, Dicamba has damaged over 3.6 million acres of soybean crops, which is a total of 4% of all soybean crops planted in the US. 2,708 complaints have been filed by farmers in over two dozen states and range from not just soybeans but other crops like tomatoes, watermelon, cantaloupe, and pumpkins to name a few. The biggest problem is the spread of the herbicide from crops that are genetically modified to tolerate the herbicide to nearby fields that cannot. Dicamba has been used since the 1960s, but, late last year, it was approved to spray the herbicide "over the top" when the soybean has already sprouted instead of applying it before they sprout.

Solution to the Problem:

The goal in this experiment is to create a computerized model of dicamba resistance and drift. The model will analyze the concentration of dicamba applied in the "over the top" application versus the "seed application" and its diffusion through water, wind, and farming equipment. We plan to solve this problem computationally with the NetLogo agent-based modeling program. In order to find the ideal environment for the dicamba to have minimal spread, these multiple variables must be computationally analyzed and experiments run.

Progress on our model:

In the interface tab, we have positioned multiple crops in specific rows. We then introduce a breed of agents that will be the herbicide. In order to simulate the spread of the herbicide, we have the agents do a wiggle walk throughout the crops. We have different factors that affect the spread of herbicide through an irrigation system. They are represented by sliders in the interface tab that create a more accurate simulation. These factors include the direction and speed the water is following, along with the amount and potency of the herbicide applied.

Expected Results:

From our model, we expect to determine the ways to limit Dicamba drift by figuring out what conditions cause it to spread quicker. By keeping track of how the herbicide spreads and how many non-resistant crops are affected we predict that the over the top application will cause the herbicide to spread a greater distance and affect more non-resistant crops. Based on our research, we have learned that over the top application spreads at a greater quantity through waterways. Also the herbicide gets onto farm equipment more easily. If the grower doesn't clean their equipment, it can lead to transmitting the herbicide onto the next crops farmed with the same equipment. Also, the wind easily carries the herbicide to nearby crops; growers in the past have ignored applying the herbicide in wind spread below 15 mph causing a dramatic amount of the herbicide to spread nearby.

REFERENCES

Arkin, Daniel. "'Dicamba Drift': Monsanto Defends Herbicide as Farmers Say It Harms Crops." NBCNews.com, NBCUniversal News Group, 28 Oct. 2017, www.nbcnews.com/news/us-news/amp/dicamba-drift-monsanto-defends-herbicide-farmers-say-it-harms-crops-n814716.

"EPA-Approved Dicamba Is an Airborne Menace and Some States Are Banning It." Modern Farmer, 11 July 2017, modernfarmer.com/2017/07/dicamba-drift/.

Farm Press Staff 1 | Dec 05, 2017. "2017 Mid-South Weed Control: Heavy with Dicamba Concerns." Delta Farm Press, 5 Dec. 2017, www.deltafarmpress.com/weeds/2017-mid-south-weed-control-heavy-dicamba-concerns.

Hamilton, K. C., and H. F. Arle. "Response of Cotton (Gossypium Hirsutum) to Dicamba | Weed Science." Cambridge Core, Cambridge University Press, 12 June 2017, www.cambridge.org/core/journals/weed-science/article/response-of-cotton-gossypium-hirsutum-to-dicamba/A78A2261CBBA913AA586B8C154952F46.

Ishii-Eiteman, Marcia. "Dicamba Drift? This Is on You, Monsanto." HuffPost - Breaking News, U.S. and World News, HuffPost, 8 Sept. 2017, m.huffpost.com/us/entry/us_59b2e283e4b0bef3378cdfda/amp.

"Registration of Dicamba for Use on Genetically Engineered Crops." EPA, Environmental Protection Agency, 13 Oct. 2017, www.epa.gov/ingredients-used-pesticide-products/registration-dicamba-use-genetically-engineered-crops#q2

"These Maps Show How Much Farmland Has Been Damaged by Dicamba Drift." Modern Farmer, 1 Nov. 2017, modernfarmer.com/2017/11/maps-show-much-farmland-damaged-dicamba-drift/.