

Projection for Increased Dicamba Use

Currently the only public estimate of the anticipated increase in dicamba usage that has been performed was from Monsanto, when it was applying for deregulation of Xtend cotton and soybean in 2012.¹ Not only did the company underestimate the amount of acreage that will ultimately adopt the dicamba-tolerant trait (compared to current projections by Monsanto), but they assumed dicamba use rates that are either below the minimum single use rate required by the pesticide label or equal to the minimum use rate.² This underestimates anticipated usage and must be updated in order to accurately reflect potential for exposure to humans and the environment in the coming years.

Total Acreage Treated

For our analysis we looked at the most recent predictions of Xtend soybean- and cotton-crop adoption and updated the anticipated use rates to ones that are more likely to be used based on the current label. Monsanto estimates that 55 million soybean acres will be Xtend varieties by 2019.³ There is no current update on the amount of cotton acreage that is expected to be dicamba resistant; however, in its application to the U.S. Department of Agriculture, Monsanto estimated that 50 percent of cotton acres would be converted to Xtend at the time of peak adoption.⁴ With 12.1 million acres of cotton predicted to be grown in 2017,⁵ this comes to around 6 million cotton acres anticipated to be grown with the Xtend trait in the coming years. Thus the combined acreage anticipated to be grown in Xtend cotton and soybean by 2019 is 61 million acres.

Anticipated Dicamba Use

How much dicamba will be used is a bit more difficult to predict. Users will vary in the amount of dicamba they apply to their crops. But assuming minimum or below-minimum use rates is clearly not an accurate reflection of how the farming community, as a whole, uses pesticides. The minimum application rate for in-crop use of new dicamba products is 0.5 lb dicamba acid equivalent (a.e.)/acre.⁶ A total of 1 lb a.e./acre can be applied in-crop for soybeans and a total of 2 lb a.e./acre can be applied in-crop to cotton. Both Xtend cotton and soybeans also allow for pre-emergence use — with a maximum yearly application of 2 lb a.e./acre.⁷ Therefore, the range of applied dicamba will be between 0.5 lb a.e./acre and 2 lb a.e./acre per year. Clearly there are many variables that dictate how much dicamba farmers will use on their Xtend crops, such as whether glyphosate resistant weeds are present, whether they practice no-till farming, and whether they live in a state that has additional restrictions on dicamba.

Although some farmers may purchase dicamba-resistant seeds either for defense purposes against drift or without the intention of using dicamba, we believe this will be a small minority. Most farmers who purchase Xtend seeds will do so with the purpose of being able to use dicamba for post-emergence use on cotton or soybeans.

Average Number of Applications

Currently growers average 1.5 applications of glyphosate per growing season on Roundup Ready soybeans and 2.1 applications per growing season on Roundup Ready cotton,⁸ so many growers are

accustomed to using multiple applications of herbicides to kill weeds in their GE soybean and cotton fields. Furthermore, the number of no-till acres is steadily increasing in the United States,⁹ which often results in the use of herbicides to kill weeds before planting (this would result in an additional application — at least one pre-planting and one in-crop application). With a maximum of 4 applications per growing season,¹⁰ we believe that an average of 1.5 applications per year of pre-planting and in-crop use of dicamba is a reasonable estimate. This would be in line with the current average number of glyphosate applications on Roundup Ready soybeans and cotton and would be expected to increase over time as weeds inevitably develop resistance to dicamba.

Average Rate Applied

As for the average rate to be applied per application, with a minimum application rate of 0.5 lb a.e./acre and a maximum application rate of 1 lb a.e./acre (pre-planting only),⁷ the value will be somewhere between 0.5 lb a.e./acre and 1 lb a.e./acre. For our analysis we have assumed that 75 percent of all applications will be at the minimum in-crop rate of 0.5 lb a.e./acre and 25 percent will be at the maximum pre-planting application rate of 1 lb a.e./acre. This assumption is based on the number of no-till acreage for cotton and soybeans. As of 2008, 39 percent of soybean growers and 18 percent of cotton growers did not till their land,¹¹ a number that has likely increased since that time. In the absence of tilling, herbicides are often used as the only method of pre-planting weed control. Some of these pre-planting applications will be at the maximum rate and some at the minimum rate, and we felt that 25 percent at the maximal rate was a reasonable assumption. Monsanto would not have sought approval of the higher 1 lb a.e./acre pre-planting use rate if it did not expect there to be a demand for that higher use rate. And as a plan to delay developing weed resistance to dicamba, farmers are being encouraged to apply “full rates” of dicamba formulations in an effort to manage weed resistance.¹² So we calculate the average application rate as $(0.5 \text{ lb a.e./acre} * 0.75) + (1 \text{ lb a.e./acre} * 0.25) = 0.625 \text{ lb a.e./acre}$.

Total Dicamba Applied

With an average application rate of 0.625 lb a.e./acre and an average number of applications per year of 1.5, this comes to an average of 0.9375 lb a.e. of dicamba used per acre per year. When used on 61 million acres in the United States by 2019, we estimate, 57.2 million pounds of dicamba acid equivalents will be applied on U.S. soil each year. We did not take into account recent state restrictions that may reduce this volume, because those restrictions have only been approved on a temporary basis, and their future is uncertain due to pending litigation.

¹ USDA. Final environmental impact statement. *Monsanto Petitions (10-188-01p and 12-185-01p) for Determinations of Nonregulated Status for Dicamba Resistant Soybean and Cotton Varieties*. EIS appendix, 2014. Tables 4-9 and 4-12. Available from: http://www.aphis.usda.gov/brs/aphisdocs/dicamba_feis_appendices.pdf.

² The EPA approved label for new dicamba products direct the user: “Do not apply less than 22 fluid ounces (0.5 lb a.e. dicamba) per acre.” Available here: https://www3.epa.gov/pesticides/chem_search/ppls/000524-00617-20171012.pdf. Use rates in the company estimates ranged from 0.5 lb a.e. dicamba per acre (which is both the maximum and minimum single use rate in-crop) to 0.375 lb a.e. dicamba per acre (a use rate that would be non-

compliant with the pesticide label because it is too low). The company also assumed an Xtend soybean adoption rate of 40 percent, much lower than the 60 percent the company is now anticipating.

³ Polansek, T and Flitter, E. "Exclusive: EPA eyes limits for agricultural chemical linked to crop damage." Reuters. Sept. 5, 2017. Accessed Dec. 27, 2017. Available here: <https://www.reuters.com/article/us-usa-pesticides-epa-exclusive/exclusive-epa-eyes-limits-for-agricultural-chemical-linked-to-crop-damage-idUSKCN1BG1GT>; and

Goldberg, S. "Ban of Herbicide Could Benefit Agriculture Prices." Bloomberg. Oct. 2, 2017. Accessed Nov. 15, 2017. Available here: <https://www.bloomberg.com/view/articles/2017-10-02/ban-of-herbicide-could-benefit-agriculture-prices>.

⁴ USDA. Final environmental impact statement. *Monsanto Petitions (10-188-01p and 12-185-01p) for Determinations of Nonregulated Status for Dicamba Resistant Soybean and Cotton Varieties*. EIS appendix, 2014. Pg 4-23. Available from: http://www.aphis.usda.gov/brs/aphisdocs/dicamba_feis_appendices.pdf.

⁵ USDA, National Agricultural Statistics Service. Acreage. June 30, 2017. Available at: <http://usda.mannlib.cornell.edu/usda/current/Acre/Acre-06-30-2017.pdf>.

⁶ The EPA approved master label for new dicamba products direct the user: "Do not apply less than 22 fluid ounces (0.5 lb a.e. dicamba) per acre." Section 12. Available here: https://www3.epa.gov/pesticides/chem_search/ppls/000524-00617-20171012.pdf.

⁷ See EPA approved master label for new dicamba products. Section 12. Available here: https://www3.epa.gov/pesticides/chem_search/ppls/000524-00617-20171012.pdf.

⁸ USDA, National Agricultural Statistics Service. Data and Statistics. 2015 Cotton, Oats, Soybeans, and Wheat - Released May 13, 2016. Glyphosate - potassium salt. Accessed 12/14/2017. Available here: https://www.nass.usda.gov/Data_and_Statistics/Pre-Defined_Queries/2015_Cotton_Oats_Soybeans_Wheat/

⁹ Horowitz, J, Ebel, R, Ueda, K. USDA Economic Research Service. Report summary: "No-Till" Farming Is a Growing Practice. November 2010. Available here: https://www.ers.usda.gov/webdocs/publications/44512/8084_eib70_reportsummary.pdf?v=41055.

¹⁰ Minimum dicamba application rate of 0.5 lb a.e./acre and a total of 2 lb a.e./acre per growing season.

¹¹ Conservation Technology Information Center. "2008 Amendment to the National Crop Residue Management Survey Summary." 2008. Available here: [http://www.conservaioninformation.org/media/pdf/National%20Summary%202008%20\(Amendment\).pdf](http://www.conservaioninformation.org/media/pdf/National%20Summary%202008%20(Amendment).pdf).

¹² See EPA approved master label for new dicamba products. Section 7. Available here: https://www3.epa.gov/pesticides/chem_search/ppls/000524-00617-20171012.pdf; and Weed Science Society of America. Dicamba and the Treadmill of Herbicide Resistance. Agfax, November 27, 2017. Available here: <http://agfax.com/2017/11/27/dicamba-and-the-treadmill-of-herbicide-resistance/>.