

Perspectives on soybean yield losses due to weeds in North America

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Introduction

- Weeds are one of the most significant threats to crop production in North America. Crop losses in yield and quality due to weed interference, as well as costs of controlling weeds, have a significant economic impact on crop production.
- The United States ranks 1st in the world with 31% of global soybean production while Canada ranks 7th with 2% of soybean production in 2012-2013 (USDA-FAS 2016).
- WSSA Weed Loss committee generated reports in 1984 (Chandler et al.) and 1992-1993 (Bridges; Swanton et al.) that summarized crop losses due to weeds across the US and Canada. Chandler et al. (1984) reported an estimated 13 to 27% soybean yield loss across the US and 9% soybean yield loss across Canada due to weeds.
- Bridges (1992) reported an estimated 2 to 20% soybean yield loss due to weeds across the US even when Best Management Practices with herbicides were used and increased to 15 to 65% corn yield loss with BMPs but no herbicidal weed control. Swanton et al. (1993) estimated 10% soybean yield loss in Ontario, Canada due to weeds.
- These data have been useful to highlight the continued need for weed science research.

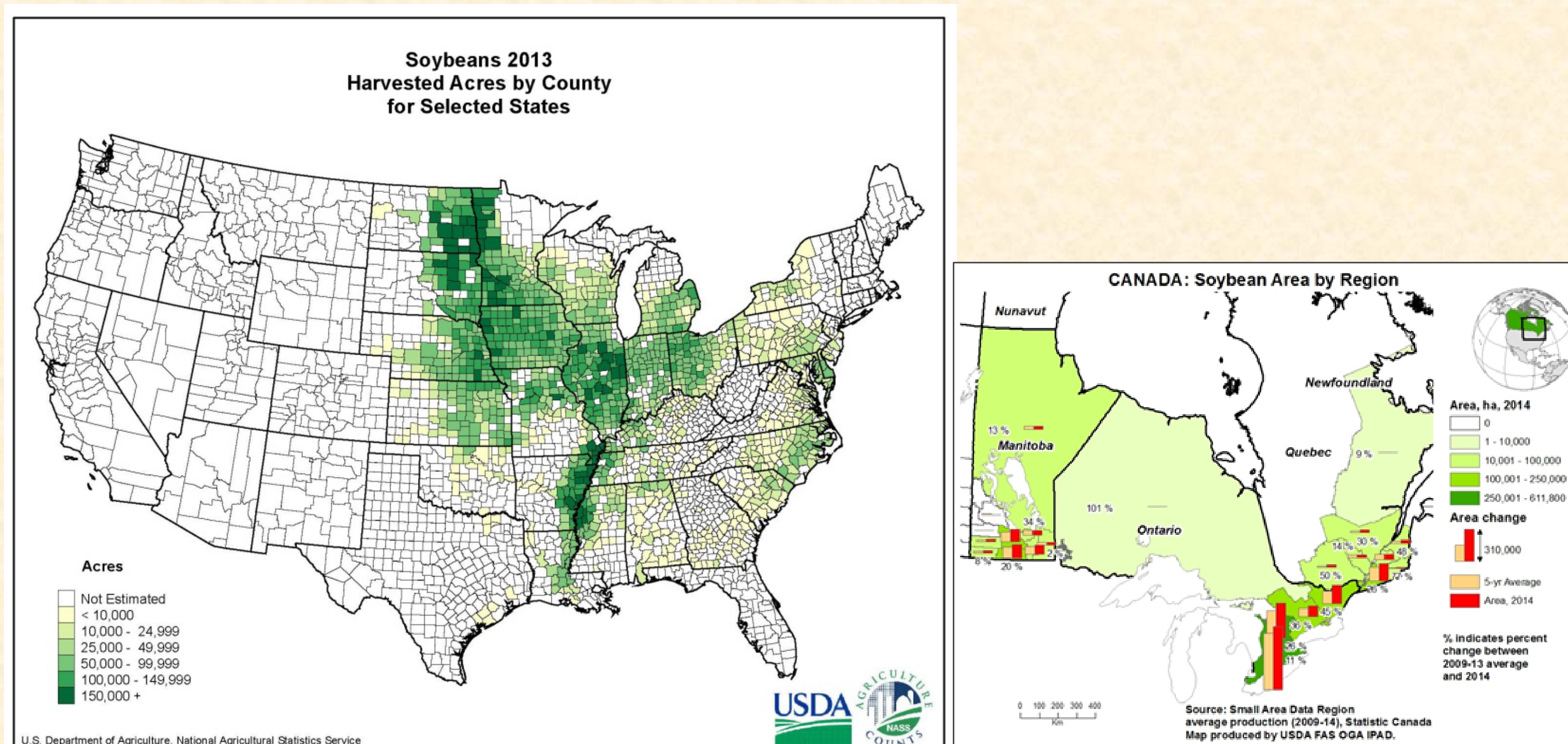


Figure 1. Distribution of soybean acres harvested in the United States (2013) and in Canada (2014). Images and data from USDA-NASS and Statistics Canada, respectively.

Objective

- To report on potential soybean yield and economic losses due to weeds across the US and Canada between 2007-2013.

Procedures

- Requests for data were sent to research and/or extension weed science specialists in 2014 and 2015. Each specialist was asked to provide results of up to 10 individual studies conducted within a year during the period of 2007 to 2013 on weed control in soybean. Data were also obtained from weed control research reports published online for several states and provinces.
- Information requested:
 - Weedy yield** = average yield from the untreated weedy plot (yield using Best Management Practices (BMP) but no weed control), and
 - Weed-free yield** = average yield from a herbicide control plot with > 95% control for each weed species (yield with BMP and excellent weed control)
- Yield loss (%) was determined for each individual study, then averaged within a year, and averaged across the seven years for each state or province:

$$YL\% = \frac{(\text{weed-free yield} - \text{weedy yield})}{\text{weed-free yield}} * 100$$

- State- and province-level data for total soybean acres harvested, average soybean yield (bushels/acre), as well as total production (bushels) and yearly average commodity prices (US \$/bushel) were obtained from USDA-NASS and Statistics Canada reports.
- Average commodity price for the period of 2007 to 2013 was US \$10.61/bushel and this prices was used to determine potential loss in value due to weeds.

Results

Table 1. Potential average losses in soybean production and value due to weeds for each state or province that provided data for the period of 2007 to 2013. Harvested acres and average yield data obtained from USDA-NASS and Statistics Canada.

Region State or province	Acres harvested (ac x 1000)	Average yield (bu / ac)	Yield loss (%)	Potential loss in production (bu x 1000)	Potential loss in value (\$10.61/bu) (US \$ x 1000)
Northeast					
Delaware	172	35.7	28.7	1,762	18,698
Pennsylvania	481	44.3	35.2	7,501	79,581
Eastern Canada					
Ontario	2,418	43.5	38.1	40,075	425,193
Lake States					
Michigan	1,937	41.8	62.6	50,685	537,769
Minnesota	6,907	41.4	65.3	186,725	1,981,155
Wisconsin	1,583	42.0	53.7	35,703	378,809
Appalachian					
Kentucky	1,414	39.0	82.1	45,275	480,366
North Carolina	1,534	31.2	47.4	22,686	240,699
Tennessee	1,350	35.1	36.0	17,059	180,992
Corn Belt					
Illinois	9,017	46.9	60.5	255,853	2,714,599
Indiana	5,227	47.1	54.8	134,913	1,431,427
Iowa	9,336	48.9	46.8	213,656	2,266,893
Missouri	5,166	37.6	51.5	100,034	1,061,365
Ohio	4,494	46.1	42.3	87,634	929,800
Northern Plains					
North Dakota	4,011	31.6	61.2	77,570	823,013
South Dakota	4,143	37.7	51.9	81,063	860,080
Nebraska-dry	2,585	43.0	36.3	40,349	428,106
Kansas	3,554	33.6	52.6	62,812	666,435
Delta States					
Arkansas	3,166	38.9	34.1	41,997	445,585
Mississippi	1,879	41.0	48.6	37,441	397,249

Table 2. Potential total soybean losses in production (bushels) and value (US \$) due to weeds for the United States and Canada based on 2012 Census Data from USDA-NASS and Statistics Canada.

Country	Acres in soybean	Total production (bu x 1000)	Value (\$10.61 / bu) (US \$ x 1000)	Potential loss in production (49.5% YL) (bu x 1000)	Potential loss in value (US \$ x 1000)
United States	76,104,780	2,926,823	31,053,592	1,448,777	15,371,528
Canada	4,149,400	186,892	1,982,924	92,512	981,547
Total	80,254,180	3,113,715	\$33,036,516	1,541,289	\$16,353,075

Summary

- Soybean is grown on more than 80 million acres in North America with a value of more than \$ 33 billion US using current BMPs.
- On average, weeds cause 49.5% soybean yield loss when using BMPs but no herbicidal weed control. Nearly half of soybean production and economic value across North America would potentially be lost with weeds left uncontrolled.

References

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