Summary of the Michigan Soybean Benchmarking and Yield Gap Surveys (2014 and 2015)

Summarized by Mike Staton, MSU Extension soybean educator

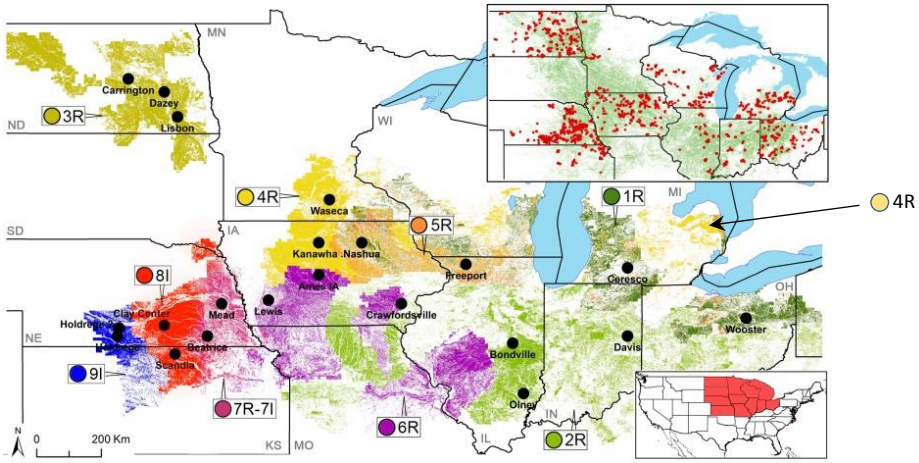
Michigan is participating in a multi-state, checkoff-funded project to identify soybean yield gaps and the management practices responsible for them. To accomplish this, we asked soybean producers to provide field-specific information regarding management practices, crop inputs and yields from four fields in 2014, 2015 and 2016. Information was collected from 149 fields in 2014, 168 fields in 2015 and 340 fields in 2016. Only the 2014 and 2015 surveys for rain-fed fields in Michigan have been summarized and included in this article.

Producers were also asked to provide the location for each field. The field location information was used solely to identify regions having similar soil and climatic conditions and group the surveyed fields within the identified regions. The four factors used to identify the regions have a significant effect on soybean yield potential and are listed below:

- Annual growing-degree day accumulation
- Annual precipitation
- Annual temperature fluctuations
- Plant available water-holding capacity in the rooting zone

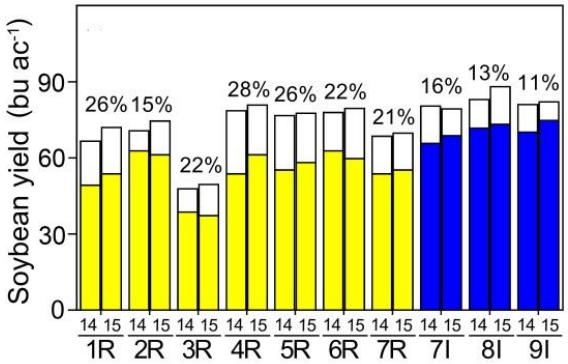
The surveyed fields from Michigan were grouped into two regions (1R, green and 4R, yellow) based on these factors as shown in figure 1. The R and I following the number indicate rain-fed and irrigated regions.

Figure 1. Map of the North Central region of the United States showing the 10 regions, weather station locations and the surveyed field locations (top insert).



Soybean yield gap is defined as the difference between the yield potential for a given region and the yield reported by producers from that region. The yield potential for each region was estimated using actual daily weather data collected from 2-3 weather stations located near the highest concentration of surveyed fields. The average yield gap for both years in each region is presented at the top of the bars in figure 2. The top of the colored portion of each bar in the figure represents the actual reported yields and the top of each bar is the yield potential. The bad news is that the yield gaps for the two regions

Figure 2. Comparison between the actual reported yields and crop model estimates for yield potential in 10 regions within the North Central United States. Yellow = rain-fed and blue = irrigated.



in Michigan rank the highest of all 10 regions. The good news is we have more opportunity to produce higher yields through management.

In order to identify the management practices responsible for the yield gap within a region, the fields were ranked by yield and then divided into a high-yield group (HY) and a low-yield group (LY). The HY group represented the top 1/3 of the fields and the LY group represented the bottom 1/3 of the fields in a given region. The management practices implemented by the two groups were compared and statistically analyzed. Five practices (planting date, tillage, foliar fungicide and/or insecticide, drainage system and soybean maturity group) were identified as having a 90% probability of explaining the yield gap in half or more of the 10 regions. In region 4R, the high-yield group had 25% more tilled fields, planted 8 days earlier, planted 20% more fields in wide rows, planted varieties that were 0.1 of a maturity group later and applied a foliar fungicide and/or insecticide in 31% more fields than the low-yield group (table 1). In region 1R, the high-yield group planted 10 days earlier and planted varieties that were 0.2 of a maturity group earlier than the low-yield group.

Table 1. Comparison of producer yield, selected management practices and applied inputs between the top 1/3 (HY) and the bottom 1/3 (LY) yielding fields in two regions in Michigan. The values listed in the last two columns reflect the difference between the HY and LY groups for each of the management practices.

Management practice	Units	Region	
		1R (HY – LY)	4R (HY – LY)
Tillage	% tilled fields	-3	25***
Planting date	days	-10***	-8***
Row spacing	% planted in wide rows	11	20*
Maturity group	Unit less	-0.2*	0.1*
Foliar fungicide and/or insecticide	% treated fields	10	31***

Asterisks indicate statistical significance at $p < 0.1$(*), $p < 0.05$ (**) and $p < 0.01$ (***).

Planting date was the main management practice identified for explaining the yield gap in both regions in Michigan. For region 1R, yields decreased by 0.5 of a bushel per acre for each day that planting was delayed after May 1st. In region 4R, yield losses of 0.4 of a bushel per acre per day were found. These values are consistent with the results obtained from replicated planting date trials conducted in Wisconsin and Michigan.

This summary of the 2014 and 2015 soybean benchmarking and yield gap producer surveys indicates that the soybean yield gap for Michigan producers is between 26% and 28%. This is among the highest for the 10 identified regions in the North Central US. The summary also identifies key management practices responsible for the yield gap which can be implemented to increase soybean yields in the future. We will ask producers to complete and submit surveys again for 2017.

The information presented in this article was extracted from two, more comprehensive and detailed publications which are listed below. Both publications are available online at: http://fieldcrop.msu.edu/soybeans/.

References:

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