

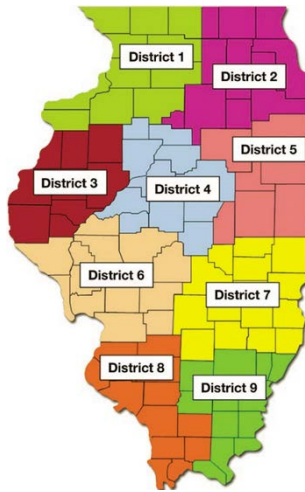


**Project Objectives:**

The goal of this project is to work with producers and retailers to improve N, P, and K fertilizer recommendations for Illinois. Specifically, we seek to modernize P and K removal rates by analyzing P and K concentrations in corn, soybean, and wheat grain samples collected from producers across Illinois. This information is essential for nutrient replacement plans and optimal crop management.

**Preliminary Results**

**Sampling numbers:** Number of samples collected and analyzed to this date is detailed in **Table 1**.



Year	CRD	Corn	Soybean	Wheat
<b>2014</b>	1	183	131	0
	2	45	81	1
	3	60	78	0
	4	103	140	2
	5	86	113	5
	6	88	124	1
	7	36	135	4
	8	43	94	1
	9	39	55	4
<b>2014</b>	<b>Sub-total</b>	<b>684</b>	<b>951</b>	<b>18</b>
<b>2015</b>	1	62	104	8
	2	88	78	4
	3	69	79	1
	4	66	117	12
	5	110	85	22
	6	65	92	24
	7	122	145	44
	8	17	64	231
	9	18	59	19
<b>2015</b>	<b>Sub-total</b>	<b>617</b>	<b>823</b>	<b>365</b>
<b>2016</b>	<b>Sub-total</b>	<b>840</b>	<b>408</b>	<b>242</b>
<b>Total analyzed</b>		<b>2,141</b>	<b>2,182</b>	<b>625</b>

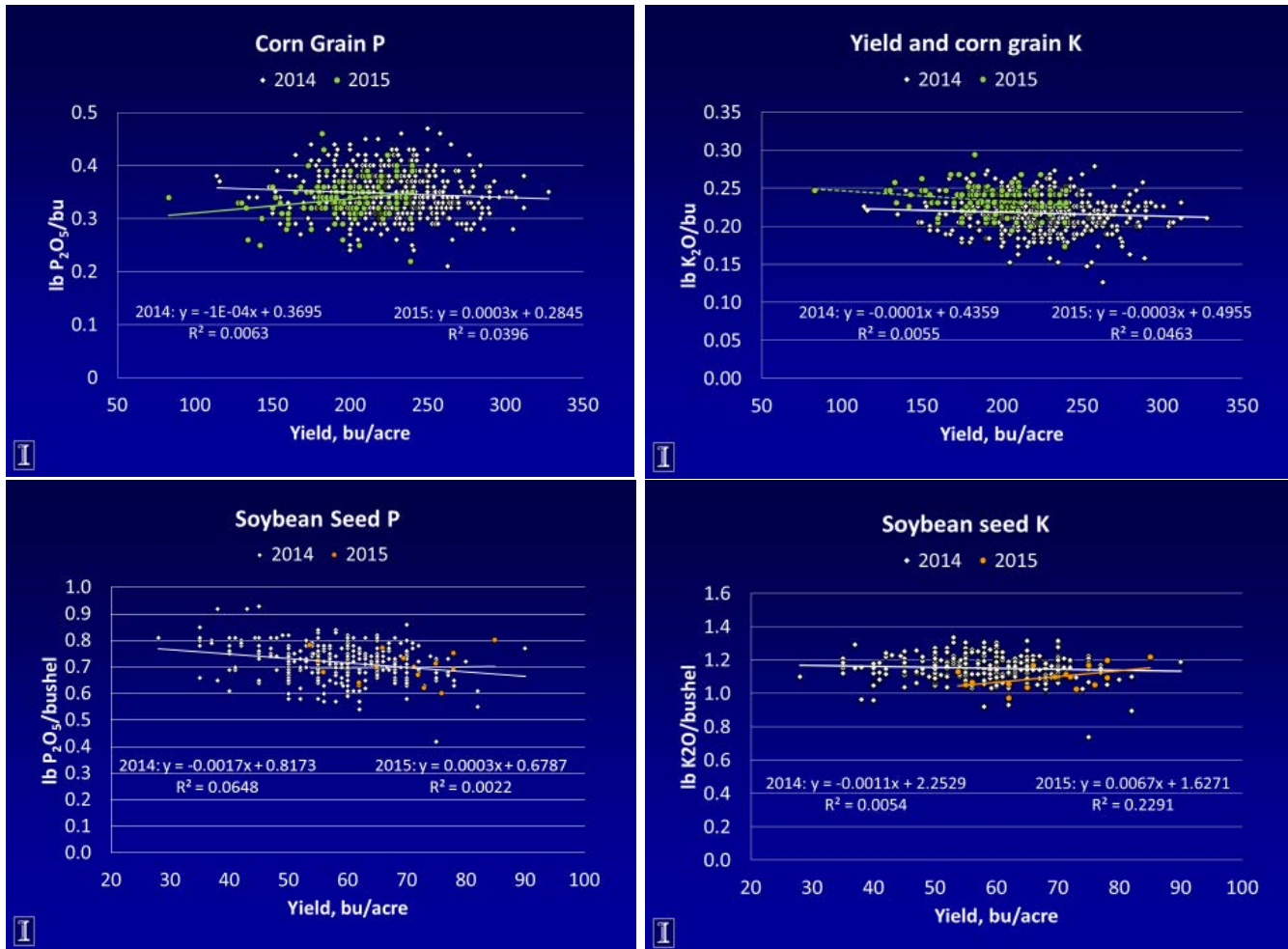
**Table 1.** Number of samples of corn, soybean, and wheat grains collected per crop reporting district (CRD) and year of the study. Totals for each crop analyzed to date are included at the bottom of the table

We were able to collect samples from all nine Cropping Reporting Districts (CRD) for corn and soybean. The wheat crop was not well represented during our first year due to a general failure of the crop but sampling during 2015 and 2016 achieved good numbers.

**Relation with yields:** **Figure 1** shows the relationships between corn yield (bushels/acre) and P and K concentrations in grain (expressed as pounds P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O/bushel) in samples collected in 2014 and 2015. Similar trends were found for the soybean crop in both years, with grain yield for both crops unrelated to P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O concentrations in harvested grain as revealed by the low values of the Pearson correlation coefficients and their non-statistically significant levels.

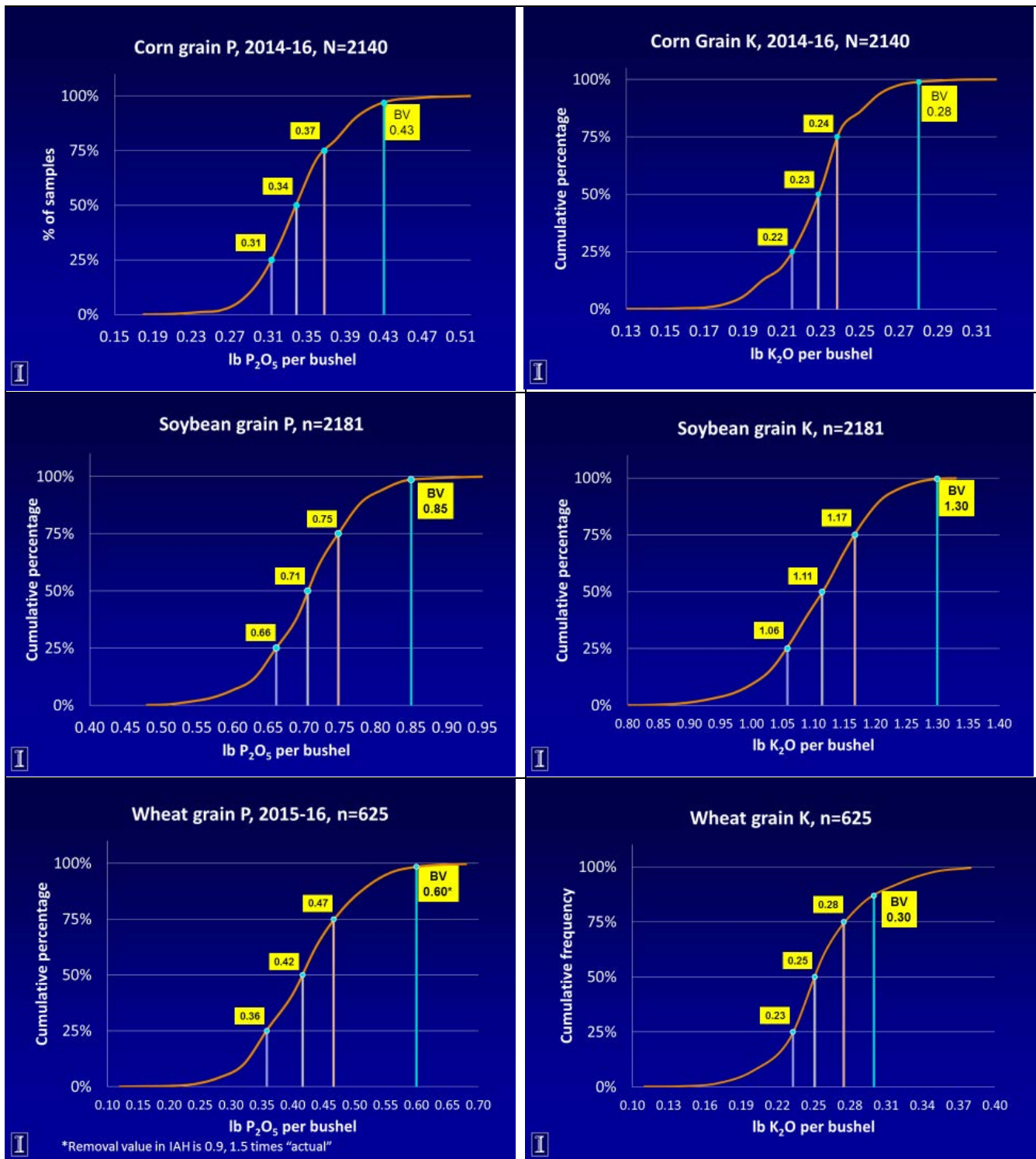


This lack of measurable relation between yield levels and nutrient concentration in grains allowed us to remove the requirement of reporting yields when submitting the grain samples, which led to easier sampling and reporting across the state.



**Figure 1.** Corn (upper panels) and soybean (lower panels) yield (bu/ac) and P and K concentrations in grain (expressed as pounds P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O/bushel) in samples collected in 2014 and 2015.

**Nutrient removal estimates:** Figure 2 shows estimates of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per bushel of corn (upper panels), soybean (middle panels), and wheat (lower panels) crops in this study based on 2040, 2181, and 625 grain samples for each crop respectively, collected across the state. Table 2 illustrates the variability associated to crop reporting districts each year for each crop and nutrient evaluated in our samples. In addition, Table 3, presents a summary of our study results, comparing the ranges of nutrient removal determined for our samples from each crop and the corresponding book values commonly used.



**Figure 2.** Corn (upper panels), soybean (middle panels), and wheat (lower panels) grain P (left panels) and K (right panels) concentrations (expressed as pounds P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O/bushel) in samples collected and analyzed up to January 2017 compared with the book values (bv) commonly used. The yellow boxes from left to right on each curve indicate the values obtained for 25%, 50% and 75% of the samples analyzed.



CRD	Corn			Soybean			Wheat		
Year	Nº	P2O5/bu	K2O/bu	Nº	P2O5/bu	K2O/bu	Nº	P2O5/bu	K2O/bu
CRD 1-2	627	0.35	0.23	658	0.71	1.12	56	0.42	0.26
CRD 3-5	841	0.34	0.23	833	0.69	1.11	78	0.47	0.28
CRD 6-7	530	0.34	0.23	658	0.70	1.12	170	0.40	0.26
CRD 8-9	336	0.36	0.23	471	0.73	1.10	321	0.41	0.25
2014	683	0.35	0.22	919	0.71	1.12	-	-	-
2015	617	0.34	0.23	851	0.70	1.11	382	0.42	0.24
2016	1035	0.34	0.23	792	0.73	1.11	243	0.41	0.27
Total/avg	2334	0.34	0.23	2620	0.71	1.11	625	0.42	0.26

**Table 2.** Number of samples (Nº), and estimates of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O removal per bushel of corn, soybean, and wheat per CRD and year of sampling. We have only a few samples of wheat during the first year of collection so estimates of removal are not included for 2014.

Nutrient	No. of	Average	Range, percentile		Book	% change
	samples	value	25th	75th	value	BV to 75th%
-----lb P/K (oxide) per bushel-----						
Corn P	2,334	0.34	0.31	0.37	0.43	14
Corn K	2,334	0.23	0.22	0.24	0.28	15
Soybean P	2,620	0.71	0.66	0.75	0.85	12
Soybean K	2,620	1.11	1.06	1.17	1.30	10
Wheat P	625	0.42	0.36	0.47	0.60	22
Wheat K	625	0.26	0.23	0.28	0.30	8

**Table 3.** Number of samples (Nº), and estimates of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O removal per bushel of corn, soybean, and wheat per CRD and year of sampling. We have only a few samples of wheat during the first year of collection so estimates of removal are not included for 2014.

**Findings to date:**

- We don't know the origin of the "book values", so we don't know if values have changed or not
- Current (75th percentile) numbers are modestly (average about 12%) lower than the book values
- Differences between years and regions aren't large enough to consider these in guidelines
- Removal levels per bushel do not vary with crop yield
- The new IL numbers are comparable to the (2011) Iowa State University numbers

**Significance of findings:**

- Those who are using nutrient replacement to set P and K rates have probably been moving soil test levels up that may or may not be noticeable. Removal calculations can be adjusted to use the new numbers.
- We have NO indication that current soil test levels are "inadequate" for high yields; better root systems of today's hybrids and varieties makes them better at extracting nutrients.



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End of cycle report 2017

*Updating P and K Response and Crop Removal Numbers for Illinois*

**Outreach:** Dr. Nafziger shared these results at the ILFCA in January 2017 and during the Crop Management conferences Jan-Feb 2017 organized by University of Illinois Extension in several locations across the state.

**Budget:** No changes needed at this point.