




Wheat Variety Yield Data: Do Commercial and Public Performance Tests Provide the Same Information?

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MOTIVATION

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- Wheat performance test in Kansas has for many years been conducted by K-State
 - Reported information from performance test trials is crucial to producers
 - Recent private sector involvement
 - Sygenta, WestBred, Limagrain
 - Highly competitive wheat seed market
 - Yield data shows
 - Reported “best” varieties differ across breeders
 - Potential information asymmetry to wheat producers



OBJECTIVES

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- Quantify the impact of private and public wheat breeding programs on yields over time
 - Test for sample selection bias between public and private wheat yield data.

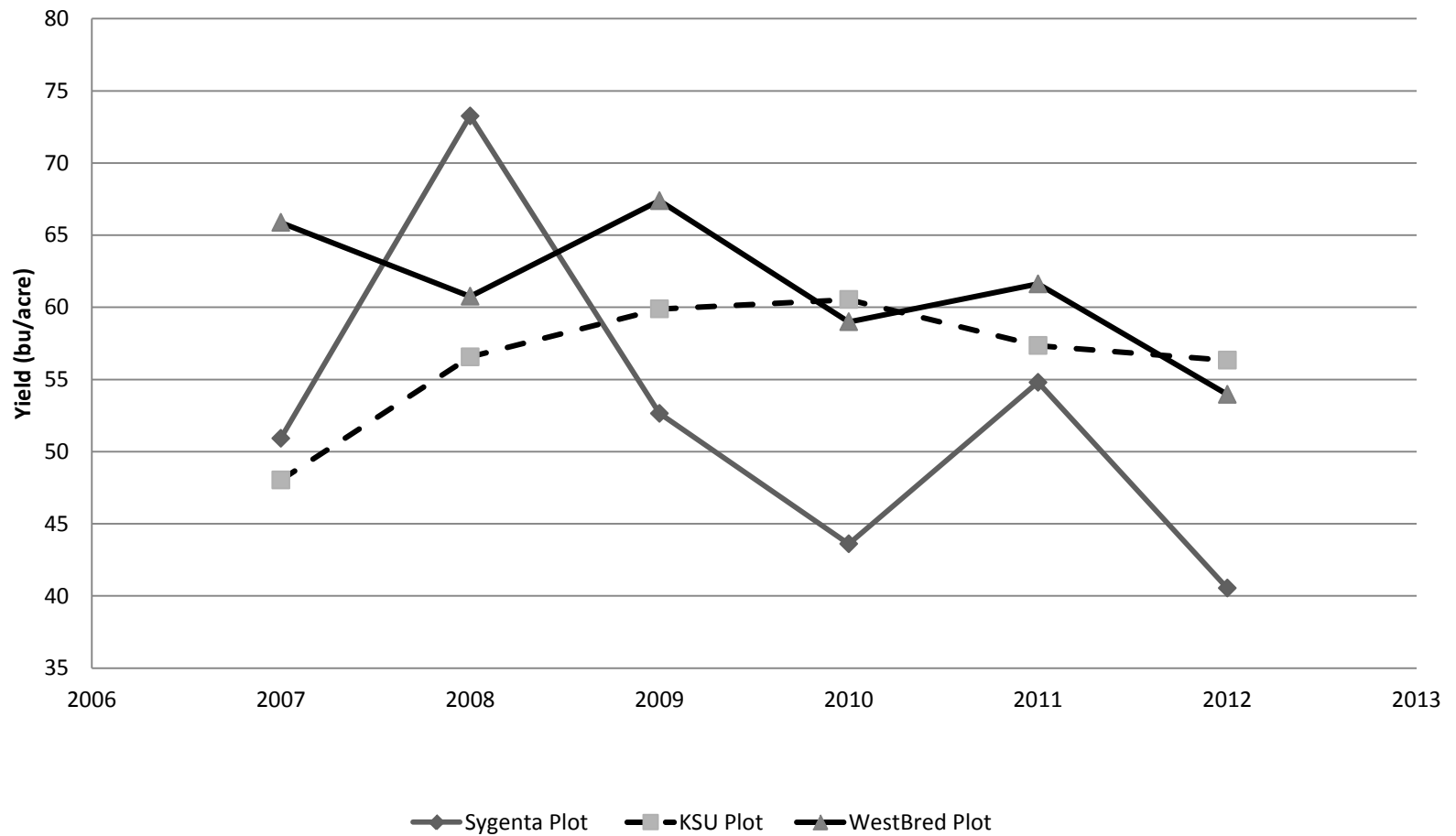


DATA AND METHODS

Dataset reports for:

- 113 unique wheat varieties
- 17 unique public and private breeder institutions or companies
 - Only four breeders have experimental plots in Kansas
 - KSU, Syngenta, WestBred and Limagrain
- 71 unique experimental sites.
 - 23 for Syngenta plot
 - 19 for KSU plot
 - 20 for WestBred plot
 - 6 for Limagrain plot

Mean yields across Kansas wheat test plots, 2007-2012



Methods: Impact of Wheat Breeding Programs

$$Yield_{ijkt} = \alpha + \beta_1 HWW_i + \beta_2 IRR_i + \beta_3 RLYR_i + \beta_4 YEAR_t + \delta_i + \theta_i + \gamma_i + \nu_i + \varepsilon_{ijkt}$$

$Yield_{ijkt}$: yield in bushels per acre

HWW_i : hard white wheat

IRR_i : irrigated

$RLYR_i$: release year for *variety* i .

$YEAR_t$: trend term for the trial year spanning the study period (2007-2012).

δ_i : vector of qualitative variable for each of seventeen (17) wheat breeders

θ_i : vector of qualitative variable for each of the three (3) regions.

γ_i :vector of qualitative variable for each experimental plot.

ν_i :vector of interaction terms between same experimental plot and same breeder variables.

ε_{ijlt} : normally distributed error term that captures unmeasured variables.

Heckman Model

Hypothesis:

Breeders non-randomly report their high-yielding “best” varieties together with low-yielding “worst” varieties of their competitors

- *Outcome Equation:*

$$\text{YieldPlt}_{it} = \varphi + \phi_1 \text{HWW}_i + \phi_2 \text{IRR}_i + \phi_3 \text{RLYR}_i + \phi_4 \text{YEAR}_t + \psi_i + \theta_i + u_{it}$$

- *Selection Equation:*

- $\text{Plt}_{ik}^* = \phi_1 Z_{t-1} + \phi_2 \text{RLYR}_i + \phi_3 \text{BR}_n + \varepsilon_{it}$
 - $\text{Plt}_{ik} = 1$ if $\text{Plt}_{ik}^* > 0$
 - $\text{Plt}_{ik} = 0$ otherwise



RESULTS


Ordinary Least Square Estimates

Variable	Model 1		Model 2	
	Coefficient	Std. Err.	Coefficient	Std. Err.
Irrigated	15.42***	-0.7014	15.43***	-0.7017
Hard White Wheat	-0.27	-0.8226	-0.22	-0.8272
East	-7.39***	-1.0354	-7.40***	-1.0359
West	8.13***	-0.5736	8.14***	-0.5739
Release Year	.22***	-0.0650	.22***	-0.0654
Year	-1.01***	-0.1699	-1.01***	-0.1706
Sygenta Plot	-3.45***	-0.6547	-3.12***	-0.8093
WestBred Plot	6.13***	-0.6051	6.29***	-0.6843
Limagrain Plot	-7.91***	-2.0019	-8.30**	-2.6209
WestBred	2.75**	-0.8485	3.03**	-0.9576
NU	3.29*	-1.4188	3.23*	-1.4236
Interaction term 1			-0.85	-1.2531
Interaction term 3			-0.72	-1.2569
Interaction term 4			0.99	-3.9831
Intercept	1630.32***	-319.77	1635.31***	-320.18
Adjusted R ²	0.225		0.224	
F ratio	66.68***		59.55***	

Estimates of the Heckman selection model

	Sygenta Plot		KSU Plot		WestBred Plot	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Selection Equation						
Mean Z lag	0.05	0.07	0.06	0.05	0.03	0.06
Sygenta	0.93***	0.06	--	--	--	--
KSU	--	--	0.47***	0.07	--	--
WestBred	--	--	--	--	0.46***	0.06
Release Year	0.02***	0.01	0.00	0.01	-0.03***	0.01
Constant	-50.64***	16.20	5.00	13.45	49.34***	13.67
Mills ratio						
λ	3.07	2.61	2.86	4.75	-1.14	4.36
ρ	0.19		0.17		-0.08	
σ	16.11		17.02		15.14	
Censored observation	2072		1261		1988	
Uncensored observation	588		1399		672	
Wald Test	127.96***		443.02***		188.18**	

CONCLUSION

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- West Kansas is the most productive region
 - Higher contribution of public wheat breeding program(performance testing) to improvements in varietal yield
 - No evidence of non-random selection of wheat varieties by breeders
 - OLS estimates are unbiased



Thank you for your time!

Questions?

Comments?

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