16. Evaluating Impacts of Ag Technology Adoption

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Dr. Terry Griffin is the cropping systems economist specializing in precision agriculture since joining Kansas State University in February 2015. He earned his bachelor's degree in agronomy and master's degree in agricultural economics from the University of Arkansas and his Ph.D. in Agricultural Economics with emphases in spatial technologies and farm management from Purdue University. He developed methods to analyze site-specific yield monitor data from field-scale experiments using spatial statistical techniques. Terry is a charter member of the International Society of Precision Agriculture. He received the 2014 Pierre C. Robert International Precision Agriculture Young Scientist Award for his work in data utilization. He has also received the 2012 Conservation Systems Precision Ag Researcher of the Year and the 2010 PrecisionAg Awards of Excellence for Research.

Abstract/Summary

Precision agricultures studies have evaluated the agronomic and economic benefits of the technologies focused on single fields, but to a lesser extent on whole-farm profitability. Using Kansas Farm Management Association (KFMA) farm data, the adoption and impact of precision agricultural technologies were evaluated for ten precision agricultural technologies on 360 farms to determine the impact for 1) with and without and 2) before and after adoption. This study provides insights into the farm management impact of precision agriculture.

Adoption and Utilization of Precision Agricultural Technology

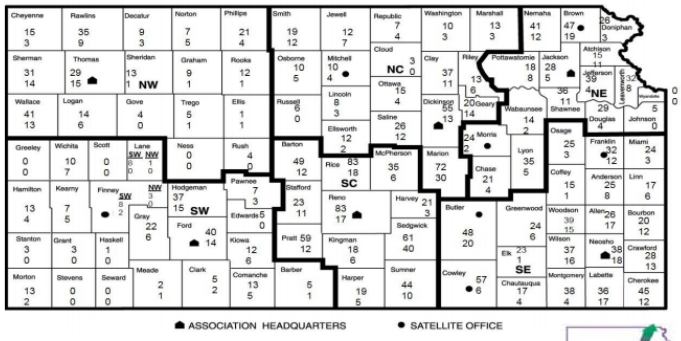
Terry Griffin & Noah Miller

Kevin Herbel, Gregg Ibendahl, Ajay Sharda, Ignacio Ciampitti, Brian McCornack

Risk & Profit

KFMA Membership

Benchmarking >1,500 peers across the state



The instrument

KFMA Economist _____

Farm number _____

Farm name _____

Precision Ag Technology	Have you ever used this technology (yes/no)	If ever used, year began	If ceased to use, year ended
combine yield monitor (without GPS)			
combine yield monitor (with GPS)			
GPS lightbar guidance *			
GPS automated guidance *			
GPS automated section control (auto boom or auto row shutoff) *			
grid soil sampling (<5 acre grids) or management zone sampling (by soil or other defined zone)			
imagery (aerial, satellite, drone, UAV, UAS)			
telematics (tracking of equipment, sprayers, combines, or also irrigation; wireless data transfer)			
variable rate N, P, K, lime with automated controller *			
variable rate seeding *			
other 1 (i.e. cotton harvester yield monitor w/out GPS, cotton harvester yield monitor w/ GPS, turn compensation sprayer, turn compensation planter) _____			
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* Indicates farm-level equipment only (do not consider custom application)

Focus on 10 technologies

- Yield monitor w/out GPS
- Yield monitor w/ GPS
- Lightbar guidance (manual control)
- Automated guidance
- Automated section control (planter or sprayer)
- Grid/zone soil sampling
- Imagery (think drones)
- Telematics (wireless data transfer, think OnStar)
- Variable rate fertilizers
- Variable rate seeding

Preliminary results

- Project initiated summer 2015
- Data collection began Fall 2015
  - Target sample expected by Winter 2016/2017
  - After initial data collection, annually updated
    - New adoption, abandonment, members, technologies
- Target sample size n = 1,400
  - Current sample size n = 358

Number of Kansas farms adopting precision agriculture technology

Technology	Farms adopting	% of total (N=348)	as % of AGS (N=228)	as % of YM (N=136)
GPS Automated Guidance	228	65.5	**100.0**	167.6
GPS Automated Section Control	162	46.6	71.1	119.1
GPS Lightbar Guidance	141	40.5	61.8	103.7
Grid Soil Sampling	140	40.2	61.4	102.9
Combine Yield Monitor (w/ GPS)	136	39.1	59.6	**100.0**
Auto Variable Rate N, P, K, Lime	87	25.0	38.2	64.0
Combine Yield Monitor (w/out GPS)	86	24.7	37.7	63.2
Variable Rate Seeding	58	16.7	25.4	42.6
Imagery	44	12.6	19.3	32.4
Telematics	25	7.2	11.0	18.4
Turn Compensation Sprayer	4	1.1	1.8	2.9
Turn Compensation Planter	2	0.6	0.9	1.5

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Number of Kansas farms abandoning precision ag technology

	Farms adopted	Farms abandoned	% farms abandoning
Combine Yield Monitor (w/out GPS)	144	58	40.3
GPS Lightbar Guidance	196	55	28.1
Telematics	27	2	7.4
Grid Soil Sampling	147	7	4.8
Auto Variable Rate N, P, K Lime	91	4	4.4
Imagery	45	1	2.2
Combine Yield Monitor (w/ GPS)	138	2	1.4
GPS Automated Guidance	229	1	0.4
GPS Automated Section Control	162	0	0
Turn Compensation Planter	2	0	0
Turn Compensation Sprayer	4	0	0
Variable Rate Seeding	58	0	0

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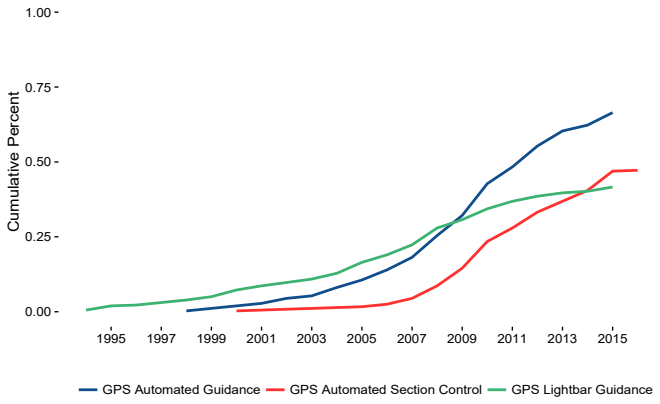
Automated GPS technology



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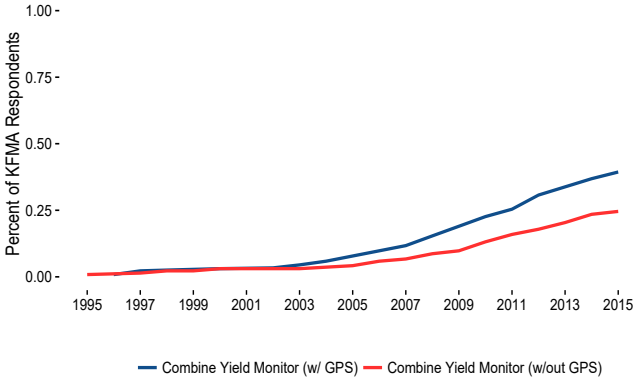
Combine Yield Monitors



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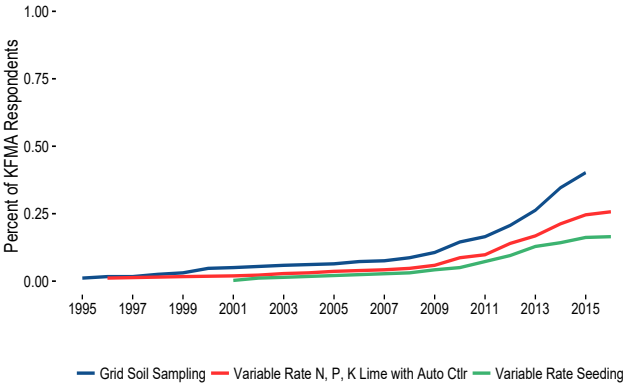
Sampling & Variable Rate



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Number of years technologies utilized before abandonment

	Farms abandon	Mean years	Min years	Max years
Combine Yield Monitor (w/out GPS)	58	6.2	2	20
GPS Lightbar Guidance	55	5.1	1	13
Grid Soil Sampling	7	5.7	1	21
Auto Variable Rate N, P, K Lime	4	1.3	1	2
Combine Yield Monitor (w/ GPS)	2	2.0	2	2
Imagery	1	1.0	1	1

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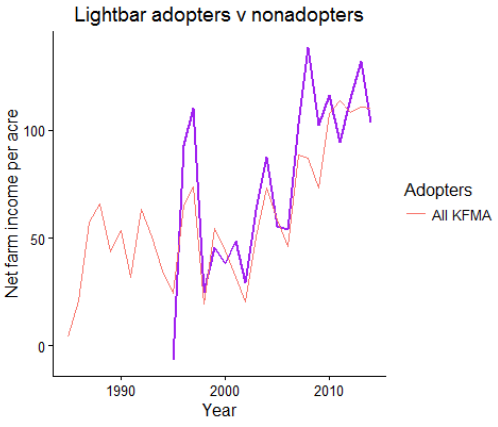
Difference in NFI



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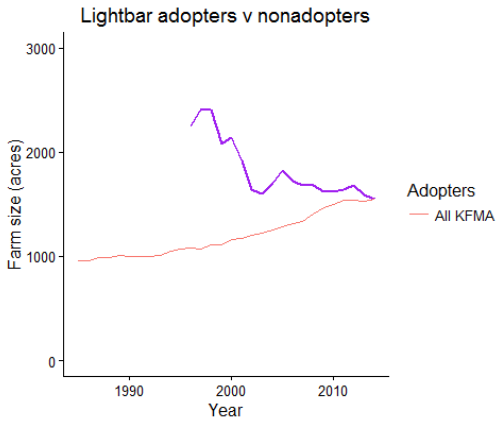
Difference in Acreage



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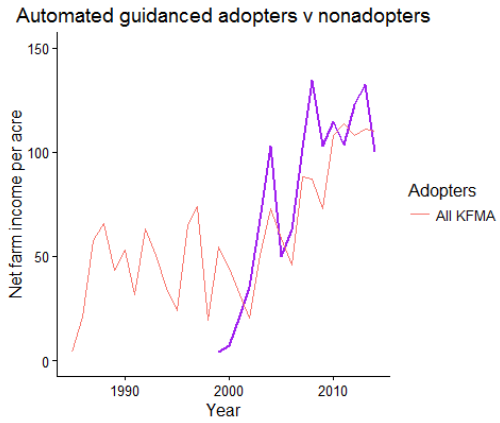

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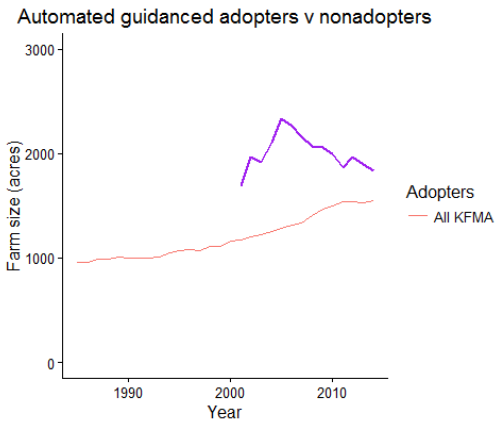

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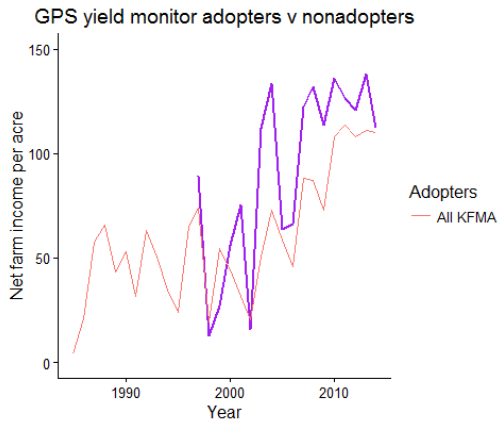

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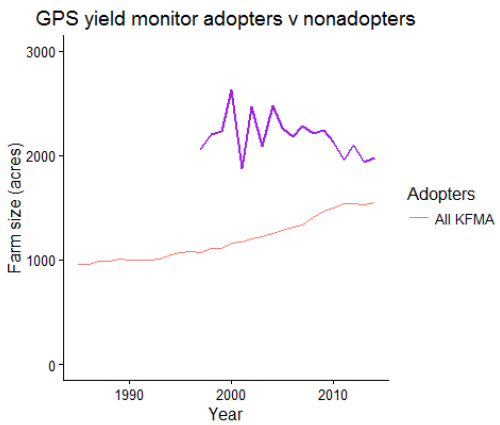

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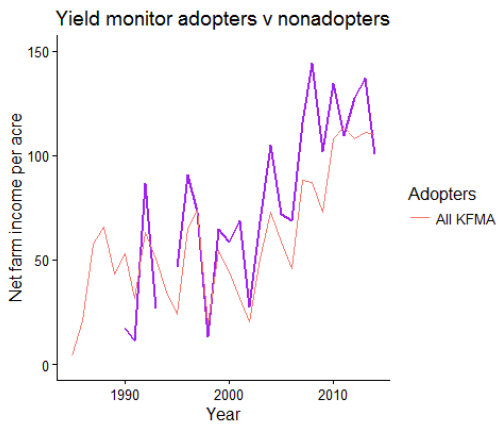

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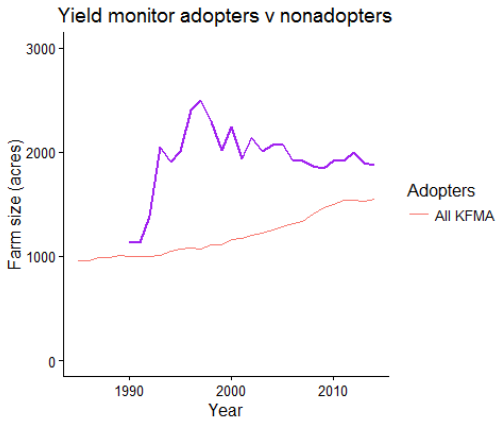

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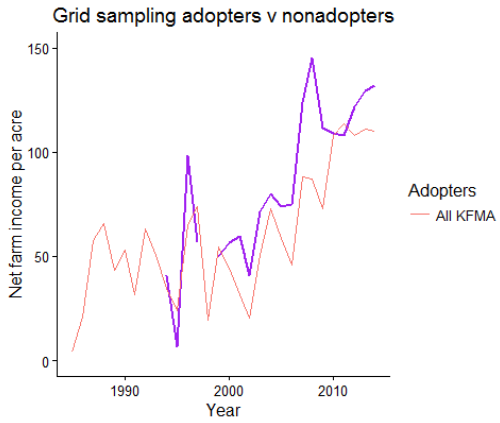

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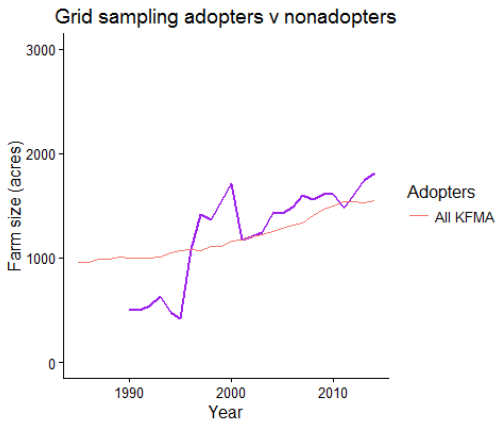

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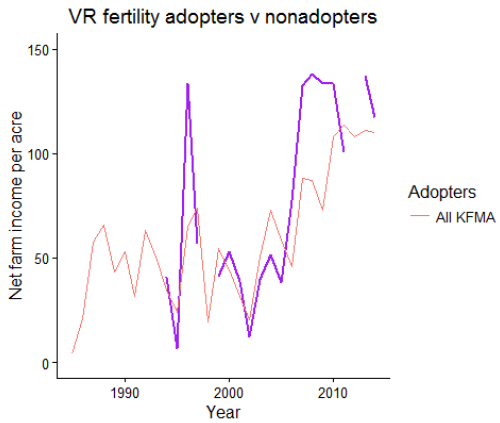

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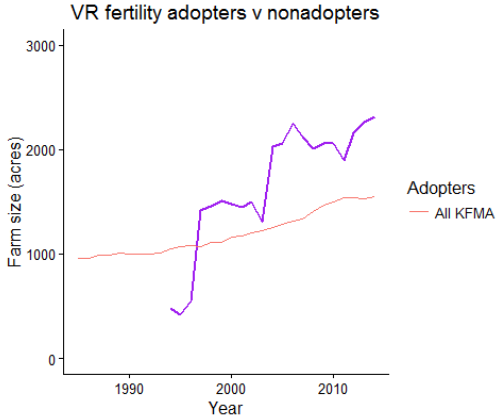

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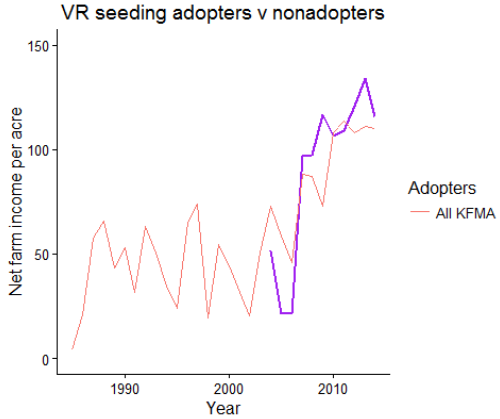

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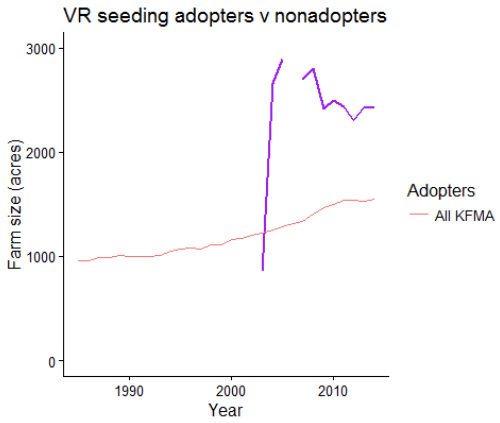

- Some technologies have quicker payback
  - Others dependent upon management ability
- Some technologies make life easier
  - Others require addition skill and effort

Next steps

- Agronomic and financial analyses including
  - 1) with and without
  - 2) before and after adoption.
- Characteristics of adopters prior to adoption
- Examine 'bundles' of technology
- Encourage other states to conduct similar study
  - Multi-state compare-contrast would be interesting

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