Knowledge and Adoption of Best Management Practices to Address Water Quality Issues

Michael Black, *Center for Agricultural and Rural Sustainability, Division of Agriculture, University of Arkansas System.* michael.black13@outlook.com
Jennie Popp, Ph.D., *Center for Agricultural and Rural Sustainability, Division of Agriculture, University of Arkansas System.* jhpopp@uark.edu
Andrew Sharpley, Ph.D., *Department of Crop, Soil, and Environmental Sciences, Division of Agriculture, University of Arkansas System.* sharpley@uark.edu
Mike Daniels, Ph.D., *Cooperative Extension Service, Division of Agriculture, University of Arkansas System.* mdaniels@uaex.edu

Selected Poster prepared for presentation at the
2015 Agricultural & Applied Economics Association and Western Agricultural Economics Association Joint Annual Meeting, San Francisco, CA, July 26-28

Knowledge and Adoption of Best Management Practices to Address Water Quality Issues

M. Black[1], J. Popp, Ph.D.[1], A. Sharpley, Ph.D.[2], and M. Daniels, Ph.D.[3]
[1]Center for Agricultural and Rural Sustainability, Division of Agriculture, University of Arkansas System
[2]Department of Crop, Soil, and Environmental Sciences, Division of Agriculture, University of Arkansas System
[3]Cooperative Extension Service, Division of Agriculture, University of Arkansas System

DIVISION OF AGRICULTURE RESEARCH & EXTENSION
University of Arkansas System

Center for Agricultural and Rural Sustainability

INTRODUCTION

The Illinois River Watershed (IRW) is located in NW Arkansas and NE Oklahoma. Poultry and beef production dominates local agriculture, and phosphorus and nitrogen runoff from litter/manure can impair the river's water quality.

Efforts to control nonpoint source pollution (NPS) that impacts water quality have focused on conservation practices, also known as best management practices (BMPs). BMPs are voluntary, and therefore adoption rates vary due to availability of financial/technical assistance, environmental perceptions, and perception and knowledge of BMPs, among other things.

The Arkansas Discovery Farm Program studies the effectiveness of BMPs on Arkansas farms including in the IRW. That research, coupled with insights into farmer perceptions of BMPs, may lead to new outreach programs which may increase adoption of BMPs, and further reduce runoff in the impaired watershed.

OBJECTIVES

Gather data to help better understand farmers':
- perceptions of water quality in the watershed
- perception and adoption of BMPs within the watershed

METHODS

A survey of Arkansas IRW producers was conducted in 2013 – 2014. Questions were related to characteristics of the farm/farmer, perceptions of water quality issues in the IRW and adoption rates and perceptions of eight BMPs: basing fertilizer application on soil test results, controlled grazing, filter strips/riparian buffer, litter storage sheds, pasture grass management, soil testing, use of a nutrient management plan, and use of manure instead of commercial fertilizer.

Statistical tests (chi-square and Fisher's exact) were conducted to determine if perception and adoption of BMPs differed by farmers engaged in different types of production and by perception of water quality in the watershed.

RESULTS

A total of 582 producers completed the survey. Demographics of respondent farms were compared to Census of Agriculture (2012) data for Northwest Arkansas. No significant differences between regional farms and respondent farms existed, suggesting survey data is representative of area producers.

Overall Survey Highlights:
- Of all respondents, 54% listed their agricultural operation as their primary job.
- The most common farm size was between 50 to 179 acres (42%), followed by 10 to 49 acre farms (32%).
- Poultry (35%) and beef (70%) production dominated agricultural production, though overall, 80% of respondents engaged in more than one type of agriculture.
- While each BMP was viewed as effective by 53 to 82 percent of respondents, only four of them were adopted by over half of respondents:
  - soil testing (95%),
  - use of a nutrient management plan (93%),
  - basing fertilizer application on soil test results (81%),
  - grass management (54%).
- Only 16 to 33 percent of respondents adopted any of the remaining four BMPs.
- 84% of respondents believed that water quality issues existed in the watershed.

Table 1. Differences by Opinion on the Existence of Water Quality Issues: Perceived Effectiveness and Adoption Rates of BMPs

Management Practices	Percent of responses (%[a])							
	Effectiveness of BMPs[b]					Adoption of BMPs[c]		
	WQ[d] Issues		No WQ[d] Issues		p-value[e]	WQ[d] Issues	No WQ[d] Issues	p-value[e]
	Yes	Not Sure	Yes	Not Sure				
Basing fertilizer application on soil test	84	6	73	16	0.0073*	83	73	0.0399*
Controlled Grazing	80	11	59	26	0.0001*	33	33	1.0000
Filter strips/riparian buffer	61	20	51	24	0.1821	23	11	0.0091*
Litter storage shed	57	18	50	23	0.3647	17	6	0.0082*
Pasture grass management	76	15	62	27	0.0102*	56	45	0.0735
Soil testing	82	7	84	11	0.1026	97	81	0.0001*
Use of a nutrient management plan	62	20	37	32	0.0001*	96	77	0.0001*
Use of manure instead of comm. fertilizer	43	21	28	35	0.0031*	18	17	0.8771

[a]Row may not sum to 100% due to rounding
[b]Response of "no" is omitted, but it can be inferred as the difference between the sum of "yes" and "not sure", and 100
[c]Rate of adoption (percent of respondents who claimed they have adopted the given BMP)
[d]"WQ Issues" refers to producers who believe water quality (WQ) issues exist; "No WQ Issues" refers to producers who do not believe water quality issues exist
[e]α=0.05

Table 2. Differences by Producer Group: Perceived Effectiveness of BMPs

Management Practice	Percent of responses (%[a])								
	Poultry[b]		Beef[b]		Both[b,c]		Neither[b,d]		p-value[e]
	Yes	Unsure	Yes	Unsure	Yes	Unsure	Yes	Unsure	
Basing fertilizer application on soil test	84	4	85	6	87	8	71	14	0.0121*
Controlled Grazing	86	8	76	12	77	11	73	22	0.0222*
Filter strips/riparian buffer	73	16	61	21	70	11	41	29	0.0001*
Litter storage shed	69	10	51	21	68	10	52	23	0.0190*
Pasture grass management	80	16	71	15	82	14	71	23	0.0066*
Soil testing	88	8	79	8	87	4	84	9	0.2152
Use of a nutrient management plan	69	24	56	20	71	19	48	30	0.0013*
Use of manure instead of comm. fertilizer	49	10	37	23	57	15	36	34	0.0002*

[a]Row may not sum to 100% due to rounding
[b]Response of "no" is omitted, but it can be inferred as the difference between the sum of "yes" and "not sure", and 100
[c]Respondents involved in both poultry and beef production are captured in this category, and are not counted in the "poultry" nor "beef" columns
[d]Respondents involved in neither beef nor poultry production are captured in this category
[e]α=0.05

RESULTS (continued)

Differences by Group:
- Table 1 shows that those who believed water quality issues exist were significantly ($p<0.05$) more likely to:
  - perceive five BMPs as effective
  - be less unsure on the effectiveness of BMPs
  - adopt five BMPs
- When compared to other producers, poultry producers (poultry only, or both poultry and beef) were significantly more likely to perceive seven of the BMPs as effective (Table 2).
- Adoption rates, however, differed based on relevance of the practice to the type of production (e.g. poultry producers adopted litter storage sheds, and beef producers adopted controlled grazing).

CONCLUSION

- Differences in adoption and perceptions of BMPs varied by the operation type and by the respondent's perception of water quality in the watershed.
- Different producer types displayed different opinions about the listed BMPs, but belief in the existence of watershed water quality issues was more often associated with increased adoption rates and greater belief in the effectiveness of BMPs.
- Focusing educational/outreach efforts on demonstrating the existence of water quality issues may prove to be the most effective tool in increasing the adoption rates of BMPs in the watershed and improving water quality for downstream stakeholders in Oklahoma.

Funding for this survey was provided by the Walton Family Foundation (Grant Number: 2012-704).