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Adoption of Phytase by Livestock Farmers

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"Today, everyone should be feeding phytase because of dical price."
- Dr. Marcia C. Shannon

Introduction

The grains and oil seeds in animal feed contain nutrients, like calcium and phosphorus, that are bound in a salt called phytate. Unfortunately, non-ruminants, like pigs and poultry, lack the ability to digest phytate. Instead of adding inorganic phosphorus, a farmer could add phytase, an enzyme that breaks up phytate, saving money on feed and reducing phosphorus pollution.

Phytase became commercially available in Europe in 1991 and regulations made phytase use widespread (Institute for Applied Environmental Economics). It was not approved by the FDA until late 1995 (Kornegay). By 1997, two studies concluded that phytase was profitable if the manure was required to be land-applied at agronomic rates (Bosch *et al*). Maryland mandated phytase in 1998 and Virginia followed in 1999. The EPA concluded in 2001 that phytase would only cost 1% more while reducing phosphorus output by 40% (EPA).

Phytase has overcome several technological barriers and production costs have decreased. Increasing dicalcium phosphate prices have also made phytase more profitable. However, to our knowledge, no other studies of the adoption of this new technology have been published.

Image taken from: www.tradekey.com

Objectives

- To examine social and economic factors that impact the stated adoption of phytase.
- To determine the state of farmer knowledge about this new technology.

Model

Since a farmer can receive satisfaction from the economic and environmental benefits of phytase, this model is based on utility maximization. The variables relate to relative advantage and compatibility of phytase as well as the socio-economic characteristics of the farmer.

U = f(Profit, Time, Phytase water quality effect, Water quality concern, Species, Animal units per acre, Manure transfers, Outside influence, Off-farm income, Education, Age, State)

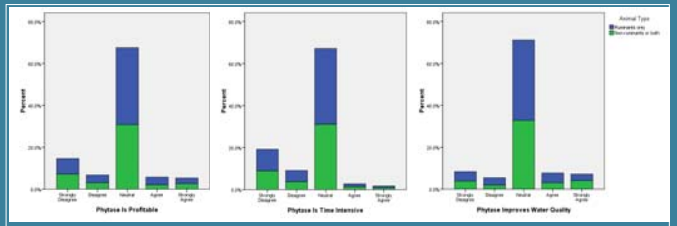
Methods

- A mail survey was conducted, following Dillman, among 3,014 randomly selected livestock producers in Missouri and Iowa in Spring 2006.
- The effective response rate was 37.4 percent.
- A logit regression was conducted to determine how the farmer's response was influenced by factors relating to the farm and the farmer.
- 437 surveys were used after dropping blank or "Don't Know" responses.

Logit Regression Results

Variable	Description	Coef.	Marginal Effect
Phytase Not Profitable (1-2)	Indicator Variables, Based on Likert Scale (1 - 5), Base "3"	-0.437	-0.010
Phytase Profitable (4-5)		1.897***	0.101
Not Time Intensive (1-2)		1.115***	0.036
Time Intensive (4-5)		-0.821	-0.015
Doesn't Improve Water (1-2)		-0.294	-0.007
Improves Water (4-5)		1.424***	0.059
Not Concerned about Water Quality (1-2)		-0.562	-0.012
Water Quality Concern (4-5)		-1.635**	-0.074
Dairy	Indicator, 1 if Species is ≥¼ of all animal units on the farm, Base "Swine (>55 lbs)"	-2.244***	-0.038
Beef Cattle		-1.639***	-0.034
Beef Cow		-2.596**	-0.044
Swine (<55 lbs)		0.460	0.015
Turkey		-0.871	-0.017
Animal units per acre		0.009	0.000
Sell Manure	Indicator, 1 if farmers sell (give) manure, Base "no"	-1.492*	-0.025
Give Manure		1.621***	0.081
Contractor (Low, 1-2)	Indicator, Based on Likert Scale from 1, no influence, to 5, very high influence, Base "3"	0.179	0.004
Contractor (High, 4-5)		-0.741	-0.015
Other Farmers (Low, 1-2)		-0.340	-0.008
Other Farmers (High, 4-5)		-0.531	-0.012
NRCS (Low, 1-2)		-0.058	-0.001
NRCS (High, 4-5)		0.359	0.010
$0 - $9,999	Indicator, Base: "No off-farm income"	-0.717	-0.015
$10K - $24,999		-1.197*	-0.022
$25K - $49,999		-0.602	-0.014
$50K - $99,999		-1.893**	-0.028
$100K +		-0.904	-0.016
High School Diploma	Indicator, Base "Less than High School"	0.292	0.008
Some College or Vocational School		0.743	0.022
Bachelor's Degree		1.241	0.048
Age	In years	0.015	0.000
Iowa	Indicator, Base = Missouri	2.206***	0.061

Pseudo R-Square= 0.5273 Overall Correct= 90.8% LR Chi-Squared (32 d.f.)= 206.35



Results

- People are more likely to say they use phytase if they think it is profitable, not time intensive, and improves water quality.
- They are less likely to indicate they use it if they are concerned about water quality, have ruminants, or have off farm income.
- They are also more likely to say they use it if they give their manure away and are from Iowa.
- The stated adoption rate for the survey was 7.7%, among farmers with non-ruminants the adoption rate was 17.2%.
- 355 of 951 farmers surveyed did not know whether they used phytase.
- The majority of responses concerning phytase attributes were neutral.
- 78% of farmers stated they were concerned about water quality.
- 71 of 79 phytase users came from Iowa.
- There were no broiler farmers that indicated they used phytase.

Implications

- Since most premixes for non-ruminants include phytase (Shannon) the fact that no broiler farmers, only 5% of turkey farmers, and less than half of swine farmers reported using phytase suggests there is an information disconnect between farmers and feed-manufacturers/contractors.
- While the stated adoption rate for non-ruminants was only 17%, the actual rate is much higher so we are measuring knowledge rather than adoption.
- Centralized decision-making by feed-manufacturers/contractors to reduce dical costs has probably had environmental benefits.
- This is a success story based in part on induced innovation. Further research needs to be conducted to develop other win/win technologies.

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