Progress Report to the TNRC for Analysis of the Economics of Atrazine Remediation for Representative Grain Farms in the Aquilla Watershed, Hill County Texas Subtasks 4.0 – 4.4

Research Report 01-1

James D. Sartwelle, III
James W. Richardson
Keith D. Schumann

Agricultural and Food Policy Center
Department of Agricultural Economics
Texas Agricultural Experiment Station
Texas Agricultural Extension Service
Texas A&M University

September 2001

College Station, TX 77843-2124
Telephone: (979) 845-5913
Fax: (979) 845-3140
Web Site: http://www.afpc.tamu.edu

Progress Report to the TNRC for Analysis of the Economics of Atrazine Remediation for Representative Grain Farms in the Aquilla Watershed, Hill County Texas

Four alternative BMPs for atrazine remediation were reported by Harmon and Wang for the study area. The BMPs involved alternative incorporation practices, tillage operations, and sediment ponds. Harmon and Wang reported no statistical difference in corn yields under the alternative BMPs.

An economic analysis of four alternative best management practices (BMPs) for atrazine remediation in Hill County, Texas, was performed by the Agricultural and Food Policy Center (AFPC) at Texas A&M University. Using the farm-level economic simulation model FLIPSIM, AFPC scientists analyzed the financial effects of the alternative BMPs on the Texas Blackland Prairie representative farm. This farm consists of 2,000 dryland acres, divided among corn (600 acres), sorghum (750 acres), wheat (250 acres), and native pasture (150 acres). This farm also maintains a small beef cowherd. Regularly updated, the AFPC maintains more than 80 farms across the nation that form the basis for probabilistic-based agricultural policy evaluation.

A meeting was held August 16, 2001, of the panel farm members and AFPC personnel to update their baseline farm and to develop the economics for the BMPs. In October of 1999, the same panel met to develop the baseline costs, yields, production systems, and crop mix for a representative grain farm in Hill County. The purpose of the August 16, 2001, meeting was to review the alternative weed management strategies identified by Harmon and Wang (Table 1) and to estimate changes in production costs for the alternatives.

The panel farm members indicated none of the BMP strategies would alter the historical yield distributions of any planted crops. This statement by the panel re-enforces the EPIC model results reported by Harmon and Wang. The producers evaluated the alternative practices with respect to likely changes in yields and adjusted input costs, acreage mixes, and equipment complements where necessary to alter the baseline situation appropriately. The representative farm was analyzed for the years 2000-2006 assuming the atrazine remediation practices were first implemented in 2002.

The EPIC model subtasks that were applied in the farm panel analysis are denoted as the following alternatives : 4.0- baseline, 4.1- incorporation of atrazine at the time of application, 4.2- non-incorporation of atrizine with 100 foot wide buffer strips, 4.3- non-incorporation of atrazine with the substitution of field cultivator tillage and disc tillage, and 4.4- non-incorporation of atrazine with the construction of sediment ponds. Under BMP alternatives 4.2 and 4.4, the farmers indicated they would not implement the practice and would opt out of planting corn or sorghum.

Economic activity for this operation was simulated for 100 iterations incorporating historical price and yield risk for grain farms in Hill County. It was assumed the current farm program would continue through 2006 for this analysis. Table 2 summarizes the expected values of the stochastic analyses of various financial measures for each BMP. Average annual net cash farm

income from 2000 through 2006 for the subtasks ranges from -$15,360 for subtask 4.1 to -$35,340 for subtasks 4.2 and 4.4. Ranking the subtasks based on average annual net cash farm income, the order of preference is: 4.0, 4.1, 4.3, 4.2, and 4.4. Subtask 4.0 is the base situation.

Despite the wide range in net cash farm income among the BMPs, a key point is that this farm is projected to generate negative net cash farm income and negative annual cash shortfalls under each alternative subtask (Table 2). Significant cash reserve deficits projected for the farm may result in sizable losses in net worth, thus placing the farm in a poor financial position by 2006. Under subtasks 4.2, 4.3, and 4.4, the farm's average ending net worth is projected to be negative by 2006.

The results of the stochastic simulations by FLIPSIM were used to perform a ranking by stochastic dominance of the alternative subtasks (Table 3). Stochastic dominance analysis is a mathematical procedure for ranking outcomes that incur risk based on the preferences of a decision-maker. A subtask is preferred if it is ranked higher in the stochastic dominance analysis given decision-maker risk preferences. In this study, the preferences derived from simulated probability distributions for average annual net cash farm income were ranked assuming a moderately risk averse decision-maker. The most preferred strategy was the baseline, subtask 4.0, non-incorporation of atrazine at the normal rate. Incorporation of atrazine at the time of application, subtask 4.1, was the second most preferred subtask alternative. Slight increases in herbicide and fuel costs for both corn and grain sorghum production associated with subtask 4.1 explain its being less preferred than subtask 4.0.

The subtask BMP 4.3 is the third ranked strategy due to the increased cost of herbicides (1 quart of Roundup), fuel costs for disc tillage, and the need to buy a flail shredder. Subtasks 4.2 and 4.4 were ranked as the least preferred alternatives due to lower returns associated with not growing corn and sorghum.

Figure 1 details the cumulative probability distribution functions (CDFs) of net cash farm income for the baseline and the four alternative subtasks. CDF graphs show the risk associated with net cash farm income and are developed using the simulated values for each subtask. The vertical axis indicates the probability of net farm income falling below an associated level of income on the horizontal axis. An outcome for a subtask is absolutely preferred to another subtask if its CDF is completely to the right of the other. The CDFs illustrate the preference of strategies 4.1 and 4.3. It also reveals the relatively tight grouping of the two most dominant strategies. Subtask 4.1 and the base (4.0) are only slightly different over all ranges of income, however the CDF graph confirms the stochastic dominance rankings that 4.0 is preferred. Subtask 4.3 with more tillage operations lies way to the left of subtask 4.0 indicating that over all ranges of risk and income, producers would not want to adopt 4.3.

The least preferred strategies under stochastic dominance rankings were 4.2- non-incorporation of atrazine with 100-foot wide bermuda grass filter strips and 4.4- non-incorporation of atrazine with the construction of sediment ponds. The CDFs for these subtasks are considerably to the left of the other three indicating how much worse off the farms would be if they were to adopt these strategies. Under these subtasks, panel members indicated they would transition feedgrain acreage to cotton production in lieu of establishing/constructing the atrazine

remediation structures. As the profit potential of cotton production on this representative farm is typically less than the projected profitability of feedgrain production, increased cotton production decreases net cash farm income relative to the more preferred strategies.

In summary, analysis of alternative atrazine remediation practices in the Aquilla Watershed reveal preferences for strategies close to the current, baseline situation. Dramatic changes in cultural practices, such as the required construction of on-farm remediation structures, would be met with a change in crop mix.

Table 1. Summary of Sub-Tasks for Remediation of Atrazine on a Representative Grain Farm in the Aquilla Watershed.

Sub-Task	Practice	Application Identified by a Producer Focus Group
TXBG_4.0	Non-incorporation of Atrazine	Baseline
TXBG_4.1	Incorporate atrazine immediately after application	Increased sorghum herbicide costs in 2002 from $14.28 to $14.83 and corn herbicide costs from $17.35 to $18.39. Increased sorghum fuel costs in 2002 from $11.36 to $12.00 and corn fuel costs from $11.36 to $12.00.
TXBG_4.2	Non-incorporation of atrazine with 100'-wide strips	Farmers would not implement this option. In 2002, the farm switched from 750 ac. of sorghum, 600 ac. of corn, 400 ac. of cotton, 250 ac. of wheat and 150 ac. of pasture to 1230 ac. of cotton, 770 ac. of wheat and 150 ac. of pasture.
TXBG_4.3	Non-incorporation of atrazine, substitute disc tillage with field cultivator tillage	Increased sorghum fertilizer costs in 2002 from $32.55 to $44.72 because of the addition of 1 quart of Roundup. Increased sorghum fuel costs in 2002 from $11.36 to $12.92 and corn fuel costs from $11.36 to $12.92. Added a 20' flail shredder to the equipment list in 2002 at a cost of $17,714.
TXBG_4.4	Non-incorporation of atrazine, with 20 sediment ponds	Farmers would not implement this option. In 2002, the farm switched from 750 ac. of sorghum, 600 ac. of corn, 400 ac. of cotton, 250 ac. of wheat and 150 ac. of pasture to 1230 ac. of cotton, 770 ac. of wheat and 150 ac. of pasture.

Table 2. Economic Comparison of Alternative Atrazine Remediation Practices on a Representative Grain Farm in the Aquilla Watershed, 2000-2006.

Subtask	4.0	4.1	4.2	4.3	4.4
Overall Financial Position					
2000-2006 Ranking	Poor	Poor	Poor	Poor	Poor
Total Cash Receipts ($1000)					
2000	356.99	356.99	356.99	356.99	356.99
2001	329.79	329.79	329.79	329.79	329.79
2002	332.34	332.34	412.95	332.34	412.95
2003	337.87	337.87	419.25	337.87	419.25
2004	341.39	341.39	420.60	341.39	420.60
2005	352.97	352.97	425.58	352.97	425.58
2006	356.76	356.76	435.00	356.76	435.00
2000-2006 Average	344.02	344.02	400.02	344.02	400.02
Net Cash Farm Income ($1000)					
2000	27.32	27.32	27.32	26.94	27.32
2001	-13.87	-13.87	-13.87	-14.28	-13.87
2002	-7.77	-9.81	-26.92	-18.40	-26.92
2003	-8.38	-10.62	-30.46	-19.74	-30.46
2004	-24.67	-27.15	-53.75	-37.17	-53.75
2005	-28.74	-31.51	-69.07	-42.62	-69.07
2006	-38.80	-41.90	-80.64	-54.28	-80.64
2000-2006 Average	-13.56	-15.36	-35.34	-22.79	-35.34
Ending Cash Reserves ($1000)					
2000	-21.05	-21.05	-21.05	-21.88	-21.05
2001	-81.59	-81.59	-81.59	-83.23	-81.59
2002	-140.74	-142.73	-160.68	-153.38	-160.68
2003	-203.97	-207.98	-245.54	-227.48	-245.54
2004	-309.93	-316.35	-380.57	-346.29	-380.57
2005	-401.41	-410.49	-511.53	-452.12	-511.53
2006	-497.01	-509.16	-648.29	-563.17	-648.29
2000-2006 Average	-236.53	-241.34	-292.75	-263.93	-292.75
Nominal Net Worth ($1000)					
2000	470.82	470.82	470.82	483.41	470.82
2001	413.36	413.36	413.36	424.52	413.36
2002	349.50	347.51	329.57	349.17	329.57
2003	284.94	280.93	243.36	273.38	243.36
2004	196.05	189.63	125.41	171.40	125.41
2005	120.11	111.03	9.99	81.01	9.99
2006	26.21	14.07	-125.07	-29.12	-125.07
2000-2006 Average	265.86	261.05	209.63	250.54	209.63

Table 3. Stochastic Dominance Results for Atrazine Remediation Alternatives on a Representative Grain Farm in the Aquilla Watershed.

Preference Level	Subtask	Mean NCFI	Std. Dev.	Coefficient of Variation	Minimum
1	4.0	-13.56	26.79	-197.58	-65.72
2	4.1	-15.36	26.82	-174.58	-67.55
3	4.3	-22.79	26.92	-118.11	-75.07
4	4.2	-35.34	30.02	-84.95	-95.63
5	4.4	-35.34	30.02	-84.95	-95.63

Figure 1. CDF of Alternative Sub-Tasks for Remediation of Atrazine for the Texas Blackland Grain Representative Farm