2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

AN ECONOMIC ANALYSIS OF POULTRY LITTER USE IN LOUISIANA COTTON PRODUCTION

Kenneth W. Paxton and Krishna P. Paudel
Department of Agricultural Economics and Agribusiness
LSU Agricultural Center
Baton Rouge, LA
Eddie P. Millhollon and James L. Rabb
Red River Research Center
LSU Agricultural Center
Bossier City, LA

Abstract

Poultry production in the state has been increasing in recent years. Increased production of poultry has increased the amount of poultry litter that must be disposed of in an environmentally friendly manner. Since poultry litter is a good source of nitrogen fertilizer, one option for disposal is utilization for crop production. Previous studies have examined the technical feasibility of using poultry litter in cotton production. This study uses budgetary analysis to examine the economics of poultry litter use in Louisiana cotton production. The analysis is based on three years of data from a study on poultry litter use in cotton production conducted at the Red River Research Station. Results of the study indicate that the use of poultry litter at the rate of two tons per acre within a delayed tillage system was the most profitable.

Introduction

The poultry industry has been expanding rapidly in Louisiana over the last several years. As production increased within the state, so has the problem of disposing of increasing amounts of poultry litter. One potential alternative for disposing of poultry litter is to use it in crop production. The use of poultry litter in crop production has been studied in a number of states throughout the southeast in recent years. Results of studies on the feasibility of using poultry litter in cotton production have generally found that broiler litter can effectively be used as a source of nitrogen for cotton production (Mitchell, et al., 1995; Mitchell, et al., 1993; Glover, et al.,1998; Malik and Reddy, 1999). Most of these studies have found that equivalent nitrogen rates (from poultry litter) produced equivalent seedcotton yields. The initial results from the study by Glover, et al., found that equivalent nitrogen rates did not produce equivalent seedcotton yields.

Poultry litter has traditionally been disposed of by applying to pasture lands. As the volume of litter has increased, there has been increased concern that over application of poultry litter to pastures might result in water quality problems. Since the litter is generally not incorporated into the soil, heavy rain events following application might increase the potential for water quality problems (Liebhardt et al., 1979; Pratt, 1979, Sallade and Simms, 1992; Sharpley et al., 1991). Utilizing poultry litter in crop production systems has the potential to reduce environmental problems associated with the use of poultry litter (Glover, et al., 1998). A three year study by Millhollon, et al., found that poultry litter could be used in a cotton production system without adversely affecting water quality. Results of this study also indicated that the use of conservation or delayed tillage production systems could be useful in minimizing the potential of adversely affecting water quality when poultry litter is used in cotton production systems.

The objective of this study is to assess the economics of using poultry litter in cotton production in Louisiana. Economics of poultry litter use are evaluated within alternative tillage systems and at various rates of application.

Materials and Methods

The experimental results upon which this analysis is based was conducted at the Red River Research Station location of the Louisiana Agricultural Experiment Station. The study was designed to determine if using poultry litter along with best management practices could provide a feasible method of disposal for poultry litter without adversely affecting water quality. There were five treatments in the study:

1. Conventional tillage: cotton plots conventionally tilled and grown continuously. Inorganic nitrogen applied at 60 pounds per acre. No attempt was made to maintain winter cover.
2. Conventional tillage with two tons poultry litter/acre: same tillage practices as above except two tons of poultry litter were used in place of the inorganic nitrogen.

3. Conservation tillage: shredded cotton stalks and other residue are allowed to remain on the soil surface until three weeks prior to planting. Ground cover was maintained at a minimum of 30%. Inorganic fertilizer was applied at a rate of 60 pounds per acre.
4. Conservation tillage plus two tons poultry litter/acre: same cultural practices as 3 above except that two tons of poultry litter were substituted for the inorganic nitrogen.
5. Conservation tillage plus four tons poultry litter/acre: same cultural practices as 3 above except that four tons of poultry litter were substituted for the inorganic nitrogen.

The five treatments were replicated four times in a complete block design. Each treatment was approximately 0.25 acres in size. Two plots in each treatment were equipped with runoff and shallow ground water collection devices. The tillage systems defined above as conservation tillage systems are more correctly defined as delayed tillage systems. The term delayed tillage is used in this report in reference to those tillage systems employing delayed tillage. Note that all the systems included some tillage operations, but in the "conservation tillage" systems tillage operations were delayed until just prior to planting. Results of the experiment are reported in Millhollon et al. Although the term delayed tillage is perhaps a more accurate characterization of these tillage systems, they do meet the requirement of maintaining 30% cover for conservation tillage.

The study by Millhollon et al., demonstrated that it was possible to use poultry litter in a cotton production system while maintaining yield without adversely affecting water quality. Poultry litter used in this study was approximately 2.8% nitrogen or about 56 pounds of N per ton of litter (Millhollon et al.). It was estimated that approximately 60 percent of the total N was available for plant uptake. Therefore, each ton of poultry litter would make available approximately 40 pounds of N per acre. The purpose of this study is to evaluate the economics of the alternative systems included in the study by Millhollon et al. Budgetary analysis is used to evaluate costs and returns associated with the various systems described above.

The Mississippi State Budget Generator, with appropriate user specified coefficients, was used to generate enterprise budgets for each of the five treatments defined above. Enterprise costs were based on cultural practices used in the experiment, but extrapolated to a per acre basis. New equipment prices are assumed and other input prices were based on the standardized enterprise budgets developed for cotton production in the Northwest portion of the state. Poultry litter used in the study was obtained from a broiler producing facility located several miles from the experiment site at a cost of $18 per ton spread.

Results and Discussion

Table 1 shows yields associated with each of the treatments over the last three years. Although the experiment was initiated in 1998, yields for the initial year are not included in this analysis. Difficulties associated with initiating the experiment prevented a timely planting in 1998 and consequently yields were severely reduced. As shown in Table 1 the delayed tillage system with two tons of poultry litter was the highest yielding treatment every year of the experiment. Although there are numerical differences in yields among the various treatments, these differences are not generally significant at the five percent level of significance (see Millhollon et al.). While not statistically significant, the differences are consistent across years and are economically important to producers. It is interesting to note that the addition of two tons of poultry litter to either the conventional or delayed tillage system produced an increased yield. Further, the delayed tillage system produced higher yields than the conventional tillage system. When the delayed tillage system was combined with two tons of poultry litter, the separate positive contribution to yield of each was maintained so that the delayed tillage system with two tons of poultry litter produced the highest yields. It should be noted that the two tons of poultry litter provided approximately 80 pounds of nitrogen compared to the 60 pounds supplied by commercial nitrogen treatments. Some of the increased yield for the poultry litter plots can likely be attributed to a slightly higher nitrogen rate.

Table 2 shows average costs per pound of lint for each tillage system for the period 1999-2001. As shown here, the delayed tillage system with two tons of poultry litter produced the lowest cost per pound of lint. Total variable costs per acre for this system were the second highest among the various tillage systems, but the higher yield more than offset the higher cost. The higher cost was due primarily to the cost of the poultry litter compared to commercial nitrogen fertilizer. As shown in tables 3-7, the material cost for commercial nitrogen was 25 cents per pound or $15 for the 60 pounds applied in this experiment. Poultry litter used in the experiment was obtained at a cost of $18 per ton or $36 per acre for an approximate equivalent 80 pound nitrogen rate (or approximately 45 cents per pound). Assuming the current yield differential, the break-even price for poultry litter would be approximately $26 per ton.

The source of nitrogen accounted for virtually all of the differences in costs among the tillage systems. As shown in Table 2, there is approximately a one dollar difference between the conventional tillage system and the delayed tillage system. This difference is attributable primarily to the difference in timing of cultural practices. As noted above, only the stalk cutting and subsoiling operations were performed in the fall for the delayed tillage system. In the conventional tillage system, the fields were also disked in the fall. This disking operation was delayed until the spring in the delayed tillage systems. Delaying disking until the spring helped maintain a native cover on the soil during the winter, thus reducing run-off potential from those plots. In addition, the delayed tillage operation helped to conserve organic matter by minimizing exposure of the soil particles.

Summary and Conclusions

Previous research at the Red River Research Station in Louisiana demonstrated that poultry litter could be safely and effectively used as a source of nitrogen for cotton production. Results from that research indicated that a delayed tillage system produced superior results both in terms of yield and amount of nutrients loss from the field. The present study evaluated the economics of poultry litter use under the five tillage system/nitrogen source combinations.

Results of this economic analysis indicated that the delayed tillage system incorporating two tons of poultry litter was superior to the other systems. This system produced cotton for an average of $0.424 per pound of lint. The focus of the research was to evaluate the use of poultry litter and consequently, the source of nitrogen was the only significant difference among the various tillage systems.

Based on this analysis, as well as other studies cited here, poultry litter can profitably be used in cotton production without negatively impacting environmental resources. As nitrogen prices continue to increase and poultry production expands within the state, the use of poultry litter in crop production becomes and increasingly feasible alternative nitrogen source.

References

Glover, R. E., E.D. Vories, and T. Costello. 1998. Poultry Litter as a Nitrogen Source for Dryland Cotton on Clay Soil. Proceedings of the Beltwide Cotton Conferences. 1:681-683.

Liebhardt, W. C., C. Golt, and J. Turpin. 1979. Nitrate and Ammonium Concentration of Ground Water Resulting From Poultry Manure Applications. J. Environ. Qual. 8:99-125.

Malik, R.K. and K.C. Reddy. 1999. Effects of Poultry Litter on Cotton Lint Yield. Proceedings of the Beltwide Cotton Conferences. 2:1293-1295.

Millhollon, E.P., J. L. Rabb, R. A. Anderson, J.F. Liscano, and J.R. McIntosh. 2001. Using Poultry Litter in Cotton Production and Effects on Water Quality. Proceedings of the Beltwide Cotton Conferences. 1:604-606.

Mitchell, C.C., C.H. Burmester, and C.W. Wood. 1993. Broiler Litter as a Source of N for Cotton. Proceedings of the Beltwide Cotton Conferences. 2:1357-1359.

Mitchell, C.C., C.H. Burmester, J.A. Hattey, and C.W. Wood. 1995. Broiler Litter on Cotton. Proceedings of the Beltwide Cotton Conferences. 2:1338-1340.

Mitchell, C.C., J.O. Donald, and J. Martin. 1989. The Value and Use of Poultry Waste as Fertilizer. Agriculture and Natural Resources, Circular ANR-244.

Pratt, F. P. 1979. Management Restrictions in Soil Application of Manure. J. Animal Sci. 48:134-43.

Sallade, Y.E. and J. T. Simms. 1992. Evaluation of Thiosulphate as a Nitrification Inhibitor for Manures and Fertilizers. Plant Soil. 147:283-291.

Sharpley, A.N., W.W. Troeger, and S. J. Smith. 1991. The Measurement of Bioavailable Phosphorous in Agricultural Runoff. J. Environ. Qual. 20:235-238.

Table 1. Cotton Lint Yields, by Tillage System, Poultry Litter Experiment, Red River Research Station, Louisiana, 1999-01.

	Year			
Tillage System	**1999**	**2000**	**2001**	**Average Yield (lbs. Lint/ac)**
Conventional	838	448	594	627
Conventional + 2T Litter	845	561	656	687
Delayed Tillage	821	488	654	654
Delayed + 2T Litter	900	582	770	751
Delayed + 4T Litter	831	502	611	648

Table 2. Summary of Costs Associated with Tillage Systems in Poultry Litter Experiment, Red River Research Station, Louisiana, 2001.

Item	Tillage System				
	Conventional	**Conv. + 2T**	**Delayed**	**Delayed + 2T**	**Delayed + 4T**
Average Yield (# lint/ac)	627	687	654	751	648
Total Variable Cost/ac	$292.54	$317.30	$291.43	$318.64	$350.62
Cost/# Lint	$0.467	$0.462	$0.446	$0.424	$0.541

Table 3. Estimated costs per acre Stacked gene cotton, sandy soil, 8-row equipment, conventional till, Red River area, Louisiana, 2001.

ITEM	UNIT	PRICE ($)	QUANTITY	AMOUNT ($)
DIRECT EXPENSES				
CUSTOM				
Airplane lo-vol (RR)	acre	3.05	2.000	6.10
Airplane hi-vol (RR)	acre	4.23	1.000	4.23
DEFOLIANT				
Dropp	pounds	56.34	0.2000	11.26
Prep	pint	6.53	1.333	8.70
Pix	ounces	0.77	4.000	3.08
FERTILIZER				
Nitrogen	pounds	0.25	60.000	15.00
HERBICIDES				
Treflan 4L	pint	3.19	1.500	4.78
Cotoran 4L	quart	8.65	0.600	5.19
Roundup Ultra	pint	4.68	5.500	25.74
INSECTICIDES				
Baythroid	pint	50.85	0.132	6.71
Orthene 90SP	pounds	10.19	0.500	5.09
HIRED LABOR				
Tractor Operator	hour	7.50	2.5972	19.48
Self Propelled Operator	hour	12.00	0.2887	3.46
OTHER				
BT/RR Tech Fee	acre	33.80	1.000	33.80
BWE Assessment (Red)	acre	10.00	1.000	10.00
Module Hauling	bale	5.00	1.310	6.55
Insect Scout (Bt)	acre	12.00	1.000	12.00
Storage	bale	25.00	1.310	32.75
SEED				
BT/RR Cotton Seed	pounds	1.15	10.000	11.50
DIESEL FUEL				
Tractors	gallon	1.17	13.377	15.65
Self Propelled Equipment	gallon	1.17	2.520	2.94
REPAIRS & MAINTENANCE				
Implements	acre	7.08	1.000	7.08
Tractors	acre	13.51	1.000	13.51
Self-Propelled Equipment	acre	16.95	1.000	16.95
INTEREST ON OPERATING CAP.	acre	10.93	1.000	10.93
TOTAL DIRECT EXPENSES	acre			292.54

Table 4. Estimated costs per acre Stacked gene cotton, sandy soil, 8-row equipment, conventional till, 2 Tons Poultry Litter, Red River area, Louisiana, 2001.

ITEM	UNIT	PRICE ($)	QUANTITY	AMOUNT ($)
DIRECT EXPENSES				
CUSTOM				
Airplane lo-vol (RR)	acre	3.05	2.000	6.10
Airplane hi-vol (RR)	acre	4.23	1.000	4.23
DEFOLIANT				
Dropp	pounds	56.34	0.2000	11.26
Prep	pint	6.53	1.333	8.70
Pix	ounces	0.77	4.000	3.08
FERTILIZER				
Poultry Litter	tons	18.00	2.000	36.00
HERBICIDES				
Treflan 4L	pint	3.19	1.500	4.78
Cotoran 4L	quart	8.65	0.600	5.19
Roundup Ultra	pint	4.68	5.500	25.74
INSECTICIDES				
Baythroid	pint	50.85	0.132	6.71
Orthene 90SP	pounds	10.19	0.500	5.09
HIRED LABOR				
Tractor Operator	hour	7.50	2.4982	18.74
Self Propelled Operator	hour	12.00	0.2887	3.46
OTHER				
BT/RR Tech Fee	acre	33.80	1.000	33.80
BWE Assessment (Red)	acre	10.00	1.000	10.00
Module Hauling	bale	5.00	1.430	7.15
Insect Scout (Bt)	acre	12.00	1.000	12.00
Storage	bale	25.00	1.430	35.75
SEED				
BT/RR Cotton Seed	pounds	1.15	10.000	11.50
DIESEL FUEL				
Tractors	gallon	1.17	13.377	15.65
Self Propelled Equipment	gallon	1.17	2.520	2.94
REPAIRS & MAINTENANCE				
Implements	acre	7.08	1.000	7.08
Tractors	acre	13.03	1.000	13.03
Self-Propelled Equipment	acre	16.95	1.000	16.95
INTEREST ON OPERATING CAP.	acre	12.32	1.000	12.32
TOTAL DIRECT EXPENSES	acre			317.30

Table 5. Estimated costs per acre Stacked gene cotton, sandy soil, 8-row equipment, delayed till, Red River area, Louisiana, 2001.

ITEM	UNIT	PRICE ($)	QUANTITY	AMOUNT ($)
DIRECT EXPENSES				
CUSTOM				
Airplane lo-vol (RR)	acre	3.05	2.000	6.10
Airplane hi-vol (RR)	acre	4.23	1.000	4.23
DEFOLIANT				
Dropp	pounds	56.34	0.2000	11.26
Prep	pint	6.53	1.333	8.70
Pix	ounces	0.77	4.000	3.08
FERTILIZER				
Nitrogen	pounds	0.25	60.000	15.00
HERBICIDES				
Treflan 4L	pint	3.19	1.500	4.78
Cotoran 4L	quart	8.65	0.600	5.19
Roundup Ultra	pint	4.68	5.500	25.74
INSECTICIDES				
Baythroid	pint	50.85	0.132	6.71
Orthene 90SP	pounds	10.19	0.500	5.09
HIRED LABOR				
Tractor Operator	hour	7.50	2.5972	18.90
Self Propelled Operator	hour	12.00	0.2887	3.46
OTHER				
BT/RR Tech Fee	acre	33.80	1.000	33.80
BWE Assessment (Red)	acre	10.00	1.000	10.00
Module Hauling	bale	5.00	1.360	6.80
Insect Scout (Bt)	acre	12.00	1.000	12.00
Storage	bale	25.00	1.360	34.00
SEED				
BT/RR Cotton Seed	pounds	1.15	10.000	11.50
DIESEL FUEL				
Tractors	gallon	1.17	12.698	14.85
Self Propelled Equipment	gallon	1.17	2.520	2.94
REPAIRS & MAINTENANCE				
Implements	acre	6.44	1.000	6.44
Tractors	acre	12.92	1.000	12.92
Self-Propelled Equipment	acre	16.95	1.000	16.95
INTEREST ON OPERATING CAP.	acre	10.94	1.000	10.94
TOTAL DIRECT EXPENSES	acre			291.43

Table 6. Estimated costs per acre Stacked gene cotton, sandy soil, 8-row equipment, delayed till, 2 tons poultry litter, Red River area, Louisiana, 2001.

ITEM	UNIT	PRICE ($)	QUANTITY	AMOUNT ($)
DIRECT EXPENSES				
CUSTOM				
Airplane lo-vol (RR)	acre	3.05	2.000	6.10
Airplane hi-vol (RR)	acre	4.23	1.000	4.23
DEFOLIANT				
Dropp	pounds	56.34	0.2000	11.26
Prep	pint	6.53	1.333	8.70
Pix	ounces	0.77	4.000	3.08
FERTILIZER				
Poultry Litter	tons	18.00	2.000	36.00
HERBICIDES				
Treflan 4L	pint	3.19	1.500	4.78
Cotoran 4L	quart	8.65	0.600	5.19
Roundup Ultra	pint	4.68	5.500	25.74
INSECTICIDES				
Baythroid	pint	50.85	0.132	6.71
Orthene 90SP	pounds	10.19	0.500	5.09
HIRED LABOR				
Tractor Operator	hour	7.50	2.4212	18.16
Self Propelled Operator	hour	12.00	0.2887	3.46
OTHER				
BT/RR Tech Fee	acre	33.80	1.000	33.80
BWE Assessment (Red)	acre	10.00	1.000	10.00
Module Hauling	bale	5.00	1.560	7.80
Insect Scout (Bt)	acre	12.00	1.000	12.00
Storage	bale	25.00	1.560	39.00
SEED				
BT/RR Cotton Seed	pounds	1.15	10.000	11.50
DIESEL FUEL				
Tractors	gallon	1.17	12.698	14.85
Self Propelled Equipment	gallon	1.17	2.520	2.94
REPAIRS & MAINTENANCE				
Implements	acre	6.44	1.000	6.44
Tractors	acre	12.43	1.000	12.43
Self-Propelled Equipment	acre	16.95	1.000	16.95
INTEREST ON OPERATING CAP.	acre	12.37	1.000	12.37
TOTAL DIRECT EXPENSES	acre			318.64

Table 7. Estimated costs per acre Stacked gene cotton, sandy soil, 8-row equipment, delayed till, 4 tons poultry litter, Red River area, Louisiana, 2001.

ITEM	UNIT	PRICE ($)	QUANTITY	AMOUNT ($)
DIRECT EXPENSES				
CUSTOM				
Airplane lo-vol (RR)	acre	3.05	2.000	6.10
Airplane hi-vol (RR)	acre	4.23	1.000	4.23
DEFOLIANT				
Dropp	pounds	56.34	0.2000	11.26
Prep	pint	6.53	1.333	8.70
Pix	ounces	0.77	4.000	3.08
FERTILIZER				
Poultry Litter	tons	18.00	4.000	72.00
HERBICIDES				
Treflan 4L	pint	3.19	1.500	4.78
Cotoran 4L	quart	8.65	0.600	5.19
Roundup Ultra	pint	4.68	5.500	25.74
INSECTICIDES				
Baythroid	pint	50.85	0.132	6.71
Orthene 90SP	pounds	10.19	0.500	5.09
HIRED LABOR				
Tractor Operator	hour	7.50	2.4212	18.16
Self Propelled Operator	hour	12.00	0.2887	3.46
OTHER				
BT/RR Tech Fee	acre	33.80	1.000	33.80
BWE Assessment (Red)	acre	10.00	1.000	10.00
Module Hauling	bale	5.00	1.350	6.75
Insect Scout (Bt)	acre	12.00	1.000	12.00
Storage	bale	25.00	1.350	33.75
SEED				
BT/RR Cotton Seed	pounds	1.15	10.000	11.50
DIESEL FUEL				
Tractors	gallon	1.17	12.698	14.85
Self Propelled Equipment	gallon	1.17	2.520	2.94
REPAIRS & MAINTENANCE				
Implements	acre	6.44	1.000	6.44
Tractors	acre	12.43	1.000	12.43
Self-Propelled Equipment	acre	16.95	1.000	16.95
INTEREST ON OPERATING CAP.	acre	14.65	1.000	14.65
TOTAL DIRECT EXPENSES	acre			350.62