# The Nitrogen Fertilizer Value of Baled Broiler Litter for Cotton Production in the Arkansas Delta

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**Abstract**

The export of poultry litter by baling efficiently packages litter for long-term storage and transportation.  Use of baled poultry litter to supply the recommended rates of P and K and a portion of the N rate appears to be a feasible nutrient management strategy for cotton.

*Key Words***:** poultry waste management; cotton production; fertilizer

*JEL:* Q15, Q53

## BACKGROUND

In the U.S., broilers are being delivered to market at a rate in excess of 8 billion birds annually (ERS, 2006). The aged bedding material that must be removed from the houses where these birds are grown, known as broiler litter, is generated at an average rate of 1.2-1.7 tons per thousand broilers (Grimes et al. 2006; Goodwin et al. 2005). Broiler litter consists of a mixture of approximately 90% chicken manure and spilled feed and 10% bedding material. Litter is an excellent source of organic nutrients consisting of about 3-4% N, 2-3% phosphorus (P), and 2-3% potassium (K) by weight and typically has 22-30% moisture. Litter is also a good source of other nutrients such as calcium (3%) and carbon (22%) and a range of micro nutrients. Traditionally, poultry litter in the Ozark Plateau region has been surface applied in the spring as pasture growth begins. The main problem with this existing practice is the quantities of broiler litter currently being generated far exceeds the capacity that local farms can utilize in an environmentally sustainable manner. Consequently, litter may be applied to the soil at rates exceeding agronomic requirements for select nutrients; P is the nutrient of concern currently in the Ozarks. This results in leaching of the excess nutrients into surface or ground water.

500,000 tons of broiler litter is generated in the region annually. In the Illinois River Watershed (IRW) and the Eucha/Spavinaw Watershed (ESW) alone, 185,000 tons and 94,000 tons of poultry litter per year are produced, respectively (Goodwin et. al 2005). It is estimated that 80,000 and 50,000 tons of litter in IRW and ESW is surplus. An effective way to address the surplus levels of P from poultry litter in the watersheds is to move export this surplus from areas of concentrated production to areas where it can be utilized for agronomic purposes. The Delmarva Peninsula, for example, pelletizes much of the litter it produces and ships it by rail to farms in the Midwest. The market value of raw litter to crop farmers based on its nutrient content ranges from $52-74 per ton. However, the cost of pelletizing alone in most cases will exceed $55 per ton exclusive of transportation, storage, and handling expense.

The AR Delta is a logical destination for exported poultry litter with over seven million acres presently under cultivation and few local sources of broiler litter. However, at a distance of over 250 miles, the transportation of bulk raw litter in specialized walking-floor trailers from northwestern AR is cost prohibitive, largely due to a lack of feasible backhaul opportunities in these trailers and the just-in-time nature of delivery for the raw litter unless covered storage is available (Carreira, et. al 2007). Litter can be compressed into cylindrical bales wrapped in a specially manufactured plastic stretch film. The present technology was developed for municipal solid waste or MSW (Mammoth Corp, 2008). Baling litter could increase the economic feasibility of transporting it from northwest AR to eastern Arkansas; litter could be hauled on flatbed trailers or box vans, thus facilitating increased backhaul opportunities. In addition, baled litter can stored for extended periods of time without covered storage, increasing flexibility of delivery and lowering inventory costs.

Field studies to evaluate cotton response to baled poultry litter (BPL) are needed to provide information to growers who might be interested in utilizing BPL as a source of N and other nutrients. The overall objective of this project was to evaluate the effect of inorganic-N fertilizer and BPL application rate on seedcotton yield (cotton seed plus cotton lint) on soils commonly used for cotton production in the Arkansas River Delta Region (Delta). A simple economic analysis is accomplished to assess the economic feasibility of using BPL in the Delta.

**OBJECTIVES**

The overall objective of this research is to determine the fertilizer value of BPL utilized as a source of nitrogen (N) and other nutrients for cotton production as related to seedcotton yield. Evaluation will be based on the effect of inorganic-N fertilizer and BPL application rates on 1) cotton yield, 2) cotton petiole $NO_3$-N concentration, 3) cotton leaf blade nutrients, 4) N uptake by cotton, and 5) post-harvest soil chemical properties on soils commonly used for cotton production in the AR Delta. Four scenarios are examined in the economic analysis to compare the value of using BPL with the cost of commercial fertilizer to meet recommended fertilization rates for the soil.

## DATA AND METHODS

### Field Methods

Replicated field experiments were conducted at three locations in the Delta on soils representing those commonly used for cotton production. The experimental sites were on University of Arkansas Agricultural Experiment Station facilities in Desha (DEG71), Lee (LEG71), and Mississippi (MSG71) Counties. These sites represent a range of latitude from southeast to northeast AR. Each study was arranged as a randomized complete block design with a factorial arrangement of N-fertilizer sources and rates. There were two sources of N (urea and BPL) and six rates of N within each source corresponding to 0, 30, 60, 90, 120, and 150 lb N/acre from urea or BPL (Table 1). On plots receiving urea, blanket applications of P and K were made at their corresponding recommended rates of 60 and 90 lbs per acre, respectively. Each experimental treatment was replicated four times at each site. Experimental plot were 40-ft long and 25- (LEG71 and MSG71) or 12.6-ft wide (DEG71) allowing for eight or four rows of cotton with 38-inch wide row spacing.

BPL used in this study was provided by the same entity that is working on commercial-scale baling and shipping of the poultry litter to eastern Arkansas, thus it represents the type of BPL that eventually will be used by cotton producers in eastern Arkansas. Sub-samples of BPL were analyzed by the University of Arkansas Agricultural Diagnostic Laboratory by standard methods (Peters et al., 2003). The results of chemical analysis of six subsamples of that BPL are reported in Table 2.

Prior to application of BPL or urea a composite soil sample was collected from the 0 to 6 inch depth for each replication. Soil samples were oven-dried, crushed, extracted with Mehlich-3 solution, and the concentration of elements in the soil extracts were measured by inductively coupled plasma atomic emission spectroscopy (Dahlquist and Knoll, 1978). Soil nitrate was extracted with 0.025 *M* aluminum sulfate and measured with a specific ion electrode (Donahue, 1992). Soil pH was measured in a 1:2 (weight:volume) soil-water mixture (Donahue, 1983). Particle size analysis was performed by the hydrometer method (Arshad et al., 1996). Selected soil properties for each site are listed in Table 3. Nutrients other than N were applied when needed according to the current University of Arkansas recommendations for cotton production.

BPL and urea treatments were hand applied to the soil surface and incorporated with a rotary hoe or Do-All before planting (Table 2). Cotton (‘Delta PineLand 117') was planted between 4 and 17 May at various sites and emerged within 7 days after planting. Detailed information on important agronomic dates is listed in Table 4. Conventional tillage and pest management practices were followed and irrigation was managed according to the University of Arkansas Cooperative Extension Service Irrigation Scheduler Program. Analysis of variance (ANOVA) was performed using the SAS GLM procedure. Sites were analyzed separately; mean separations were performed by the Waller-Duncan Minimum Significant Difference (MSD) or Least Significant Difference (LSD) test at significance levels of 0.05 and 0.10.

**Economic Methods**

A partial budget analytic method is employed to determine costs and revenues associated with each treatment in the field experiment and assessed within four scenarios. The recommended fertilizer application rates for use on cotton in the AR Delta are 120 lbs N per acre, 60 lbs P per acre and 90 lbs K per acre; the same P and K rates used under all scenarios of N applied. Only a portion of the N content of BPL is available to the plant during the growing season. Bitzer and Sims (1988), using a predicted available N in poultry litter of 80% of inorganic N and 60% of organic N, found values ranging from 54 to 118% of the predicted value. They concluded that while their predicted available N was "reasonably successful, (it) consistently overestimated the amount of available N in the manures." Much of the available N was released during the first few weeks after application (Bitzer and Sims, 1988; Castellanos and Pratt, 1981). Others have reported N availability factors of 75% the first year (USDA, 1979) to near 50% (Mitchell and Browne, 1992). N availability in cotton production has not been definitively quantified to date. For the purposes of this analysis, a 75 percent utilization rate was assumed. At the BPL application of 4,000 lbs per acre, the P and K needs are approximately met (Table 3). According to Table 3, the BPL obtained for the experiment consisted of 1.27 percent Total P, which translates into 51 lbs of P in 4,000 lbs of BPL. Total K is 2.31 percent of BPL which translates into 92 lbs of K in 4,000 lbs of BPL. Total N was found to be 3.06 percent (or 122 lbs of N per 4,000 lbs of BPL) but the amount available to the plant likely ranges from 70-80 percent.

Four scenarios are examined over a two year period. Scenario 1 examined the value of BPL as the lone N, P and K source for cotton production. Scenario 2 examined the use of BPL and urea N in combination to meet accepted fertilizer recommendations for N, P and K (120-60-90 lbs of N P and K, respectively). Scenario 3 replaced the values of N, P and K observed in the BPL obtained for this experiment (which were uncharacteristically low in P) with historically observed values gathered over multiple years from producers in northwest AR. Poultry litter was assumed the only source of nutrients under this scenario. Finally, Scenario 4 looked at the combination of BPL and urea N using the historical values of N, P and K for litter. Because in year 1 of Scenarios 3 and 4 BPL is applied at rates likely to result in excess amounts of P and K, the method of fertilization is assumed to be commercial in year 2 for these scenarios. All scenarios were compared to current commercial fertilizer prices of meeting the recommended requirements for cotton grown in the AR Delta, which is assumed to be 120 lbs N per acre, 60 lbs P per acre and 90 lbs K per acre. Fertilizer prices were obtained on January 7, 2008.

## RESULTS AND DISCUSSION

### Properties of BPL and Soil

BPL obtained for this study contained on the average (n=6) 3.06% N, and 1.27% P, and 2.31% K (Table 3). P levels were lower than anticipated; historical values for P in broiler litter produced in northwest AR are 2.85% (VanDevender, 2004). Of the total nitrogen present, organic N comprised well over 90 percent. The manure data suggests that in addition to N, the BPL can potentially be used to meet P and K fertilizer requirements for the crop. Analysis of soil samples collected before application of treatments indicated that the average soil pH ranged from 6.4 to 7.1, and P and K were in the optimum range (Table 4). Soil $NO_3$-N was 3 to 5 ppm, thus a yield response to N application was expected. Surface horizon soil texture ranged from silt loam to clay loam.

### Seedcotton Yield

The N source × N rate interaction did not have any significant effect ($P$◂ 0.1446) on seedcotton yield. Nitrogen source, averaged across N rates, significantly ($P$◂0.0748) affected seedcotton yield (Table 5) with seedcotton yields ranging from 1699-2685 lbs/acre for cotton receiving urea and 1519-2273 lbs/acre for cotton receiving BPL. On average, cotton fertilized with urea produced greater overall yields. This result was expected due to the limited amount of N in BPL available to the plant during the growing season (Bitzer and Sims, 1988; Castellanos and Pratt, 1981; Warren and Phillips, 2007).

Averaged across both N sources, seedcotton yields receiving no N or BPL ranged from 1096-1687 lbs/acre and 2009-2745 lb/acre for cotton were fertilized with 150 lbs N/acre (Table 6). Application of >30 lbs N/acre produced significantly ($P$=0.1) higher yields than the no N control. Application of 120 lbs N/acre increased yields 841-1219 lbs/acre as compared to 0 N plots and in general maximum seedcotton yields were produced with application of 120 lbs N/acre. However, the yields at 150 lb N/acre were not significantly ($P$=0.1) different the yields at 120 lbs N/acre.

**Practical Interpretation**

Application of N increased seedcotton yield, regardless of the N source. Seedcotton yield was increased 50-90% by application of 120 lbs N/acre. This single year of data from three sites suggest that BPL is a good N source for cotton production in silt loam and clay loam soils of AR Delta. Use of BPL to supply the recommended or maintenance rates of P and K and a portion of the recommended N rate appears to be a feasible nutrient management strategy for cotton. Additional field studies are needed to generate a more robust data base for developing reliable N availability recommendations for utilization of BPL in cotton production in Arkansas.

**Economic Analysis**

Under all scenarios, BPL is assumed to be applied at 4,000 lbs per acre to meet the P and K recommended nutrient rates in Year 1; for Scenarios 3 and 4, commercial fertilizer is assumed to be used in Year 2 to capture the added value of the stored P and K in the soil from Year 1 and to avoid and excess buildup of these nutrients. Additionally, all four scenarios were compared to the current cost of commercial fertilizer application at the recommended rates. The cost of meeting the recommended commercial fertilization application was estimated to total $127. Urea totaled $65, P was $32 and K was $30 (Table 7). The value of the commercial fertilizer was assumed to be equal to its January 7, 2008 cost.

Under Scenario 1, BPL was assumed to be the sole source of nutrients for cotton. Under this scenario, the N needs of the soil are likely not met. The nutrient value of the BPL in this scenario is $108, of which $50 is derived from N (Table 7). Compared to the cost of commercial fertilizer ($127) Scenario 1 costs less; however, the use of BPL alone would lead to less than the recommended rate of N being applied to the crop. Using average seedcotton yields across all three locations for the 120 N level, cotton lint yield would be approximately 930 lbs per acre under Scenario 1 (BPL only, 75% available N) compared to 1,040 lbs per acre with commercial fertilization (Tables 6 and 7). Cotton lint revenues, minus the cost of fertilizer, would be $342 per year under this scenario compared with $389 with commercial fertilization (Table 7).

Under Scenario 2, BPL was combined with urea to meet the recommended N rate for the crop. 30 lbs of urea were assumed to be purchased to bring the approximate rate of N to a total of 90 lbs per acre. Under this scenario, the total value of BPL+urea was $124. The total cost of this fertilization method increased to $136. Compared to the cost of commercial fertilizer alone ($127) Scenario 2 appears to be less than optimal. Cotton lint yield would be approximately 1040 lbs per acre under Scenario 2, equal to commercial fertilization (Tables 6 and 7). Cotton lint revenues, minus the cost of fertilizer, would be $380 per year under this scenario compared with $389 with commercial fertilization (Table 7).

Scenarios 3 and 4 replaced the observed nutrient content values from this experiment with historical rates collected over several years in northwest AR. Historically, the N content of litter (per 4,000 lbs) was 120 lbs, the P content 114 lbs, and K content 104 lbs. These values were used to revise Scenarios 1 and 2. Under Scenario 3, the nutrient value of 4,000 lbs of BPL was found to be $145. The value of N was $49, P was $62 and K was $34 (Table 7). Compared to the total cost of fertilizer alone ($127) Scenario 3 results in what appears to be a good value; however, the N needs are not likely to be met without further N sources. Under Scenario 3, cotton lint yield is assumed to be 930 lbs per acre compared with the 1,040 lbs per acre under commercial fertilization during year 1 (Tables 6 and 7). Cotton lint revenues, minus the cost of fertilizer, would be $342 year 1 under this scenario compared with $389 with commercial fertilization (Table 7). However, during year 2 the revenues (minus fertilizer costs) under Scenario 3 increase to $406 per acre due to the cost savings from the stored P and K from the year 1 application of BPL. The two year total revenues (minus fertilizer costs) under Scenario 3 are $748 per acre, compared to $778 per acre under commercial (Table 7).

Scenario 4 resulted in what appears to be the optimal fertilization strategy. Scenario 4 was assumed to supplement the additional N required by the crop but not supplied by BPL alone as in Scenario 3; 30 lbs of urea were assumed to be purchased for use with the 4,000 lbs of BPL per acre. Scenario 4 resulted in a total nutrient value for BPL+urea of $161. The cost of fertilization under this scenario was $136 compared to $127 under commercial fertilization during year 1. During year 2, the cost of fertilizer decreases to $110 due to the stored P and K from the year 1 application of BPL. Under Scenario 4, cotton lint yield is assumed to be 1,040 lbs per acre, which is equal to commercial fertilization during years 1 and 2 (Tables 6 and 7). Cotton lint revenues, minus the cost of fertilizer, would be $380 year 1 under this scenario compared with $389 with commercial fertilization (Table 7). However, during year 2 the revenues (minus fertilizer costs) under Scenario 4 increase to $406 per acre due to the cost savings from the stored P and K from the year 1 application of BPL. The two year total revenues (minus fertilizer costs) under Scenario 4 are $786 per acre, compared to $778 per acre under commercial (Table 7). Additional details on the economic results can be found in Table 7.

**SUMMARY**

The export of various poultry wastes is a priority in the region due to concerns about agricultural runoff in area watersheds. It is imperative that a technology be developed that can economically address this problem and convert broiler litter from an environmentally hazardous waste product into a valuable commodity. Baling litter efficiently packages broiler litter for safe long-term storage and transportation. With over seven million acres presently under cultivation in the AR Delta, it is a logical market for BPL. Determining the economic value to producers for utilizing baled litter is a key component of convincing producers to accept baled litter as a viable alternative to conventional fertilizer products. The use of BPL to supply the recommended or maintenance rates of P and K and a portion of the recommended N rate appears to be an economically feasible nutrient management strategy for cotton.

It must be noted that at the present time, there is a $15 per ton state-funded subsidy for utilizing Arkansas poultry litter within Arkansas. The budget assessments within this manuscript do not reflect this existing subsidy. Under Scenario 4 (Historic BPL + N), adding the $15 per ton subsidy into consideration results in a net revenue increase of $34.34 per acre over the commercial fertilizer only scenario and does so without increasing P build up in the soil, the key motivator for exporting poultry litter from the IRW and ESW. Thus, the issue of excess P in soils is not transferred to the AR Delta.

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Table 1. Nitrogen sources and rates for the three experiments conducted at three locations in Arkansas in 2007 to evaluate the effect of urea and baled poultry litter (BPL) on seedcotton yield.

| N source | BPL rate | Total N rate |
|---|---|---|
| | lb/acre | - lb N/acre - |
| Urea-control | 0 | 0 |
| Urea | 0 | 30 |
| Urea | 0 | 60 |
| Urea | 0 | 90 |
| Urea | 0 | 120 |
| Urea | 0 | 150 |
| | | |
| BPL-control | 0 | 0 |
| BPL | 1,000 | 30 |
| BPL | 2,000 | 60 |
| BPL | 3,000 | 90 |
| BPL | 4,000 | 120 |
| BPL | 5,000 | 150 |

Table 2. Selected agronomic information for the experiments on evaluating nitrogen (N) availability from urea and baled poultry litter (BPL) for cotton at three locations in Arkansas in 2007.

| Site ID | Previous crop | Urea and BPL application date | Planting | Predicted 1st Square [a] | Predicted Bloom[b] | Predicted 1st open boll[c] | Harvest date |
|---|---|---|---|---|---|---|---|
| DEG71 | Cotton | 17-May | 17-May | 15-June | 2-July | 12-Aug | 11-Oct |
| LEG71 | Corn | 30-April | 4-May | 6-June | 23-June | 5-Aug | 5-Oct |
| MSG71 | Cotton | 8-May | 9-May | 9-June | 26-June | 6-Aug | 2-Oct |

[a, b, and c,], assuming that 475, 825, and 1675 Degree Days > 60° F is required from planting to first square, first flower and first open boll respectively as suggested by Oosterhuis, 1992.

Table 3. Selected chemical properties of the baled poultry litter (BPL, n=6) used in the three experiments evaluating nitrogen (N) availability of BPL for cotton production in 2007.

| Total N | Total C | Total P | Total K | $NO_3$-N | $NH_4$-N | Zn | As | Cr | Pb | Cd |
|---|---|---|---|---|---|---|---|---|---|---|
| (%) | | | | (ppm) | | | | | | |
| 3.06 | 22.61 | 1.27 | 2.31 | 19 | 5415 | 294 | 24.5 | 4.5 | 0.6 | 0.6 |

Table 4. Selected chemical and physical properties of soil samples collected (0- to 6-inch depth) from the experimental sites in the spring of 2007 before the application of treatments for the experiments evaluating nitrogen (N) availability of BPL at three locations in Arkansas in 2007.

| Site ID | Soil pH | Soil $NO_3$-N | Soil Mehlich-3-extractable nutrients | | | | | | | Soil physical properties | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P | K | Ca | Mg | Mn | Cu | Zn | Sand | Silt | Clay | Texture |
| | | ---------- (ppm) ---------- | | | | | | | | ---------- (%) ---------- | | | |
| DEG71 | 6.7 | 3 | 75 | 147 | 943 | 127 | 131 | 1.1 | 2.6 | 33 | 50 | 16 | Silt loam |
| LEG71 | 7.1 | 4 | 60 | 167 | 2046 | 428 | 120 | 2.2 | 2.5 | 4 | 56 | 40 | Silty clay |
| MSG71 | 6.4 | 5 | 47 | 235 | 3292 | 623 | 60 | 3.9 | 4.0 | 44 | 21 | 35 | Clay loam |

Table 5. Effect of N source, averaged across N rates, on seedcotton yields at three locations in Arkansas during 2007.

| N Source | DEG71 | LEG71 | MSG71 |
|---|---|---|---|
| | -------- Seedcotton yield (lbs/acre) ------- | | |
| BPL | 2071 | 1519 | 2273 |
| Urea | 2346 | 1699 | 2685 |
| LSD at 0.05[a] | 235 | 250 | 232 |
| LSD at 0.10[b] | 195 | 208 | 192 |
| *p* value | 0.0273 | 0.0748 | 0.0008 |

[a, b,] LSD, least significant difference at *P*=0.05 and 0.10

Table 6. Effect of urea and baled poultry litter (BPL) and the mean of N sources applied at six N rates on seedcotton yield at three locations in Arkansas in 2007.

| Total-N rate | DEG71 | | | LEG71 | | | MSG71 | | |
|---|---|---|---|---|---|---|---|---|---|
| | N source | | Mean of N sources | N source | | Mean of N sources | N source | | Mean of N sources |
| | BPL | Urea | | BPL | Urea | | BPL | Urea | |
| lbs N/acre | Seedcotton yield (lbs/acre) | | | | | | | | |
| 0 | 1717 | 1601 | 1659 | 947 | 1096 | 1021 | 1687 | 1857 | 1760 |
| 30 | 1755 | 2055 | 1927 | 1299 | 1465 | 1393 | 1840 | 2053 | 1946 |
| 60 | 1787 | 2428 | 2108 | 1558 | 1467 | 1512 | 2524 | 2863 | 2693 |
| 90 | 2292 | 2569 | 2430 | 1443 | 2381 | 1845 | 2465 | 2785 | 2648 |
| 120 | 2474 | 2520 | 2500 | 1810 | 2118 | 1964 | 2740 | 3217 | 2979 |
| 150 | 2537 | 2902 | 2745 | 2009 | 1844 | 1926 | 2434 | 3133 | 2784 |
| MSD 0.05 [a] | interaction was NS | | 392 | interaction was NS | | 426 | interaction was NS | | 377 |
| MSD 0.10 [b] | interaction was NS | | 334 | interaction was NS | | 363 | interaction was NS | | 322 |
| *p* value | interaction =0.4856 | | 0.0001 | interaction =0.1446 | | 0.0003 | interaction =0.8464 | | <0.0001 |

[a, b] Minimum Significant Difference (MSD) as determined by Waller-Duncan Test at $P = 0.05$ or $P = 0.10$ respectively.

Table 7. Four Scenarios Comparing the Economic Feasibility of Four BPL Fertilization Strategies, 4000 pounds per acre.

| Nutrient Values/Costs | Scenario 1<br>BPL | Scenario 2<br>BPL+Urea N | Scenario 3<br>Historical | Scenario 4<br>Historical+Urea N | Commercial Cost<br>Commercial Alone (120-60-90) |
|---|---|---|---|---|---|
| **Primary Nutrient Value** | | | | | |
| N | 49.57 | 65.77 | 48.6 | 64.8 | 64.8 |
| P | 27.43 | 27.43 | 61.56 | 61.56 | 32.4 |
| K | 30.49 | 30.49 | 34.32 | 34.32 | 29.7 |
| Sub-Total | $107.50 | $123.70 | $144.48 | $160.68 | $126.90 |
| **Stored P and K Amounts/Value[a]** | | | | | |
| P | 0 | 0 | 54 | 54 | 0 |
| K | 0 | 0 | 14 | 14 | 0 |
| P | 0 | 0 | 29.16 | 29.16 | 0 |
| K | 0 | 0 | 4.62 | 4.62 | 0 |
| Sub-Total | $0.00 | $0.00 | $33.78 | $33.78 | $0.00 |
| **Total Nutrient Value** | **$107.50** | **$123.70** | **$178.26** | **$194.46** | **$126.90** |
| **Production Value** | | | | | |
| Cotton Lint Yield Year 1 (lbs/ac)[b,c] | 930 | 1040 | 930 | 1040 | 1040 |
| Cotton Lint Yield Year 2 (lbs/ac)[b,c] | 930 | 1040 | 1040 | 1040 | 1040 |
| Price ($/lb) | 0.496 | 0.496 | 0.496 | 0.496 | 0.496 |
| **Cotton lint Revenues Year 1** | **461.28** | **515.84** | **461.28** | **515.84** | **515.84** |
| **Cotton lint Revenues Year 2** | **461.28** | **515.84** | **515.84** | **515.84** | **515.84** |
| **Year 1 Fertilization Cost** | | | | | |
| BPL[e] | $119.30 | $119.30 | $119.30 | $119.30 | $0.00 |
| Commercial | $0.00 | $16.20 | $0.00 | $16.20 | $126.90 |
| **Total** | **$119.30** | **$135.50** | **$119.30** | **$135.50** | **$126.90** |
| **Year 2 Fertilization Cost[d]** | | | | | |
| BPL[e] | $119.30 | $119.30 | $0.00 | $0.00 | $0.00 |
| Commercial | $0.00 | $16.20 | $109.63 | $109.63 | $126.90 |
| **Total** | **$119.30** | **$135.50** | **$109.63** | **$109.63** | **$126.90** |
| **Cotton Lint Revenues - Fert Cost[f]** | | | | | |
| Year 1 | $341.98 | $380.34 | $341.98 | $380.34 | $388.94 |
| Year 2 | $341.98 | $380.34 | $406.21 | $406.21 | $388.94 |
| **Two Year Total, per acre** | **$683.96** | **$760.68** | **$748.19** | **$786.55** | **$777.88** |
| **Two Year Average, per acre** | **$341.98** | **$380.34** | **$374.10** | **$393.28** | **$388.94** |

[a] Stored nutrients are those applied in excess of the plants potential utilization; no excess N is assumed.

[b] Cotton lint is assumed to be 39.7% of seedcotton yield.

[c] BPL+Urea Yield Assumed to be equal to the experimental yield for Urea at recommended rates.

[d] For year 2 under Scenarios 2 and 3, there is assumed to be excess P and K available from the BPL applications year 1. For this reason, commerical fertilizer is assumed to be the practice year 2, applied at a rate of 120-6-76 to meet the recommended nutrient requirments. Year 2 application of BPL under these scenarios would likely lead to P and K being applied at too high of rates.

[e] Cost per ton of BPL delivered to site is $59.65, per Carreira et al. 2007, with 15% fuel surcharge.

[f] Cotton lint value minus the cost of fertilization.