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SUPPLEMENTING POULTRY LITTER WITH INORGANIC NITROGEN FOR COTTON

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Abstract

Poultry litter which is rich in nitrogen, phosphorus, potassium, and other essential plant nutrients can be an inexpensive fertilizer for cotton and a valuable means of disposal and possibly a source of income for poultry producers. We conducted a study to determine whether litter should be supplemented with inorganic fertilizers for optimum cotton growth and yield. The study was conducted in large plots at a commercial farm in Mississippi. Poultry litter rates of 1, 2, and 3 ton/acre were tested in combination with 0, 30, or 60 lbs/acre UAN-N as supplements. These treatments were also compared against an untreated control and the farm standard practice which consisted of 120 lbs/acre of UAN-N and 150 lbs/acre of K_2O as KCl. Lint yield increased linearly with increasing rates of litter up to 3 ton/acre with no supplemental UAN-N. Litter at 2 ton/acre supplemented with 60 lbs/acre UAN-N produced the largest yield–1544 lbs/acre–which is 3.7% greater than that of the farm standard. The results suggest that 2 ton/acre litter with about 2.3% total N may not be adequate for cotton and, therefore, should be supplemented with inorganic N at least in the first year of use.

Introduction

Poultry litter is a mixture of bedding material, manure, feathers, and spilled feed and water. Typically handled as a waste, litter can be an inexpensive fertilizer for cotton and other row crops and a valuable means of disposal and possibly a source of income for poultry producers. It is rich in nitrogen, phosphorus, potassium, and other essential plant nutrients but these nutrients do not exist in forms and balances ideal for fertilization (Collins et al., 1999). Therefore the agronomic management of litter as a fertilizer is not as simple as managing conventional fertilizers. We recently initiated a test at a commercial farm in Mississippi to establish ways of managing litter as a fertilizer and soil amendment for cotton production. The objective was to determine whether litter should be supplemented with inorganic fertilizers for optimum cotton growth and yield.

Materials and Methods

The test was conducted in 2002 at a commercial farm in Cruger, Mississippi. Litter rates of 1, 2, and 3 ton/acre were tested in combination with 0, 30, or 60 lbs/acre UAN-N as supplements (Table 1). These treatments were also compared against an untreated control and the farm standard which consisted of 120 lbs/acre of UAN-N and 150 lbs/acre of K_2O as KCl. Litter was applied using a commercial litter spreader equipped with speed-sensing ground radar, electronic scale, and rate-control computer system. Nitrogen was applied as urea-ammonium nitrate solution (UAN, 32%N) side-dressed 2 inch deep on one side of each of the four rows.

The 10 treatments were tested in a randomized complete block design with four replications. Each plot consisted of four 40-inch rows by 390 ft (5200 ft^2). Lint yield was determined from the entire length of the middle two rows with a plot picker.

Results and Discussion

The farm standard fertility program which consisted of 120 lbs N/acre as UAN and 150 lbs K_2O/acre as KCl increased lint yield by 171 lbs/acre, which is a 13% yield advantage over the untreated control (Table 1).

Litter without supplemental inorganic nitrogen increased lint yield over the untreated control. The increase was proportional to the rate of litter up to 3 ton/acre (Table 1). Litter alone at 1 or 2 ton/acre did not yield as much as the farm standard. It was necessary to supplement 1 or 2 ton/acre litter with UAN-N to equal or exceed the yield of the farm standard fertility. Lint yield of the treatment that received 3 ton/acre litter approached that of the farm standard but we feel 3 ton/acre of litter with about 2.3% total N concentration is still a marginal rate.

Supplemental UAN-N at only 30 lbs N/acre may be adequate and more efficient in the first year of litter use. Averaged across the 1 and 2 ton/acre litter, lint yield differences were greater between 0 and 30 lbs/acre supplemental N than between 30 and 60 lbs/acre supplemental N.

Lint yield was a direct function of applied plant-available N regardless of the source. The lint yield benefit of applying litter-N with or without UAN-N to this particular soil was 2.0 lbs of lint for every lb of applied plant-available N.

With the exception of the untreated control, gin turnout decreased with increasing litter and/or applied nitrogen (data not shown). The smallest turnout was that of the farm standard which received the highest UAN-N rate of 120 lbs/acre a finding that agrees well with published research.

Conclusion

In this study, 2 ton/acre litter—which supplied about 92 lbs/acre total N and approximately 46 lbs/acre of plant-available N—did not result in lint yield equal to the yield of the farm standard fertility program. It may therefore be necessary to supplement 2 ton/acre litter that contains about 2.3% total N with inorganic nitrogen fertilizers such as UAN at least in the first year of use.

Acknowledgement

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References

Collins, E.R., Jr., J. C. Baker, L. E. Carr, H. L. Brodie, and J. H. Martin, Jr. 1999. Poultry waste management handbook. NRAES-132, Cooperative Extension, Ithaca, New York.

Table 1. Lint yield of cotton fertilized with poultry litter with or without supplemental inorganic nitrogen, 2002, Cruger, MS.

Poultry litter	**Litter total N**	**UAN-N**	**Lint Yield**
Ton/acre	----------*lbs N/acre*----------		*--lbs/acre--*
1	46	0	1396
		30	1442
		60	1496
2	92	0	1421
		30	1516
		60	1544
3	138	0	1464
		30	1510
Untreated control	0	0	1318
Farm standard	0	120	1489

UAN = Urea-ammonium nitrate solution.