

IRRIGATED MULTIPLE-CROPPING USING BROILER LITTER IN CONSERVATION TILLAGE

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INTERPRETIVE SUMMARY

Research Question

Can an irrigated, multiple-cropping system including cotton, peanut, pearl millet for grain as summer crops and wheat and canola as winter crops be sustainable using conservation tillage and broiler litter applications? What commercial fertilization and how much additional fertility will be required for the various crops in the system? A 3-year and continuing experiment is being conducted in the Coastal Plain of Georgia to determine if double-cropped economical yields can be made in an irrigated double cropped system of main line and emerging crops.

Literature Summary

Recent work in the Coastal Plain indicates that peanut may be grown with strip-tilled subsoil tillage. Previously, all peanut farmers only used a conventional tillage system, involving several discings followed by deep moldboard plowing and seed bed shaping. There remains a tradition that peanuts will only produce in a deep, loose, and fluffy soil, but the recent research is debunking that myth. As progressive farmers move to conservation tillage with peanuts it promotes the system in all crops, since peanut was the main reason that conventional tillage is dominant in the peanut belt of the Coastal Plain. Other crops have previously shown to be profitably grown using conservation tillage. With conservation tillage will come the benefits of less soil erosion by water, a major conservation problem in the area.

Georgia is now the number one broiler litter state in the nation. Most of the current expansion is in the Coastal Plain. One important reason for the expansion in south Georgia is that the Coastal Plain has abundant crop land for disposal and utilization of the litter. It is apparent that applications of broiler litter will be made on land to be planted to peanuts and cotton, the main cash crops in the Coastal Plain. Little is known on the reactions of these crops to unincorporated broiler litter application in the Coastal Plain using conservation tillage.

Study Description

An experiment was initiated on the Coastal Plain Experiment Station, Tifton, GA on a Tifton loamy sand, (Plinthic Kandiudult) in Feb. 1996. The experiment is a 3-year irrigated double-cropped rotation with each crop grown each year. The sequence of crops in a single cycle (three cycles) are cotton, fallow, peanut, canola, pearl millet, and wheat. Within the cycles there are four broiler litter rates of 0, 2, 4, and 6 ton/acre as the main plots of a split-plot arrangement of a randomized complete block design. Within each litter rate, six fertilizer treatments are included to attempt to balance plant nutrition for top yield, grade, and profitability. The moldboard plow was not used in this experiment and surface tillage has been eliminated gradually in the 3 years of the experiment reported. Soil samples were obtained in main plots in depth increments of 0-6, 6-12, 12-18, 18-24, and 24-30 inches each winter to evaluate changes in nutrient elements with soil depth as affected by litter rate. Responses to broiler litter to applications and to supplemental fertilization for each crop and litter rate were determined.

Applied Questions

What have been the main effects of the shift to more conservation tillage with application of broiler litter in this experiment?

Mehlich-1 soil test P levels are increasing rapidly in the surface soil where more than 2 ton broiler litter/acre has been applied. Cotton yields in our experiment were 2 to 2.5 greater than the state average in all 3 years of the experiment. The main reason for the high yields was irrigation, but broiler litter also had a large positive effect on yield. The effect was positive to the 4 ton rate in 1996 and 1997 and then only to the 2 ton rate in 1998. The different response in 1998 was possibly due to the fact that N and P were increasing to excessive levels in the soil due to repeated applications of broiler litter. Following application of litter to the 1998 cotton, a total of 20 tons had been applied at the 4 ton rate and 30 tons at the 6 ton rate. In all 3 years, peanut value/acre was reduced greatly by application of broiler litter, regardless of the rate. Wheat yield was poor in 1997 (due to late detected disease

problems) and good in 1998. Wheat responded well to broiler litter. Response to litter was to the 4 and 6 ton rates for the 2 years completed. Canola yields above state averages were produced on the plots in 1997 and 1998. Yields responded positively to litter application, peaking at the 4 ton and 6 ton rates for 1997 and 1998, respectively.

What crop responses were made by applications of inorganic fertilizers following broiler litter application?

Over all litter rates, cotton yields were increased by starter fertilizer applications in 1996 and 1997, but not in 1998. Three foliar applications of KNO_3 did not produce significantly more cotton yield. That result may have been different if soil test K were at a “low” rather than at a “medium” level. Following application of 2 ton/acre litter gross economic increases were not consistent over the 3 years of cotton in the rotation. Mean increases of 66 and \$33/acre/year were attained from 10-34-0 and 12-22-5 (2S) starters, respectively. Peanut did not respond to starter fertilizers. Over all litter rates in wheat, top dress dribble application of 40 to 60 lb N as UAN on about 15 February (early) produced the greatest yield.. There appeared to be a penalty for late application (15 March) and no additional response to two applications. At the 2 ton litter rate, approximately \$60/acre gross revenue was averaged by early applications of 40 to 60 lb N. Responses to top dress dribble UAN were also significant

for canola, but different than for wheat. Application of the UAN 90 DAP resulted in greater response than application at 45 DAP. However, application on wheat at 45 DAP and on canola at 90 DAP arrived at nearly the same calendar date, possibly suggesting that specific weather conditions may have been important in the observed responses. At a 2-ton litter rate, our data suggest profitable responses to dribble applications on canola. The gross responses averaged \$63/acre/year for a single application of 40 lb N at 90 DAP and \$84/acre/year when two applications of 40 lb N were made.

Recommendations

Broiler litter application should be limited to no more than 2 ton/acre/crop in a double-cropped conservation-tilled system. Greater rates of application appear to be increasing P levels in the surface soil. The excessive P will likely be subject to losses in surface runoff. Broiler litter application prior to planting peanut should be avoided. Accurate and precise methods for prediction of fertilizer needs for crop production following broiler litter application need further development.

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