POTENTIAL USE OF SLOW-RELEASE UREA IN WATER-SEEDED, STALE SEEDBED RICE

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INTERPRETIVE SUMMARY

Problem

Stale seedbed rice production systems have increased in popularity and have significantly contributed to reducing soil erosion and improving the quality of floodwater discharged from rice fields. Proper management of fertilizer nitrogen (N) is a concern since N is not preplant incorporated in these stale seedbeds. Nitrogen has to be applied to the soil surface, which may be wet or saturated, or into the floodwater on seedling rice. In these situations, N efficiency is reduced and grain yields are decreased. Slow-release urea formulations have the potential to improve efficiency and increase grain yields in these stale seedbed, water-seeded cultural systems. The objective of this study was to compare slow-release urea products with standard urea at varying rates and N application timings in a water-seeded, pinpoint flood culture using conventional and stale seedbed tillage systems.

Literature Summary

Nitrogen efficiency is reduced when urea N is applied to wet or saturated soil surfaces, or into the floodwater on seedling rice. In southwest Louisiana, most rice is water-seeded and cultured in a pinpoint flood system in order to suppress red rice, a noxious rice biotype that cannot be selectively controlled in established commercial rice. Stale seedbed tillage does not allow for incorporation of N, and all N is applied to the soil surface either preplant (PP), postdrain (PD), or postflood (PF). Delayed flood establishment after N application, even when N is applied to dry soil surfaces, can result in N loss via ammonia volatilization or denitrification, resulting in reduced grain yields. Slow-release urea products have been shown to be effective in conventional tillage systems and in water-seeded rice. Little is known about the effectiveness of these products in stale seedbed tillage systems.

Study description

The experiment was conducted at the Rice Research Station in Crowley, LA in 1997 and 1999. Factorial treatment combinations of tillage, N source, N timing, and N rate (1999 only) were replicated four times. Tillage factors included conventional tillage and stale seedbed. Conventional tillage consisted of all necessary tillage operations to form a smooth, uniform, and weedfree seedbed just prior to planting. The stale seedbed was prepared in October or November each year, was allowed to revegetate with native weeds, and was burned down with glyphosate and 2,4-D 4 weeks before planting. N sources included a polyolefin-coated urea (PCU), a sulfur-coated urea (SCU in 1997 only), and standard urea. N timing included PP, PD, and PF. All N was applied to the soil surface. The PD application consisted of N being applied to a saturated soil surface after initial flood removal (3 to 4 days after seeding) and just prior to permanent flood establishment. The PF application consisted of N being applied 2 ½ to 3 weeks after emergence, and rice was in the 3-leaf growth stage. Days to 50% heading, plant height, grain yield, and N content of the grain and straw (1997 only) were determined. Data were statistically analyzed using ANOVA procedures and Fisher's Protected LSD for mean separation.

Applied Questions

How did performance of the slow-release N products compare with standard urea?

Both PCU and SCU increased rice grain yields compared with standard urea. The yield increases for PCU and SCU were 12 and 13% respectively, in 1997. In 1999, PCU increased grain yield by 23%. In general, plants were taller and tended to mature a few days earlier with the slow-release products.

What is the economic potential for use of slow-release N products in rice?

At the present time, the use of slow-release N products in commercial rice production is cost-prohibitive. The approach of this research was to use slow-release N to provide the total amount of N required to optimize grain yields. Future research should investigate the possibility of using slow-release N fertilizers in combination with standard urea. If the proper combination and/or application timing results in higher grain yield, improved N efficiency, and reduced fertilizer inputs, the use of slow-release N could become economically feasible.

Management Recommendations

Even though the use of slow-release N is not an economical consideration for commercial rice production, the application timings of both slow release urea and standard urea that were evaluated do show how N efficiency can be improved in water-seeded, stale seedbed rice production. In a pinpoint flood water management system, urea applied to the soil surface PP resulted in the highest grain yields. Postdrain applications were less effective. Applying N into the floodwater on seedling rice was very inefficient and resulted in significant yield losses. Although applying N in split applications was not addressed in these experiments, it is believed that such a delivery system would also be suitable. It is highly encouraged that the initial application be made either PP or PD, and the remainder applied into the floodwater on rice that has at least reached the tillering growth stage. In situations where N has to be applied into the floodwater, N efficiency is improved as the rice plant develops a more extensive root system.

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