ROLE OF WINTER RYE CULTIVAR AND SEEDING RATE IN MANAGING RESIDUE AND NITROGEN AVAILABILITY IN CORN CROPPING SYSTEMS

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ABSTRACT

Winter cereal rye (*Secale cereale* L.) (WCR) is the most widely used cover crop in Illinois and is recognized as one of the most effective in-field practices to reduce nitrate-N and phosphorus (P) losses to the Mississippi River Basin (MRB). However, adoption of WCR prior to corn (*Zea mays* L.) remains limited due to challenges such as stand establishment and nitrogen immobilization. Management strategies, such as selecting appropriate cultivars and optimizing seeding rates, may help mitigate these issues by improving N capture and release. Two experiments were conducted to evaluate the effects of WCR seeding rate (Study A) and cultivar × seeding rate interactions (Study B) on biomass production, tissue composition, decomposition, N release, and soil N dynamics. In Study A, a no-cover crop control and four seeding rates (30, 50, 75, and 100 lb ac^{-1}) were arranged in a randomized complete block design (RCBD) with six replicates. In Study B, two WCR cultivars (normal vs. hybrid) were factorially combined with two seeding rates (60 and 90 lb ac^{-1}) in an RCBD with four replicates. Study A showed that increasing seeding rate did not significantly affect WCR biomass, N, C, or C:N ratio, but did result in a positive linear increase in the lignin:N ratio. Decomposition rates were similar across seeding rates, but not for changes in C:N ratio over the corn growing period. Estimated N release at 30 lb ac^{-1} was greater than other rates in 2021 but not in 2022. In Study B, hybrid rye produced higher biomass than normal rye at the higher seeding rate, yet tissue composition (N, C, C:N, and lignin:N) and decomposition/N release were unaffected by treatment. Overall, our results suggest that reducing WCR seeding rates to as low as 30 lb ac^{-1} can enhance nutrient cycling benefits, lower cover crop costs, and potentially improve adoption. Moreover, N release dynamics differed between hybrid and normal rye, indicating that cultivar choice may further influence nutrient cycling outcomes. Future research should investigate low seeding rates in relation to water quality benefits.

Key words: Cover crop biomass; skipping the corn row; winter cereal rye, ecosystem services