

NITROGEN RECOVERY FROM INCORPORATED COTTON RESIDUE

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Abstract

This study was conducted in the San Joaquin Valley, CA, in two fields differing in soil type to determine the recovery of residue N in plants and soil. Acala (cv. Maxxa) was grown in 1998, 1999, and 2000 on a Panoche clay loam (fine-loamy, mixed (calcareous), thermic Typic Torriorthent) and on a Wasco sandy loam (coarse-loamy, mixed, nonacid, thermic Typic Torriorthent). Four main N treatments were established in four replications at each site and in each year: 56, 112, 168, and 224 kg N ha⁻¹. Microplots within the N-56 and N-168 treatments, were fertilized with ¹⁵N-urea in 1998. In these microplots leaves that had fallen to the ground were collected prior to machine harvest. After harvest aboveground residue was coarsely chopped using standard field operations and then removed from the microplots. A new series of microplots was established by applying the ¹⁵N-labeled residues, collected from the original microplots, onto areas cleared of aboveground residues in the same N treatment. Thus, the new series of microplots received labeled aboveground residue but was not labeled in its belowground component. Residues were incorporated into the soil when the field was disked. Cotton was planted in 1999 and 2000 and aerial plant portions were collected and separated into different fractions several times throughout each growing season. Plant samples were dried, ground, and analyzed for N and ¹⁵N content. After harvest in 2000, soil samples were collected in 0.3-m or 0.6-m increments to a depth of 2.4 m, air dried, ground, and analyzed for N and ¹⁵N content.

On both soil types, uptake of residue N was considerably greater in the first year than in the second year after application. The majority of the residue N was recovered between early square and peak bloom, coinciding with the time of greatest total plant N uptake. At the time of defoliation in the first year after residue application, an average of 3.1% of the residue N was recovered by the plants on the Panoche clay loam and 5.9% by those on the Wasco sandy loam ($P = 0.053$). These recoveries correspond to about 1.8 and 2.8% of the total plant N taken up at these two sites, respectively. In the first season after application, N recovery from residue tended to be greater for the N-168 than the N-56 treatment at both locations, however, the difference was not statistically significant at either location when analyzed across all sampling dates. In the second year after application, the differences between treatments were not significant although they separated on the Wasco sandy loam.

In 1999, approximately 60% of the residue N recovered by cotton plants was removed from the field in seed and lint. In the second year after residue N application, partitioning of recovered residue N into the harvested plant portion was again about 60% on the Panoche clay loam but only about 44% on the Wasco sandy loam. Combined over the two growing seasons, only 2.7% to 5.2% of the initially applied cotton residue was removed from the field as harvest. At the end of the 2000 season, 48% to 86% of the N applied in form of cotton residue in 1998 was recovered in the soil, and between 12.9 % and 50.9 % of residue N was not accounted for.