FIELD PLOT DESIGN EVALUATION FOR NITROGEN-15 LABELED FERTILIZERS IN A FURROW IRRIGATED SYSTEM

J.C. Silvertooth, E.R. Norton, J.C. Navarro, A. Galadima and C.A. Sanchez
University of Arizona
Tucson, AZ

Abstract

In the use of ^{15}N labeled fertilizers as tracers in a soil-plant system, two aspects of the field plot techniques are very important. First, ^{15}N microplots need to be of sufficient size to allow for the collection of plant and soil samples while taking into account border effects on the perimeter of the microplot area. Secondly, most researchers are encouraged to minimize microplot size due the expense associated with ^{15}N labeled fertilizer materials. A considerable amount of research has been done to address this aspect of labeled fertilizer N research in various crop systems. However, there is no information available relative to the appropriate design or field microplot dimensions necessary for the use of ^{15}N labeled materials in a furrow irrigated, row cropping system. The objective of this project was to evaluate the size and dimensions of ^{15}N subplot areas necessary for a furrow irrigated row crop system. Field experiments were conducted at the University of Arizona Maricopa Agricultural Center in 1991 on a Casa Grande sandy loam soil (Typic Natrargid) and at the Marana Agricultural Center in 1995 on a Pima clay loam soil (Typic Torrifluvent). At each location Upland cotton (*Gossypium hirsutum* L.) was planted with 1m row spacings. Microplots were four, 1 m rows wide and 1 m in length. ^{15}N labeled fertilizer as $(^{15}NH_4)_2SO_4$ with 5 atom % ^{15}N was applied to the side of the rows by hand in a simulated side dress fashion to each of the four rows in each microplot between first bloom and peak bloom at a rate of 56 kg N/ha/application. At maturity, entire plants were collected in 0.25m increments on a grid pattern from the center of each plot and extending 2m beyond the vertical and horizontal borders of each plot. Samples were dried, ground, and subjected to total N and isotope ratio analysis for ^{15}N determinations. Patterns of ^{15}N labeled fertilizer uptake were symmetrical and consistent in both the vertical and horizontal dimensions. These results indicate that due to border effects, plant samples should not be collected within 0.25 m of the microplot perimeters. Adequate ^{15}N microplot dimensions in an irrigated row crop system could consist of microplots 4 m wide and 1 m in length. Plant and soil samples for measuring fertilizer N uptake and recovery should be taken from the interior 0.5 m segments of the center two rows. This leaves 0.25 m distances to the microplot border within the row and over 1.0 m distances to the mircoplot edge horizontally.

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