NITROGEN MANAGEMENT IN ULTRA NARROW ROW COTTON

Mark L. McFarland and Robert G. Lemon
Texas Agricultural Extension Service
College Station, TX
Frank M. Hons
Texas A&M University
College Station, TX
Thomas Gerik
Texas Agricultural Experiment Station
Temple, TX

Abstract

Proper nitrogen management is more important for cotton than for most other major field crops. Ultra narrow row (UNR) production systems may alter N uptake and use efficiencies relative to conventional and narrow row spacings. A study was conducted to evaluate the effects of four nitrogen rates (0, 50, 100 and 150 lbs N per acre) and two row spacings (7.5 and 38 inches) on cotton growth and production. Plant height was significantly affected by row spacing and N rate. Plants were consistently shorter in 7.5-inch rows compared to those in 38-inch rows from pinhead square through maturity. Neither row spacing nor N rate affected cotton lint yield, with average yields totaling approximately 338 lbs lint per acre. Consistent with previous research findings, plants in 7.5-inch rows set a higher percentage of bolls on fruiting branches 6 through 10 compared to plants in conventional, 38-inch rows.

Introduction

Cotton producers are continually seeking to improve production systems and increase profitability. Ultra narrow row (UNR) cotton production systems (i.e., row spacing less than 20 inches) have the potential to significantly increase production efficiency compared to conventional (40-inch) and narrow (30-inch) row spacing systems. UNR systems enable the crop to intercept more sunlight and make more efficient use of available moisture. Research in Texas has shown that UNR systems may shorten the crop development period, which can reduce costs associated with late season insect control, and yield and quality losses from September rainfall. In addition, early crop development has the potential to reduce over-wintering boll weevil populations for the coming year. Most importantly, studies at the Blackland Research Center in Temple, Tx, have shown that UNR production systems can increase cotton yields by 40 to 100% compared to conventional and narrow row systems.

Proper nitrogen management is more important for cotton than for most other major field crops. Nitrogen deficiency during the critical fruiting period from first square to peak flowering (typically 40 to 85 days after planting) will have a significant effect on yield (Gerik et al., 1997). Conversely, excess N can promote vegetative growth at the expense of boll production, promote shedding of floral buds and small bolls, and delay maturity.

Although the N requirements of cotton are thought to be reasonably well understood, large variations occur among published reports. Recent studies suggest a potential range from 16 to 20 lb N per 100 lb lint for optimum production. However, no information is available regarding the effects of narrow row spacing on cotton N requirements. UNR production systems may alter N uptake and use efficiencies relative to conventional and narrow row spacings. Shorter growth periods and more effective use of soil N may reduce the amount of fertilizer necessary to supply adequate N during the growth phase. Conversely, increased water use efficiency and the associated greater yield potential may increase crop N requirements. The objective of this study was to evaluate the effects of ultra narrow row spacing compared to conventional row spacing on nitrogen requirements for optimum growth and yield in cotton production systems.

Materials and Methods

The study site was located on the Stiles Research and Demonstration Farm in central Texas. The soil series is a Burleson clay (fine, montmorillonitic). Average annual rainfall for the area is about 34 inches and the average frost free period is approximately 224 days. The study was designed as a randomized complete block, arranged as a split plot with four replications. Main plots were row spacing (7.5 and 38 inches) and subplots were nitrogen rate (0, 50, 100 and 150 lbs N per acre). Nitrogen fertilizer was applied as 32% solution on March 5 and 6, 1998. For UNR plots, the fertilizer was knifed on 15-inch centers 6 inches deep. In conventional row spacing plots, fertilizer N was knifed 6 inches deep and 6 inches to the side of the row. Plots were 30 by 330 feet and were planted on April 14 with DPL5690 RR. Conventional rows were planted with a White 6700 vacuum planter to achieve a final plant population of 53,000 plants per acre. UNR plots were planted with a John Deere 1510 drill to a final population of 94,000 plants per acre. Pendimethalin was applied preplant incorporated for base weed control.

Soil samples were collected in increments of 0 to 6, 6 to 12, 12 to 24, 24 to 36 and 36 to 48-inches prior to fertilization and subjected to a routine soil test by the TAEX Soil Testing Laboratory. Plant height was determined at pinhead square, peak bloom and maturity by measuring 20 plants in each plot. Petiole nitrate concentrations were measured at peak bloom by collecting 20 petioles from each plot. Plots were harvested on August 11 and 12, 1998 by hand harvesting 12 foot swaths from interior rows at three locations in each 38-inch row spacing plot. For UNR

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treatments, samples were harvested within 1 m^2 quadrats at three locations in each plot. Plant and boll counts were taken in each harvested area to provide estimates of bolls per acre and bolls per plant. Prior to harvest, 5 plants in each plot were collected to determine plant height, node number, fruiting position and retention.

Results and Discussion

Available moisture was the major limiting factor during 1998. Total rainfall during the April-August growing season (1.79 inches) amounted to only 15% of the long-term average (20.08 inches) for that period. Incremental soil samples to a depth of 48 inches indicated very low residual nitrogen ($\leq$ 1.0 ppm) levels within the soil profile. Phosphorus levels were moderate and showed significant evidence of stratification. The preceding crop was grain sorghum yielding approximately 4000 lbs per acre.

Plant height was significantly affected by row spacing and N rate. Plants were consistently shorter in 7.5-inch rows compared to those in 38-inch rows from pinhead square through maturity. Nitrogen fertilizer increased plant height at each growth stage compared to the control, but there were no differences among N rates. Due to the dry conditions, no mepiquat chloride was needed to manage crop height.

Neither row spacing nor N rate affected cotton lint yield, with average yields totaling approximately 338 lbs lint per acre. As expected, number of bolls per acre was significantly greater for UNR spacing treatments; however, this was offset by consistently lower lint per boll. Consistent with previous research findings, plants in 7.5-inch rows set a higher percentage of bolls on fruiting branches 6 through 10 compared to plants in conventional, 38-inch rows. In addition, increasing N rate tended to shift boll retention to higher positions, regardless of row spacing. Row spacing and N rate did not significantly affect the fiber properties of micronaire, strength or length.