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Tillage and N management to maximize profitability on wheat following cotton

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Many growers in Arizona plant a durum wheat crop on beds following cotton in their production. Some growers adopt no-till approach and drill the wheat crop directly into shredded cotton residue (No tillage), some use a Pegasus or Sundance system that combine cutting stalks and listing beds in one operation to bury most residues in the beds (Conservation tillage), while the others use conventional tillage systems including separate operations of shredding cotton stalks, disking the field, and list the beds for wheat planting (Conventional tillage). In all situations, wheat crop is planted in both beds and furrows.

Since significant N is required to produce a high-yield and high-quality wheat crop, optimizing N input is important to produce required yield and quality with minimal N input. There is about 120 lbs/A of N in cotton residue with a 3.5 bales cotton yield (Ayala and Doerge, 2001). Effectively using N in cotton residue can reduce nitrogen input in wheat and increase growers' profitability.

Due to the fact that decomposing cotton residue tied up N in the soil, it is common to find N deficiency at early wheat growth stage. The situation is more obvious for wheat plants in furrows than on beds in the bedding systems because irrigation water leaches N into the deeper soil profile or moves N from furrows to beds. A lower stem nitrate analysis of wheat sample in a grower's field at Marana, AZ, in the spring of 2009 showed that wheat in furrows were smaller and yellower and had 4 times less NO_3-N in the lower stem at 5-6 leaf stage. The difference in wheat growth is still visible in many fields at late growth stage.

A field experiment was conducted in the 2010 growing season at Marana, AZ using the conservation tillage system to study pre-plant N application on yield and quality of wheat following cotton. The results showed that 50 lbs/A of pre-plant N produced similar wheat yield and quality as the grower's 90 lbs/A of N split-applied at 3-4 leaf, booting, and flowering stages. A pre-plant N application at a rate of 110 lbs/A of pre-plant N increased yield by 20% compared to the split

application. This indicates that pre-plant N application is important for wheat growth at early growth stage and earlier N release from cotton residue.

In this project, we conducted on-farm research plots to investigate the effects of different rates of pre-plant N applications on wheat grain yield and quality in the three different tillage systems: no tillage, conservation tillage, and conventional tillage. The purpose of this project is to establish N application guidelines for durum wheat following cotton under different tillage practices.

Materials and Methods

The experiment was conducted in a grower's farm at Marana, AZ. A split plot design was used in the study. The main plot treatments include three tillage systems: no tillage, conservation tillage, and conventional tillage. Within each tillage treatment, four pre-plant N rates (0, 30, 60, 90 lbs/A) was applied.

Results

Due to delay in field preparation and delivery of irrigation water, the field was planted in the first week of February. Wheat did not germinate until the third week of February due to unusual cooler temperature in February, 2011. As a result of late planting and emergence as well as other unknown management practices and weather conditions, wheat yield in this field was not consistent. The plots in the east side of the field yielded 10 times more than west side of the field (Table 1).

The experiment is considered a failure due to the above conditions. We propose to conduct the experiment with small plots at Maricopa Ag Center in 2012 at no cost to AGRPC.

References

Ayala, F. and T.A. Doerge. 2001. Management of Fertilizer Nitrogen in Arizona Cotton Production. www.ag.arizona.edu/pubs/crops/az1243.pdf

Table 1. Tillage and N management in cotton-wheat rotation plot map with grain yield

SW												NW
240 feet	N3* 170†	N2 114	N1 184	N2 114	N1 84	N0 82	N3 68	N3 254	N2 360	N1 72	N2 48	N0 298
240 feet	N0 650	N3 588	N2 656	N3 496	N2 380	N1 355	N0 242	N0 340	N1 438	N2 380	N3 212	N2 288
240 feet	N1 906	N0 792	N3 848	N1 814	N0 666	N3 666	N2 480	N2 664	N3 778	N0 790	N1 716	N3 690
240 feet	N2 906	N1 754	N0 658	N0 738	N3 638	N2 535	N1 506	N1 565	N0 504	N3 799	N0 676	N1 722
	No-till	Peg-till	Con till	Con-till	Peg-till	No-till	Peg-till	No-till	Con-till	Con-till	No-till	Peg-till
SE	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows	six 38-inch rows

* Pre-plant N fertilizer was applied to N0, N1, N2, and N3 at rates of 0, 30, 60, 90 N lb/A, respectively.

† The numbers are lb of grain in the plot (six 38-inch rows wide and 240 feet long).