BOLL RETENTION AS INFLUENCED BY IN-FURROW, PREPLANT ASSET RTU (6-20-5) AND FOLIAR APPLICATIONS OF EMPOWER

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Abstract

Asset RTU improved germination and emergence under the adverse planting conditions of 1998, an El' Nino year. Root samples taken at 1st bloom from Asset RTU treatments demonstrated increased root length counts of 12% and 13% above the Untreated Control in 1997 and 98, respectively. Final plant map data indicated a higher percentage of cotton bolls set in the 1st fruiting position within the Asset RTU treatments compared to the controls. Asset RTU treatments out yielded the Untreated Control by 1% and 7% in 1997 and 98 respectively.

The results from the foliar application of Empower were inconclusive and varied based on the year of study.

Introduction

The principle factors affecting root distribution within a field soil profile are; (1) genetic differences (variety), (2) flows of photosynthates and growth regulating compounds from the shoots, (3) seasonal shifts in root primordia, (4) soil chemical, physical, and biological factors (V.V. Rending, H.M. Taylor, 1989). With the exception of variety selection, soil physical and chemical factors provides growers the greatest opportunity to improve root distribution and yield.

Research has demonstrated an increased uptake of phosphorus by plants (F.E Khasawneh, 1980) when the ammonium form of nitrogen is added to phosphate fertilizers. This affect is particularly evident when using a pre-plant banded phosphorus application.

Phosphate stimulates early root growth and formation. It is used in the formation of nucleic acids. Phosphate plays an important role in the storage and transfer of energy within a growing plant. Various explanations have been proposed for these observations.

Phosphate stimulates early root growth and formation producing more root mass capable of mineral uptake. The nitrification of the ammonium nitrogen lowers the soil pH enhancing the availability of the phosphate. The presence of the ammonium nitrogen and the phosphate cause a physiological change making the root cells more receptive to phosphorous and increase its transfer across the root and into the Xylem.

It has been observed that commercial fertilizer additives and pre-plant fertilizers can increase root mass. This, however, has not always translated into higher yields. It is proposed that by providing additional micronutrients and reducing pest pressures early in the development of a crop, one may increase yields consistently.

The objectives of this study are as follows: to determine the affect of Asset RTU on root formation, to measure any subsequent changes in boll retention and to evaluate the use of a micro nutrient/insect repellent foliar spray.

Methods and Materials

ASSET RTU (Ready To Use) is a nutrient solution containing 6.0% nitrogen. 20.0% Phosphoric Acid, and 5.0% Potash. ASSET RTU also contains a proprietary fertilizer additive designed for ease of mixing with a variety of crop production chemicals.

ASSET RTU contains nitrogen derived from ammonia carboxylates and ammonia polyphosphates. Phosphorous is derived from ammonia and potassium polyphosphates. Potash is derived from potassium polyphosphate. Asset RTU is applied at 1 to 6 pints per acre in a band at planting. The trial was conducted at the 1 quart rate.

Empower is a foliar treatment containing 10% Garlic Juice, 3.75% Nitrogen and 1.5% of the following combination of nutrients; Magnesium, Boron, Cobalt, Copper, Manganese, Iron, Molybdenum and Zinc. Empower is applied at 4-6 true leaf and first bloom.

In 1997, a two year study was initiated in Tulare, CA on sandy loam soils. The trial was designed to fit current cultural practices of commercial fields; while utilizing University of California recommended plant mapping and pest threshold. The experimental design was a randomized strip plot with four replicates. The cotton seed variety selected for the experiment was Acala Maxxa. The field was applied with 5 gallons 10-34-0 broadcast prior to bed preparation. A twenty five-gallon poly tank was mounted on a John Deere 7100 planter. A three-gallon per minute electric pump provided pump pressure. The discharge lines were connected to a diaphragm with a D5 (tee-jet) orifice. Individual discharge lines ¼ inch in diameter were run into the seed bed opening behind the drop tubes of the seed. All plots received 5 gallons of water in furrow at planting; with the treated plots receiving the additional 1quart of Asset RTU as a in furrow treatment. The treatments of ASSET RTU were applied and compared to an Untreated Control in 1997 and 98. Empower treatments were imposed at a latter date. Each treatment consisted of four replicated plots. Each plot consisted of six beds on 38 inch spacing with a plot length of 1056' and 1260' in 1997 and 98, respectively.

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Sampling for total planted seed per acre was evaluated. Subsequent sampling information collected on a weekly basis until root to shoot length exceeded 1.5 inches (Kerby, Keeley, and Johnson, 1987) established germination.

Root length was determined by the method developed by Bobby M^{c}Micheal of Lubbock, Texas USDA for the Cotton Incorporated Root Health study. A total of two root length sample events were recorded. Asset RTU and untreated control were sampled across four repetitions. Plants were selected for sampling based on uniform stand and plant map data taken prior to selecting a dig site. Depths required to excavate varied by sample date. The stages of development targeted were 4-6 true leaf and 1st bloom. Sampling depths ranged from sixteen and thirty six inches; at the first and second sample, respectively. Sampling width was determined by root length at the time of sampling event. The excavation was performed with hand tool to carefully prepare the site, maintaining the integrity of the dirt "wall" for root counting. Pressurized tanks filled with water were utilized to remove one – two millimeters of soil from the shaved surface. A grid was placed over the prepared surface and all visible fine root per 10 by 10-centimeter grid were counted and recorded.

Following the development of the first true leaf, plant map information including height, nodes, percent retention were collected and recorded. Insect information was also collected on a weekly basis through sampling twenty five leaves per repetition and counting all pests and beneficial insects. In addition, fifty sweep net sweeps per repetition were also performed.

All foliar insecticide/miticide/herbicide and defoliant application was performed by Integrated Cop Strategies utilizing a Melroe Spray Coupe. Foliar additions of 1pint Empower were made with insecticide/miticide applications to the Asset RTU and Untreated Control plots to determine the affect of micro nutrient on 1st position boll set.

Spindle picker harvest was performed of strip plots. All six rows were harvested per repetition. A scale mounted on a cotton boll buggy was used to weigh total seed cotton per repetition.

Statistical analysis was performed using MSTATC.

Results and Discussion

Asset RTU influenced germination and emergence under adverse conditions. In fact, most of the original trial was plowed under leaving ten of the original eighty four acres planted containing the Asset RTU treatments between the remaining Untreated Controls.

The slower rate of emergence in the Untreated Control subjected the seedlings to pathogens for a longer period of time. 1998 final stand counts were statistically significant (table 1) demonstrating a response from Asset RTU. No improvement in germination or emergence was recorded during 1997, under optimum planting conditions.

Root samples in Asset RTU treatments at the 4-6 true leaf stage demonstrated an average increase (compared to UTC) of 15% and 46% in root length per 10X10 centimeter grid location for 1997 and 98, respectively (table 2). Root length data collected at 1st bloom showed consistency from 1997 to 98. Root length was statistically significant at 12% and 13% above the Untreated Control in 1997 and 98 respectively. Indicating an improved root structure when Asset RTU is applied at planting.

Pest pressure was not a factor and foliar Empower treatments demonstrated no consistent improvement in yield.

In season plant mapping demonstrated no statistically significant difference in height, nodes and percent retention in the top five fruiting positions at any sample event up to cutout. However, final plant map data demonstrated improved percentage of 1st position bolls in Asset RTU treatments (table 3). This trend was consistent across 1997 and 98 when compared to the Untreated Control. Further evidence of improved 1st position boll set with Asset RTU was evidenced with a higher percentage of vegetative bolls produced in the Untreated Control (table 3). Empower treatments reduced first position retention when applied early compared to the Asset treatments and the Untreated Control of 1997 (data not shown). However during 1998 all Empower treatments produced more 1st position bolls compared to the Untreated Control; while demonstrating a consistent negative response when applied early (4-6 true leaf), compared to Asset RTU treatments.

Total seed cotton produced in Asset RTU treatments out yielded the Untreated Control by 1% and 7% in 1997 and 98 respectively (table 4). The improved yield response was due to an improvement in final plant stand and final bolls set in the 1st fruiting position. Yield was lower across all treatments from 1997 to 1998.

References

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Table 1. Final plant stand per acre.

Year	Treatment	Plant Stand per Acre
1997	Asset RTU	44,000 (a)
	Untreated Control	39,500 (a)
1998	Asset RTU	52,480 (a)
	Untreated Control	33.840 (b)

Means within a column followed by the same letter are not significantly different at (lsd = .05).

Table 2. Average root length counts per (10X10 centimeter grid location)

Year	Treatment	4-6 leaf	1st bloom
1997	Asset RTU	4.260 (a)	9.964 (a)
	Untreated Control	3.635 (a)	8.776 (b)
1998	Asset RTU	3.006 (a)	5.911 (a)
	Untreated Control	1.637 (b)	5.112 (b)

Means within a column followed by the same letter are not significantly different at (lsd = .05)

Table 3. Final plant map, percent boll retention by fruiting branch position.

Year	Treatment	FP1	FP2	FP3	Veg.
1997	Asset RTU	75% (a)	22% (a)	4% (a)	0% (a)
	Untreated Control	72% (a)	18% (a)	7% (a)	3% (a)
1998	Asset RTU	84% (a)	13% (a)	2% (a)	1% (a)
	Untreated Control	51% (b)	26% (b)	5% (b)	18% (b)

Means within a column followed by the same letter are not significantly different at (lsd = .05)

Table 4. 1997 and 1998 yields per acre.

Year	Treatment	Seed Cotton	Seed	Cotton Lint
1997	Asset RTU	3521 (a)	2173 (a)	1348 (a)
	Untreated Control	3494 (a)	2162 (a)	1332 (a)
1998	Asset RTU	2977 (a)	1995 (a)	982 (a)
	Untreated Control	2783 (a)	1865 (a)	918 (a)

Means within a column followed by the same letter are not significantly different at (lsd = .05)