EVALUATION OF SALINITY MANAGEMENT PRODUCTS IN WEST TEXAS IRRIGATED COTTON

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Introduction and Abstract

Cotton is produced on millions of salt affected acres and many of them are due to poor quality irrigation water and surface water evaporation, especially in semi-arid environments. Due to recent drought and increased irrigation, salinity problems are intensifying in West Texas. Cotton is considered a salt tolerant crop but germination, seedling establishment, and yield are much reduced in salt affected soils. Soil sampling has identified high salt concentrations in many fields and also salt stratification within drip irrigated cotton beds at different rooting depths with the highest concentrations on the top of the drip bed. See Table 1. Seedling emergence, stand, and yield are reduced in many locations (Figure1.).

Traditional recommendations for salinity treatments have been centered on leaching salts below the root zone with additional and higher quality surface applied water. Non-traditional remedies are needed with subsurface drip irrigation and as quality water becomes more expensive and scare. At planting applications of commercial soil amendment products as experimental remedies were evaluated by Drake and Easterling in the 2014 cropping season (2015), and reevaluated in 2015 with the addition of a new product. An electromagnetic water treatment system for the irrigation water was also evaluated during the 2014 and 2015 cropping system. Although some higher numbers were observed none of these commercial remedies produced statistically significant greater stand counts, other agronomic measurements, or yields compared to the untreated check. Based on these findings, the use and potential benefits of these products should be carefully evaluated including replicated treated and untreated areas of measurement.

Table 1. Measurement of salinity, salt species, and sodium absorption ratio (SAR) at different soil depths in two cotton seed beds in Upton Co. Texas. One bed exhibited good seedling emergence and another poor seedling emergence with very high salt concentrations.

Emergence	Depth of soil sample (inches)	Electro-conductivity (µmho/cm)	Ca ppm	K Ppm	Na ppm	SAR (Na absorption ratio)
Poor	0-3	2820	10708	740	1578	11.83
Poor	3-6	2130	10746	563	1090	9.18
Poor	6-12	1950	11213	422	921	-
Good	0-3	1870	10686	712	720	6.61

Figure 1. Poor seedling emergence and deformed cotton seedlings from high salt concentrations in the seed bed

Materials and Methods

At Planting Treatments

Cotton was seeded into salt affected pre-watered seed beds on May 19, 2014 and June 1, 2015. Treatments, listed in Table 2; were mixed with water and applied on the open seed furrow with a spray nozzle, at 6 gallons/acre; after seed drop and before the closing wheels. The experimental design was a modified randomized complete block with a split plot of 4 treated rows next to 4 untreated rows. Plot size was 300 ft in length with 4 replications per treatment. Plots were evaluated at the cotyledon stage and 4-5 leaf stage for stand count. Plots were also evaluated for yield at the end of the growing season. Pre and post treatment soil tests were taken and compared for differences.

Electromagnetic irrigation water treatments

An electromagnetic field generating box, TransGlobalH2O, and electrodes were installed in the main irrigation line at the drip filter house. Electrodes consisted of a charging electrode attached to the generator box and a grounding electrode downstream in the irrigation pipe. Irrigation was initiated after stand establishment on July 3, 2014. The charge was applied for 24 hours as each of the treated stations was irrigating. Adjacent drip irrigation stations were assigned as treated and untreated. Each station was 6 acres with 6 treated and 6 untreated stations. See Figure 2 for a picture of a measurement of the electromagnetic field at the charging electrode. Plant growth parameters were taken during the season and a final yield and quality were measured. Pre and post treatment soil tests were taken and compared for differences (data not shown). The field was rotated to dryland winter wheat in the fall of 2014 and wheat yields in treated and untreated irrigation stations were measured in June of 2015.

Figure 2. Spray nozzle mounted on the planter to apply salinity mediation and liquid fertilizer products at planting, left; measurement of an electromagnetic field supplied to an electrode inside of an irrigation pipe to treat irrigation water before passing into the subsurface drip irrigation field.

Table 2. Commercially available salinity and liquid fertilizer products with rates per acre, ingredients, and manufactures used in the 2014 and 2015 field trials. Midkiff, TX.

Product	Rate	Ingredients	Manufacturer
Black Label	32 fl. oz.	N,P,Zn,Micronutrients, humic acid	Loveland Products
Accomplish	32 fl. oz.	Microorganisms	Loveland Products
Asset	32 fl. oz.	N, P, K Micronutrients	Helena Chemical
Black Label + Accomplish	32 fl. oz. 32 fl. oz.	See above	Loveland Products
C.A.L.F.A.	10 fl.oz.	Carboxylic acid solution	Plant Bio Tech

Results and Discussion

Agronomic measurements and lint and seed yield results are presented in Tables 3 and 4. Statistically significant differences between treatments were not observed although some numerical differences in means were positive and potentially economically large not all replications performed consistently. This is a common problem with salt affected fields, as salinity is not uniform across the field thus creating a large standard error in trials. Salinity affects also vary by salt composition, soil type, and soil tilth.

Table 3. Stand count and lint yield for at planting treatments in a high salinity cotton field , Midkiff, TX 2014 and 2015.

Treatment	Rate	Stand Count Plants per row ft. 2014/2015	Lint Yield Pounds/acre 2014/2015
C.A.L.F.A.	10 fl.oz.	not tested / 3.26	not tested / NS
Black Label + Accomplish	32 fl. oz. 32 fl. oz.	1.15/2.81	NS/NS
Black Label	32 fl. oz.	1.14/2.20	NS/NS
Asset	32 fl. oz.	1.18/2.64	NS/NS
Accomplish	32 fl. oz.	1.20/2.99	NS/NS
Untreated Check	-	1.00/2.94	1302/536
Statistical Significance $P \leq 0.05$		NS/NS	NS/NS

Table 4. Agronomic measurements, 2014 lint yield and 2015 wheat yield for electromagnetic irrigation water treatments in a high salinity cotton field, Midkiff, TX.

Agronomic Measurement	Untreated	Treated	Significance / P-value
Node of 1st Fruiting Branch	5.6	5.8	NS / 0.46
Nodes Above White Flower Sept. 17, 2014	3.2	3.3	NS / 0.27
Plant Height Oct. 29, 2014	35.2	35.4	NS / 0.80
Bolls/Row Foot	32.3	33.7	NS / 0.81
Percent Open Bolls Oct. 29, 2014	57.0	46.9	NS / 0.34
Lint Yield Lbs/Acre	1190 lb/ac	1223 lb/ac	NS / 0.84
Dryland Wheat Yield	50.2 bu/ac	45.7 bu/ac	NS / 0.30

Conclusions

- No significant differences in cotton yield were observed with any of the treatments.
- No significant differences in 2015 plant measurements or subsequent 2015 wheat yield were identified in the water treatment experiment.
- The at planting treatments show a non-significant trend of increasing stand count and yield when compared with the untreated plots. This experiment should be repeated in another year.
- Producers should carefully evaluate cost and potential benefit of these types of products and if they choose to use them, use them in a way as to evaluate them with untreated areas to measure potential benefits.

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References

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