

## 2011 Syngenta Agrisure Artesian™ First Generation Drought Tolerant Corn Trial Progress Report

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### Introduction

2011 was the first year of commercially available drought tolerant corn research at the Texas AgriLife Research Station in Etter, TX, located approximately 10 miles north of Dumas, TX. The Agrisure Artesian™ is Syngenta’s first generation drought tolerant technology. The Artesian package, for now, is all native traits. The objective of this trial was to determine if the Artesian hybrid produced significantly more grain under drought stressed conditions, and to examine how this technology performed in the High Plains of Texas.

### Materials and Methods

The trial consisted of three commercial check hybrids and one Artesian hybrid. (Table 1) These hybrids were planted at three seeding rates under 4 irrigation levels with 6 replications. Entries were planted under a center pivot irrigation system on 30-inch raised beds. Treatments were blocked across the

**Table 1. Hybrids and Maturity**

Hybrid	Relative Maturity
Check 1	105
Check 2	107
Artesian	109
Check 3	111

**Table 2. Irrigation Levels**

ET Level	Inches of Irrigation
100%	29.7
75%	23.0
50%	16.3
40%	14.1

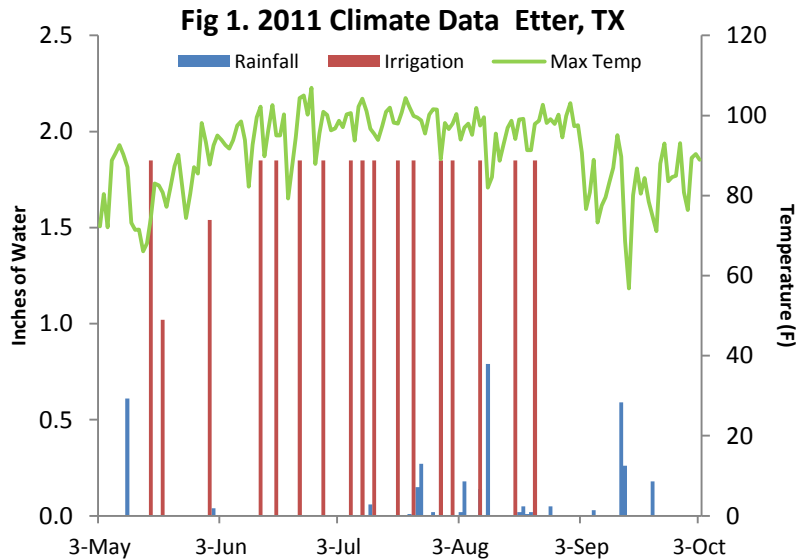
length of the pivot by replication, in case of an equipment breakdown. Irrigation scheduling was determined by a water loss equation developed by Thomas Marek, Texas AgriLife Research Irrigation Engineer, which accounts for evapotranspiration (ET or water use), and calculates the amount of plant available water in the profile. Irrigation rates were set at 100% 75% 50% and 40% ET. Because of limited space, the 40% ET rate had only one check hybrid and one Artesian hybrid. Total irrigation amounts can be found in Table 2. All plots were irrigated when soil water in the 100% ET treatment dropped to 50% plant available water. Irrigation amounts were varied across ET levels by using different output nozzles in different spans of the pivot. On the first two irrigation applications, all ET levels were watered at 100% irrigation to assure adequate germination and emergence. In addition, AquaSpy sensors were installed in the 100% and 75% ET levels to monitor relative soil water throughout the season. An unprecedented drought in the High Plains of Texas provided little effective rainfall to the crop (Fig 1). Only three rainfall events of over 0.5 inch were observed from planting until

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harvest. In addition, temperatures were also above normal much of the growing season with 30 days of over 100°F. The irrigation application rate for the 100% ET level was set at 1.86". This allowed for 0.93" to still be applied to the 50% ET to allow for better water infiltration and to minimize evaporative losses while keeping runoff at the 100% ET to a minimum. Commercial check 2 is

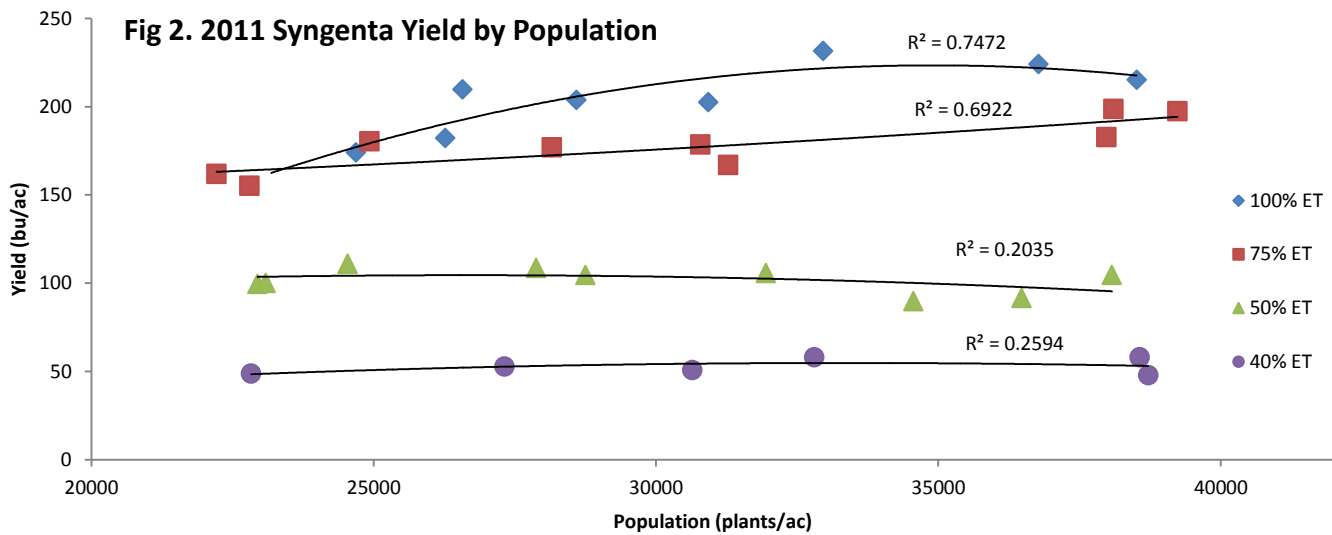
excluded from any statistical analysis and graphs, because of a significantly lower and erratic stand, possibly caused by consecutive days of high wind and very high heat.

Other cultural practices and study information are listed below:

Trial Location: Etter, TX approximately 10 miles north of Dumas, TX  
 Previous Crop: Wheat  
 Soil Type: Sherm Clay Loam, pH = 7.5  
 Plot Size: Four, 30 inch bedded rows by 35 foot long  
 Replications: 6  
 Study Design: Randomized complete block  
 Planting Date: May 3, 2011  
 Planting Rate: 24,000 32,000 40,000 sd/ac  
 Seed Method: John Deere Max-Emerge planter with Almaco seed cones  
 Fertilizer: Applied 300 lb/acre N and 100 lb/acre P<sub>2</sub>O<sub>5</sub> preplant based on soil test results  
 Herbicide: Bicep Lite immediately after planting. Status for bindweed control  
 One aerial application of Oberon and Onager for spider mite control  
 Irrigation: Center Pivot Irrigation. Amounts listed in Table 2

## Results and Discussion

No lodging or disease was observed in the trial. Yield by population data can be seen in Figure 2. In general, a positive correlation can be observed between population and yield at the 100% and 75% ET levels. At the low population (24,000 seeds/ac) yields were essentially the same. This can be attributed to the fact that the ears were filled to the tip under both ET levels. As the population increases, however, a significant separation can be observed. It is interesting to note the large difference in yield between the 50% and 40% ET levels. The 50% ET level yielded approximately 50 bu/ac more than the 40% level. These two irrigation levels only differed by 2.2 in/ac of seasonal irrigation water. At these low ET levels almost no response to increased population was observed when averaged across hybrids.

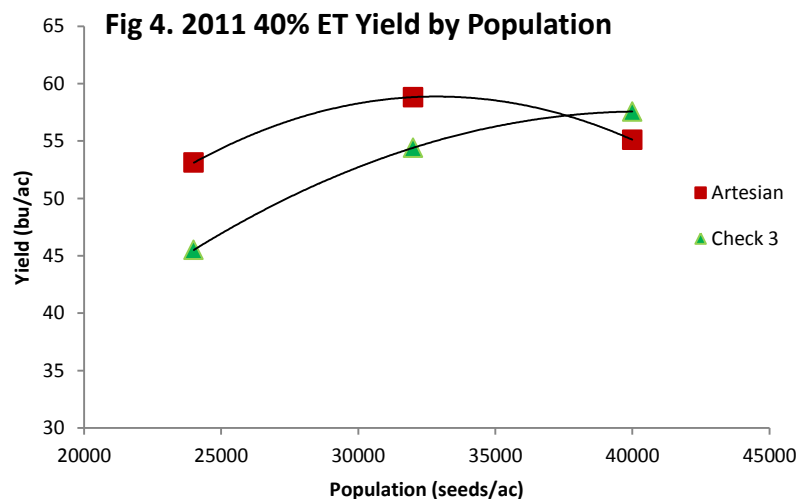
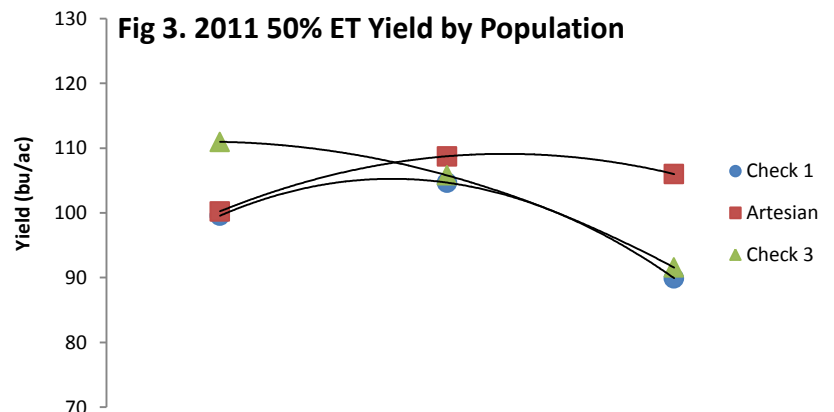


However, since a water x rate x hybrid interaction was significant (Table 3) those factors can be analyzed and substantial differences within hybrids can be seen. One example is under 50% ET (Fig 3). Check 1 has a generally flat slope that peaks at 32,000 seeds/ac, but then has a drastic drop in yield at 40,000. Check 3 performed very well at the low population, but then lost yield at each higher population. The Artesian hybrid response to population appears to be maximized at 35,000 seeds/ac. The 50% ET level had fair pollination across all hybrids during the season, however, at the 40% ET level it appeared that Check 3 had considerably more difficulty pollinating than the Artesian hybrid (Pic 1). This is also evident in the yield results, with the Artesian hybrid yielding significantly more than Check 3 at the 40% ET level at all but the highest population. Because check 3 did not pollinate as well as the Artesian hybrid, a higher plant population was needed to maximize yield.

**Table 3. Factorial**

AOV for Grain Yield	Prob(F)	LSD
Replication	0.076	5.07
Water Level	0.0001	3.58
Population	0.0001	3.58
Water X Pop	0.0001	6.21
Hybrid	0.0001	4.38
Water X Hybrid	0.0001	7.17
Pop X Hybrid	0.0001	7.17
Water X Pop X Hybrid	0.0063	12.46

**Pic 1. Artesian Hybrid (left) Check 3 (right) at 40% ET, 24,000 seeds/ac population**



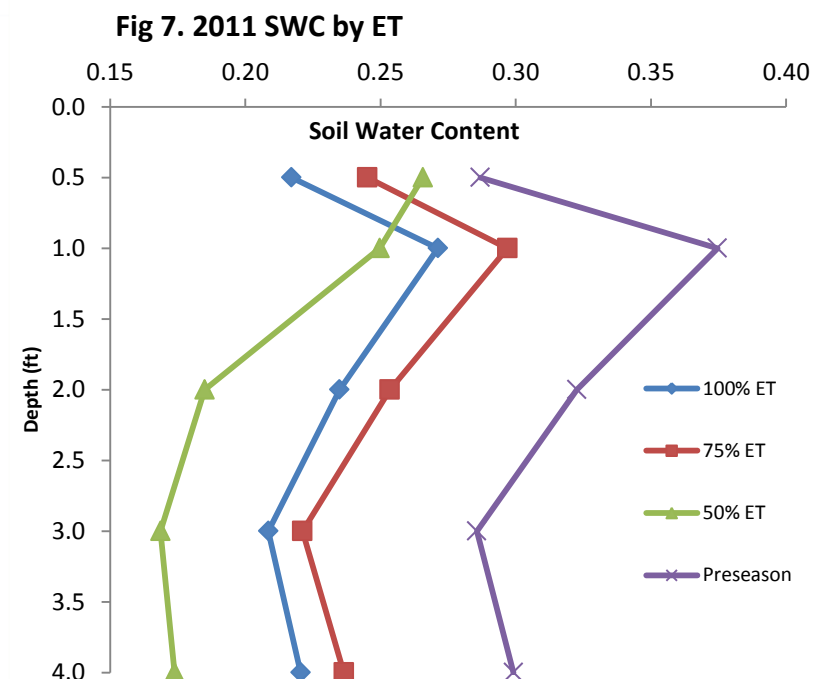
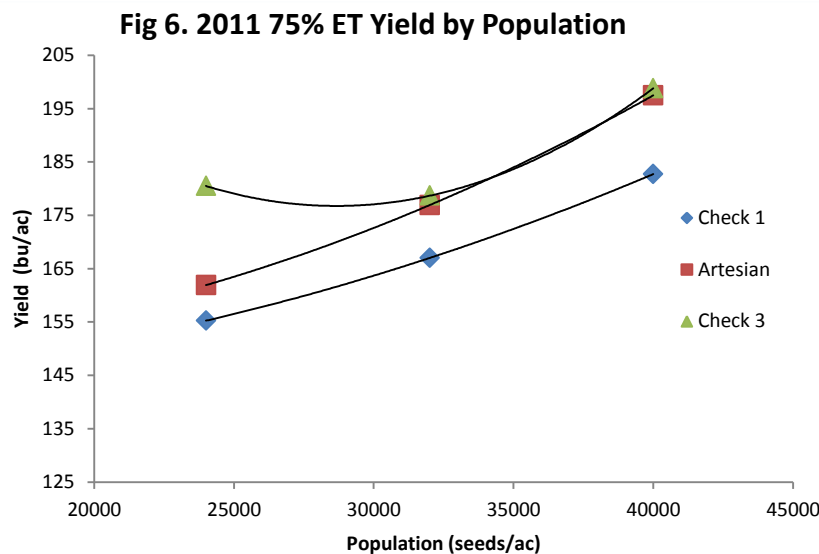
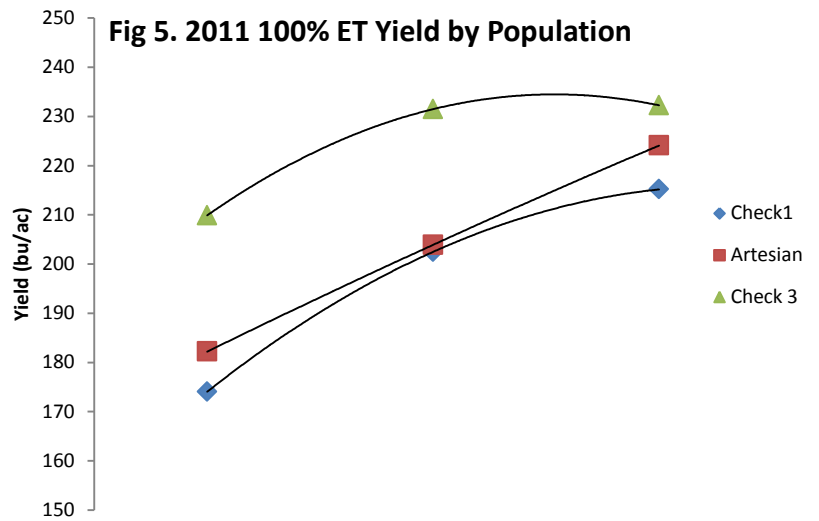
At high ET levels all of the hybrids exhibited an increased yield response to higher populations. The Artesian hybrid, in particular, responded to increasing plant population at 100% ET, yielding 182 bu/ac at 24,000 population and 224 bu/ac at 40,000 population (Fig 5). Check 3 continued to demonstrate high yields at low populations at both 100% and 75% ET (Fig 5 and 6).

Soil samples were collected at the beginning and end of the season for water content. Post-harvest volumetric water samples can be seen in Fig. 7 averaged across ET levels. 100% and 75% ET have the same relative amount of water at depth in the profile. 100% ET plots used slightly more soil water possibly because the plants were larger in the 100% ET level and required more water late in the season. The 50% ET level extracted almost all the plant available water below 2 feet in the profile. Hybrid and population differences relating to soil water are still be analyzed and are not included in this report.

Yields from all treatments are reported in Table 4. Other comparisons not discussed here can be made by using information from Tables 3 and 4.

### Conclusions

- At the higher ET levels, yields of all hybrids responded positively to increasing seeding rate up to 40,000 seed/ac. Yield of the Artesian hybrid in particular responded well to increased seeding rate.
- At the 50% irrigation level, yield response to seeding rate was much more hybrid dependent. The Artesian and



check 1 hybrids had their highest yields at 32,000 seed/ac, while check 3's yield was best at 24,000 seed/ac. The Artesian hybrid was able to maintain its high yield even at 40,000 seed/acre.

- At the 40% irrigation level, yield response of the Artesian and Check 3 hybrids was strongly correlated to increased population. This is probably due to pollination. Poor pollination at the 40,000 seed/ac rate produced erratic seed set and many unpollinated butts of the ears. The Artesian hybrid seemed somewhat immune to this at lower populations.
- **Results of this study were strongly influenced by the extreme climatic conditions present in 2011 in the Texas High Plains. This trial will be repeated in 2012, hopefully under more normal climatic conditions.**

**Table 4. 2011 Syngenta Artesian Drought Tolerant Corn Trial.**

ET Level	Yield (bushels/acre)			
	Artesian			
	24,000	32,000	40,000	Mean
100%	182.2	203.9	224.1	203.4
75%	161.9	176.9	197.5	178.8
50%	100.2	108.7	104.8	104.6
40%	52.1	58.8	48.5	53.1
Mean	148.1	163.2	175.4	162.2
	Check 1			
	24,000	32,000	40,000	Mean
100%	174.0	202.5	215.2	197.2
75%	155.2	167.0	182.7	168.3
50%	99.6	104.7	89.9	98.0
40%	-	-	-	-
Mean	142.9	158.0	162.6	154.5
	Check 3			
	24,000	32,000	40,000	Mean
100%	209.9	231.5	232.3	224.5
75%	180.5	178.7	198.8	186.0
50%	115.8	105.8	91.6	104.4
40%	45.5	54.4	57.6	52.5
Mean	168.7	172.0	174.2	171.6