RESPONSE OF DELTAPINE® CLASS OF 09 AND 10 VARIETIES TO VARYING IRRIGATION LEVELS IN WEST TEXAS

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Abstract

The Deltapine brand offers cotton producers in West Texas an excellent lineup of cotton products in the Class of 09, 10 and candidates for the Class of 11. In order to better understand each variety's response to water availability, variety x irrigation trials were conducted in 2008 and 2009 to characterize the water response curves of new Monsanto experimental lines and Deltapine cotton varieties. Each location included evaluation of 6 to 12 varieties from the Class of 09, 10 and 11 candidates compared to Deltapine standards. Understanding each variety's response to water can help producers effectively position varieties on fields with irrigation capacities that can help optimize performance.

Introduction

The Deltapine brand provides a strong cotton product line up for the West Texas region with varying responses to water availability. Trials were conducted on Class of 09, 10 and potential Class of 11 candidates to help in characterizing the water response of each variety. Results from the variety x irrigation trials will be used as baseline data for variety response in broader testing for the West Texas region.

Materials and Methods

The data describing Deltapine varieties (DP 0912 B2RF, DP 0924 B2RF, DP 0935 B2RF, DP 164 B2RF, DP 1032 B2RF, DP 1044 B2RF and DP 1133 B2RF) was obtained from 8 irrigation x variety trial locations; 2 in 2008 and 6 in 2009. To evaluate water level impact by variety, water treatments were dryland (pre-water only to obtain germination and emergence), ~30% ET, ~60% ET and ~90% ET in 2009; and 40%ET, 60%ET, 80%ET, and 100% ET in 2008. These trials were located in West Texas and divided into 3 regions: Northern region locations were Edmondson and Olton; Central region locations were Lorenzo and Lamesa; Southern region locations were St. Lawrence and Reagan County. Data collected from each location included plant growth, maturity, yield and fiber quality. Crop value was calculated using the lint yield multiplied by the loan value. Loan value was calculated using the current USDA loan chart, assuming a 31 color grade and 3 leaf grade. Net value was calculated by subtracting the cost of pumping the irrigation water (using $15/acre inch regional average) from the crop value per acre. For the plant growth and maturity response, plant mapping parameters measured included plant height, node of first fruiting branch, node of uppermost cracked boll, node of uppermost harvestable boll, total nodes and plant mapping parameters calculated include heat units to 100% open boll, number of fruiting branches and height to node ratio. Analysis of variance was completed using JMP 5.0 statistical software (SAS Institute).

Results and Discussion

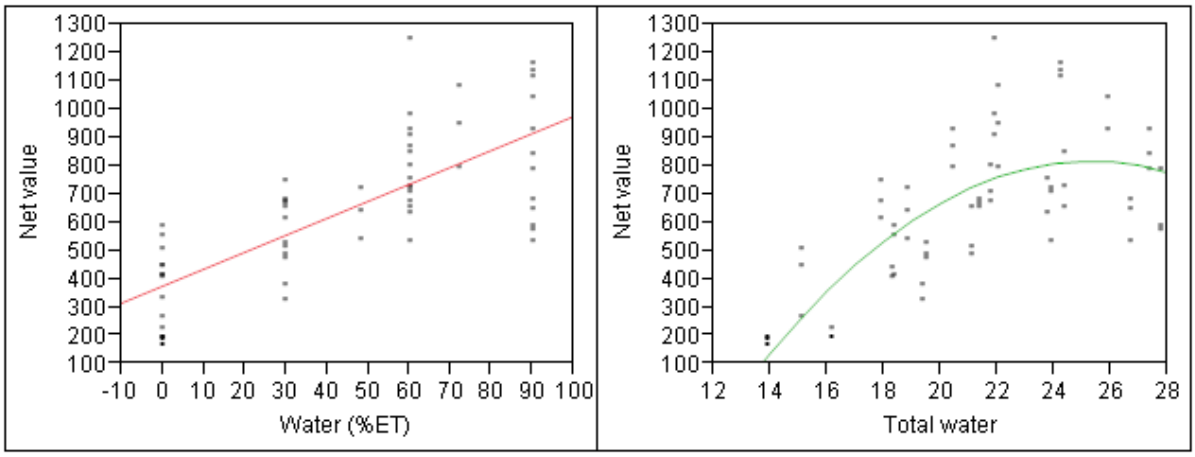
The effect of irrigation level on plant growth and maturity was determined using the plant measurements collected at 50% boll open. Irrigation treatment receiving 90% ET reported the tallest plant height (29.0 inches), the highest total node count (18.4 nodes) and the highest average node of uppermost harvestable boll (14.8 nodes) (Table 1). Compared to the dryland treatment, irrigation delayed maturity from 65 DD60's (1.3 greater NUHB) for the 30% ET treatment to 130 DD60's (2.6 greater NUHB) for the 90% ET treatment. The effect of irrigation level on plant size and maturity reinforces the need for appropriate management of each irrigation level and variety combination.

Table 1. Water impact on plant growth maturity 2009 – Water FACT sites

Water TRT	Plant Height	Total Nodes	NUHB
Dryland	25.4	16.5	12.2
30% ET	26.9	17.6	13.5
60% ET	27.8	17.6	14.0
90% ET	29.0	18.4	14.8

Irrigation Response by Variety – Net Value

For this report we will limit the discussion to net value, which combines lint yield, fiber quality (loan value), and the cost of irrigation. The earliest maturing variety in the trials was Deltapine® variety, DP 0912 B2RF. This variety increased net value per inch of water between 16 and 24 inches of total water (increase of $55.38/inch), as illustrated in Figure 1. Even though the best fit for net value was linear as a function of ET level applied, for DP 0912 B2RF the net value did not increase after reaching 24 inches of total water in the quadratic best fit for total inches of water (irrigation + rainfall).

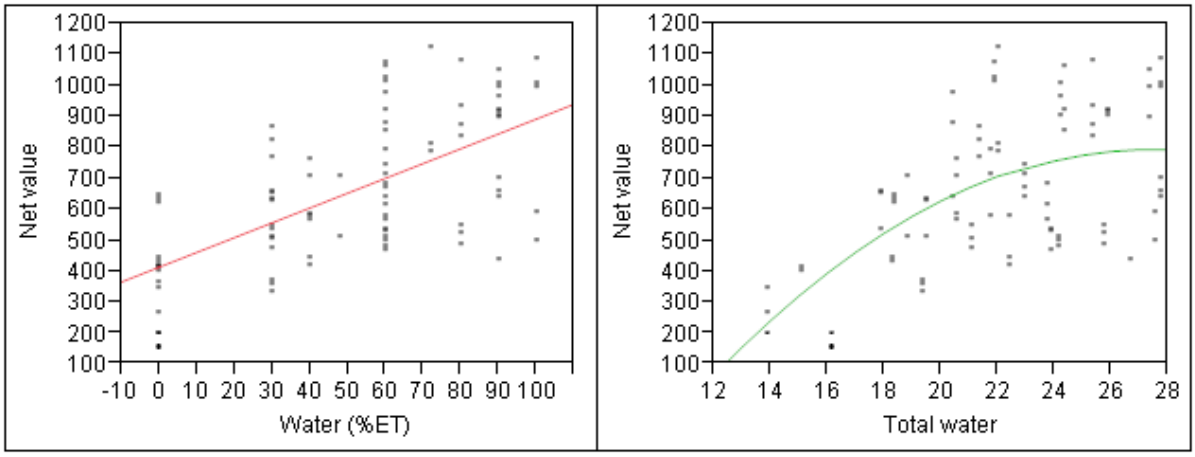


Net value – 372.0 + 6.0* Water (%ET)
R Square 0.572
Observations (or Sum Wgts) 68

Net value = -173.2 + 42.5*Total water - 5.3*(Total water-21.2)^2
RSquare 0.514
Observations (or Sum Wgts) 68

Figure 1. DP 0912 B2RF Irrigation Response – Net Value – 2008-20009.

The second most responsive variety in this analysis was DP 0924 B2RF, an early to mid maturing variety. The net value per inch of water between 16 and 24 inches of total water increased by $45.50/inch for DP 0924 B2RF. For DP 0924 B2RF net value did not increase after reaching 24 inches of total water (Figure 2). Like the analysis of DP 0912 B2RF, the best fit for net value of DP 0924 B2RF as a function of %ET was linear, while the best fit of net value as a function of total water (irrigation + rainfall) was quadratic.

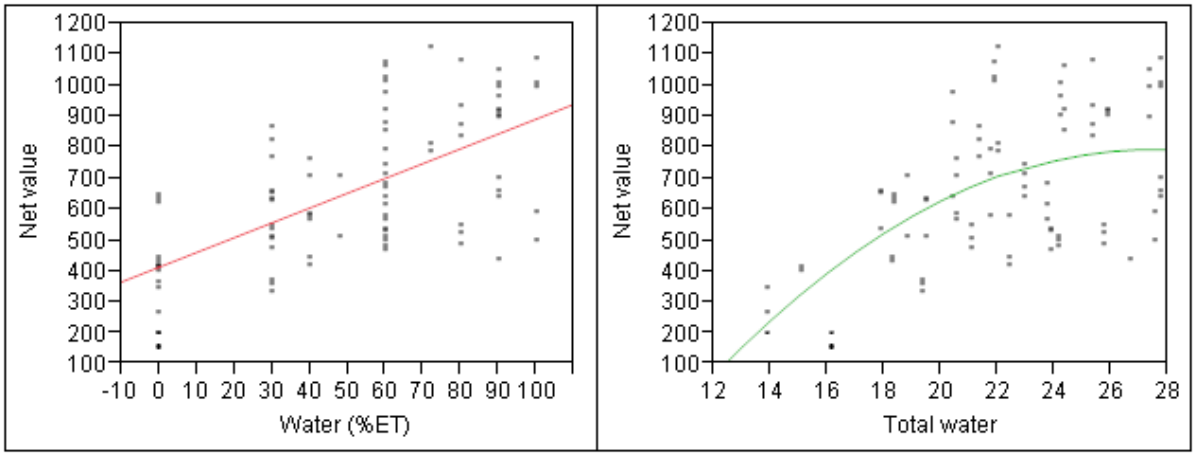


Net value – 410.4 + 4.8* Water (%ET)
R Square 0.39
Observations (or Sum Wgts) 93

Net value = 0.36 + 31.9*Total water – 3.08*(Total water-22.2)^2
RSquare 0.35
Observations (or Sum Wgts) 93

Figure 2. DP 0924 B2RF Irrigation Response – Net Value – 2008-2009.

The third most responsive variety to irrigation and total water was DP 0935 B2RF. This variety increased net value per inch of water between 16 and 24 inches of total water at a rate of $37.79/inch. For DP 0935 B2RF net value did not increase after reaching approximately 26 inches of total water. Like the DP 0912 B2RF and the DP 0924 B2RF, the best fit for DP 0935 B2RF's response of net value to %ET irrigation applied was linear, while the best fit for DP 0935's net value response to total water was the quadratic function in Figure 3.

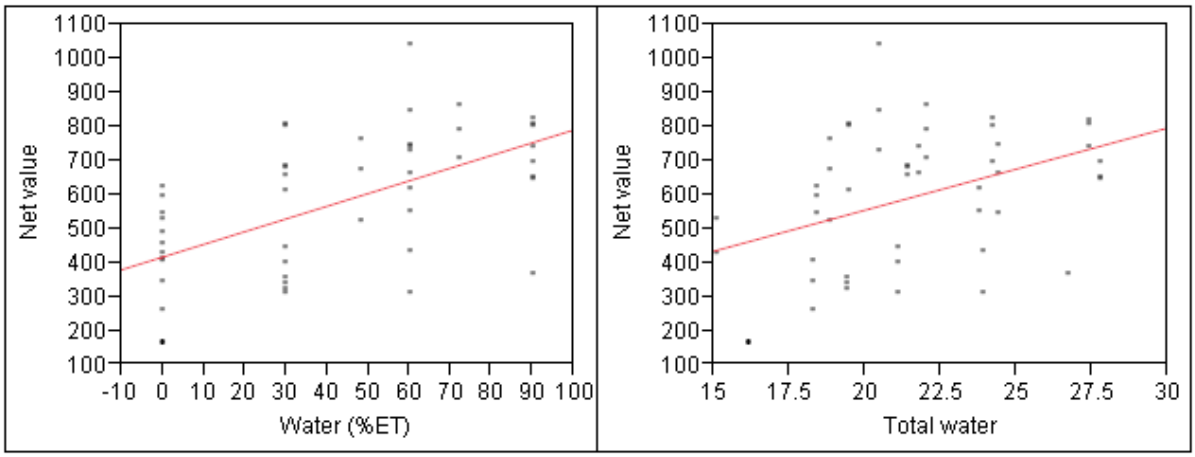


Net value – 518.2 + 2.85* Water (%ET)
R Square 0.34
Observations (or Sum Wgts) 89

Net value = 225.6 + 20.3*Total water – 3.9*(Total water-22.2)^2
RSquare 0.28
Observations (or Sum Wgts) 89

Figure 3. DP 0935 B2RF Irrigation Response – Net Value

The least responsive variety to either irrigation amount of total water in this analysis was DP 164 B2RF. Even though DP 164 B2RF had the highest net return in a limited irrigation scenario, the increase net value per inch of total water was only $24.30/inch. The net value response of DP 164 B2RF to both %ET and total water were both linear functions, as illustrated in Figure 4.



Net value – 415.7 + 3.7* Water (%ET)
R Square 0.34
Observations (or Sum Wgts) 54

Net value = 66.2 + 24.3*Total water – 3.9*(Total water-22.2)^2
RSquare 0.18
Observations (or Sum Wgts) 54

Figure 4. DP 164 B2RF Irrigation Response – Net Value

Fiber Quality and Loan Value Response to Irrigation Treatment – By Region

In the Northern West Texas trials (located in Olton and Edmonson) the later maturing varieties (DP 0935 B2RF and DP 164 B2RF) were limited on the higher levels of irrigation due to their later maturity in the shorter season region. DP 0935 B2RF had net value not different from the top variety only in the dryland treatment. DP 0912 B2RF and DP 0924 B2RF were in the top net value grouping in every irrigation treatment level, which is indicative of their broad adaptability across irrigation and water levels.

Table 2. Deltapine® cotton varieties net value response to irrigation level in North West Texas region, 2008-2009.

Dryland Level		Least Sq Mean	30 to 40% Level		Least Sq Mean
DP 0924 B2RF	A	353.7	DP 0912 B2RF	A	677.4
DP 0935 B2RF	AB	332.8	DP 0924 B2RF	AB	610.7
DP 0912 B2RF	AB	305.7	DP 0935 B2RF	BC	581.8
DP 164 B2RF	B	253.3	DP 164 B2RF	CD	494.5
60% ET Levels		**Least Sq Mean**	**80 to 100% ET Level**		**Least Sq Mean**
DP 0912 B2RF	A	822.5	DP 0912 B2RF	A	935.2
DP 0924 B2RF	AB	733.9	DP 0924 B2RF	AB	841.0
DP 0935 B2RF	C	642.6	DP 164 B2RF	BCD	676.9
DP 164 B2RF	C	557.7	DP 0935 B2RF	D	582.8
Levels not connected by the same letter are significantly different					

In the Central West Texas region (locations Lorenzo and Lamesa), only in the dryland treatment and the high water treatment (72% ET and greater) did the net value for the varieties separate statistically. In the dryland treatments, DP 0935 B2RF and DP 0912 B2RF had the net values greater than DP 0924 B2RF and DP 164 B2RF. In the highest water treatments (72% ET and greater), DP 0912 B2RF had net values greater than DP 0935 B2RF and DP 164 B2RF. In this region, there is a strong variety x irrigation interaction as DP 0935 B2RF fell from the top yield group to the bottom yield group with increasing irrigation treatment.

Table 3. Deltapine cotton variety net value response to irrigation level in Central West Texas region, 2008-2009.

Dryland Level		Least Sq Mean	30 to 48% Level		Least Sq Mean
DP 0935 B2RF	A	214.3	DP 0935 B2RF	A	541.4
DP 0912 B2RF	A	202.3	DP 0912 B2RF	A	496.8
DP 0924 B2RF	B	167.4	DP 164 B2RF	A	487.7
DP 164 B2RF	B	162.9	DP 0924 B2RF	A	484.2
60% ET Levels		**Least Sq Mean**	**72 to 100% ET Level**		**Least Sq Mean**
DP 0912 B2RF	A	795.9	DP 0912 B2RF	A	1037.3
DP 164 B2RF	A	777.5	DP 0924 B2RF	AB	930.3
DP 0924 B2RF	A	761.3	DP 0935 B2RF	BC	862.9
DP 0935 B2RF	A	715.4	DP 164 B2RF	C	778.9
Levels not connected by the same letter are significantly different					

In the Southern West Texas region (locations St. Lawrence and Reagan Co.), Class of 10 and 11 varieties (DP 1044 B2RF, DP 1032 B2RF, and DP 1133 B2RF) were in the top net value group in the dryland and 30% to 40% ET irrigation treatments (Table 4). At the 60% irrigation treatments, DP 1133 B2RF and DP 1032 B2RF had the greatest net values; While at the highest irrigation grouping (80% to 100% ET), DP 1133 B2RF had the top net value, followed by DP 1032 B2RF, which was greater in net value than DP 1044 B2RF. In general, all the Class of 09 varieties and DP 164 B2RF had lower net returns than the Class of 10 and 11 varieties. While DP 1133 B2RF and DP 1032 B2RF performed in the top group in dryland and limited water, they had the greatest response to water as irrigation treatments increased.

Table 4. Deltapine® cotton variety net value response to irrigation level in Southern West Texas region, 2008-2009.

Dryland Level		Least Sq Mean	30 to 40% Level		Least Sq Mean
DP 1044 B2RF	A	708.2	DP 1133 B2RF	A	806.3
DP 1133 B2RF	A	692.6	DP 1032 B2RF	A	752.2
DP 1032 B2RF	A	676.0	DP 1044 B2RF	AB	668.0
DP 164 B2RF	B	540.0	DP 0935 B2RF	B	598.0
DP 0935 B2RF	B	520.0	DP 0924 B2RF	B	582.5
DP 0924 B2RF	B	518.3	DP 164 B2RF	B	571.5
DP 0912 B2RF	B	462.7	DP 0912 B2RF	C	447.3
60% ET Levels		**Least Sq Mean**	**80 to 100% ET Level**		**Least Sq Mean**
DP 1133 B2RF	A	862.3	DP 1133 B2RF	A	1144.5
DP 1032 B2RF	A	815.5	DP 1032 B2RF	B	994.4
DP 1044 B2RF	B	646.0	DP 1044 B2RF	C	840.4
DP 0924 B2RF	B	633.4	DP 0935 B2RF	D	681.2
DP 0935 B2RF	B	601.1	DP 0924 B2RF	D	672.5
DP 0912 B2RF	BC	549.8	DP 0912 B2RF	D	622.6
DP 164 B2RF	C	453.1	DP 164 B2RF	D	596.9
Levels not connected by the same letter are significantly different					

Summary

In variety x irrigation testing in the West Texas region, across trials and varieties, dryland treatments matured 130 DD60 earlier than fully irrigated treatments. The NUHB differences of the varieties ranged from 2.4 to 3.5 node difference between the dryland and fully irrigated treatments.

In variety testing each cotton product reported different increases in net value per inch of water. In the range of 14 to 24 inches of total water, DP 0912 B2RF increased net return at $55.38 / inch of water, DP 0924 B2RF increased net return by $45.50 / inch water, and DP 0935 B2RF increased net value by $37.79 per inch of water. DP 164 B2RF was the least responsive variety, increasing net value by $24.30 per inch of water. In the Northern West Texas trials DP 0924 B2RF had the greatest net value in the dryland treatment, but DP 0912 B2RF had the greatest response to increased water levels. In the Central West Texas region, DP 0935 B2RF had the greatest net value in the dryland and limited water treatments, while DP 0912 B2RF had the greatest response in net value at the moderate to high irrigation treatments. In the Southern West Texas region, Class of 10 and 11 varieties the greatest net value at the dryland and limited water levels (DP 1032 B2RF, DP 1044 B2RF, and DP 1133 B2RF), while the DP 1133 B2RF had the greatest response to water as irrigation treatments increased.

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