GROWTH AND FRUITING PATTERNS OF DELTAPINE SEED ROUNDUP READY COTTON VARIETIES ACROSS SOUTHEAST TEXAS

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Abstract

Effective weed control has always been a problem in cotton production for two reasons 1) a limited arsenal against broadleaf weeds and 2) weeds that emerge following planting. The introduction of Roundup Ready technology into cotton varieties and the benefit that this technology gives to weed control in cotton production has spurred a rapid acceptance of new transgenic varieties by cotton producers. Several new Roundup Ready (RR) and Bollgard/Roundup Ready (B/RR) varieties have recently been released by Deltapine Seed and other seed companies. To select and manage a specific variety from an expanding list of choices, the grower must understand the growth and fruiting characteristics of the variety. Cotton plant mapping is a tool used to quickly and effectively characterize the growth and fruiting parameters of cotton varieties across differing environments and management practices. To effectively characterize the growth and fruiting characteristics of the Deltapine Seed Roundup Ready cotton varieties, four replicated on-farm trials and five Roundup Ready system strip trials were set up across southeast Texas in 1998. Data collected in 1998 indicate that DP 436 RR and DP 425 RR are shorter maturity varieties, which is consistent with their recurrent parents of Deltapine 50 and Deltapine 51 respectively. DP 458 B/RR and DP 5415 RR appear to be fuller season varieties with a shorter plant structure. Given their growth characteristic, they had the highest and most consistent yield profile across East Texas in 1998. DP 655 B/RR and DP 5690 RR are fuller season varieties with a taller plant structure.

Introduction

Introduction of new transgenic cotton (*Gossypium hirsutum)* varieties with enhanced weed control technologies has created excitement in the agricultural community. Weeds that are difficult to control have always been a problem in cotton production. Only a limited selection of safe and effective herbicides have been available that could be used against broadleaf weeds in cotton and for weeds that emerge following planting. The introduction of Roundup Ready technology into cotton varieties and the benefit this technology brings to weed control in cotton production has spurred rapid acceptance of new transgenic varieties by cotton producers. A common misconception by many cotton producers is that the weed control technology will *always* make weed control and cotton production easier and more profitable. This can be true as long as the correct varieties are selected and managed properly according to the environment, cropping system and management style. To select varieties adapted to differing environments and cropping systems, the grower must understand the necessary growth and fruiting characteristics of a variety to fit his environment. Cotton plant mapping has recently become an integral tool used to quickly and effectively characterize the growth and fruiting parameters of cotton varieties across differing environments and management practices. Plant mapping information can be effectively used to select and manage a cotton variety based upon a particular environment and growers' preferences. Deltapine Seed has recently introduced several new varieties, containing the Roundup Ready gene, that encompass the full range of typical upland cotton maturity ranges and plant structure types. With a wider range of varieties to select from, a grower can now choose and plant adapted transgenic varieties that fit the cropping system and management style the grower employs. Even though the addition of a transgenic gene can greatly enhance the productivity of a variety, selecting the proper maturity and plant type should take precedence over the added technology that the variety carries.

Objective

To effectively characterize the growth and fruiting characteristics of Deltapine Seed Roundup Ready cotton varieties across varying growing conditions, moisture regimes, and management practices in East Texas.

Testing Procedure

Several test locations were selected across East Texas in 1998. All locations were dryland except for one in Burleson county (Table 1). All locations were conducted on grower-cooperator field sites, using grower equipment for all field operations. All management decisions throughout the season were based on sound production practices employed by the cooperator.

Two types of trials were set up. One set of trials consisted of small plots and were set up as a randomized complete block design, replicated three times. Plot size was four rows with a minimum row length of five hundred feet. Replicated trials contained both transgenic and conventional varieties, therefore conventional weed control programs were used. The second set of trials were large block systems trials. ("System" referring to the use of the

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Roundup Ready weed control program.) Plot size averaged one to two acres per variety. All varieties within the systems trials contained the Roundup Ready gene, therefore the weed control program included the use of Roundup Ultra over the top and post directed. The weed control program in most systems trials included the use of a pre-plant incorporated or pre-emerge herbicide. Systems trials were not replicated as the purpose is to determine how the variety performs under large scale field conditions.

Data collected included: early season vigor ratings, one in-season plant map following early bloom, one final plant map prior to harvest and lint yield. Ten random plants per plot in replicated trials and fifteen random plants per plot in systems trials were collected for plant mapping. Data collected from the midseason mapping included plant height (PH), total nodes (TN), mainstem vegetative nodes (VN), nodes above the uppermost first position white flower (NAWF) and first position fruit retention. Data collected from the final map included plant height, total mainstem nodes, nodes above the upper most first position cracked boll and fruit retention on all fruiting sites. Entire plots were harvested either by a spindle picker or brush stripper

The emphasis of this paper is to look at vegetative and fruiting patterns of six Deltapine Seed varieties, either Roundup Ready or Bollgard/Roundup Ready. The varieties include DP 436 RR, DP 425 RR, DP 5415 RR, DP 5690 RR, DP 458 B/RR, and DP 655 B/RR. Plant map data presented is based on TN, VN, the contribution to yield from first (FP1) and second (FP2) position fruiting sites (FP1 + FP2), days to first bloom and the effective bloom period, referred to as the 95 percent zone. The 95 percent zone represents the number of fruiting branches that contain 95 percent of all FP1 bolls.

Statistical analysis was conducted using ANOVA and means were separated by Fisher's least significant difference at alpha level 0.05.

Discussion

In-Season Plant Map

Key indicators from in-season plant map data include node of the first fruiting branch, days to bloom and early season fruit retention. Node of the first fruiting branch and days to first bloom give an indication of how vigorous or quickly the plant develops from vegetative growth to reproductive growth. Node of the first fruiting branch will vary from one region to another, but it is fairly consistent relative to other varieties. Knowing when the plant starts to develop squares greatly aids in timing management practices such as early season insect control and herbicide applications. A variety that develops slower than other varieties early in the season may allow for a longer over-the-top application window (in days). Yet there are many disadvantages to slow early season growth which need to be weighed against a longer application window. Early season fruit retention may be an indicator of how well a variety tolerates early season environmental stresses. Again, retention will vary widely from one region to another, but is fairly consistent between varieties. Higher early season fruit retention in most cases should lead to not only a greater yield but an earlier crop as well.

Plant map data was fairly consistent across both replicated and systems trials (Tables 2 and 3). DP 436 RR, derived from Deltapine 50, and DP 425 RR, derived from Deltapine 51, appear to be very similar in respect to early season maturity indicators. Node of the first fruiting branch and days to first bloom are very similar in both varieties (Tables 2 and 3) and are also similar to conventional Deltapine 50 (Table 2). In-season mapping data suggest that DP 436 has a slighter higher early season fruit retention compared to DP 425 RR (Tables 2 and 3). DP 458 B/RR and DP 655 B/RR were very similar to DP 5415 RR and DP 5690 RR in respect to node to the first fruiting branch (NFFB) and days to first bloom. DP 5415 RR, DP 458 B/RR, DP 5690 RR and DP 655 B/RR initiated fruiting branches later than DP 436 RR and DP 425 RR , which is consistent for their maturity (Tables 2 and 3). DP 458 B/RR and DP 5415 RR take longer to reach first bloom, which would indicate slower emergence and/or early season growth and development compared to the other varieties. On the other hand, DP 655 B/RR and DP 5690 RR, although later to initiate fruiting branches, progresses quickly to first bloom (Table 2 and 3), most likely indicating more rapid emergence and early season development.

Fruit retention was generally low across all varieties due to high environmental stresses in the spring of 1998. Yet DP 458 B/RR and DP 655 B/RR, on average, had a higher early season fruit retention compared to the other Roundup Ready varieties. This may be due in part to the later fruiting habit, which may have avoided an earlier stress period.

Final Plant Map

Height-to-node ratio (HNR) is a good indication of plant vigor and final plant height. A HNR under a non-stressed environment should run around 1.8. The low height-to-node ratios (1.31 to 1.61) from 1998 demonstrate the effects of extreme heat and drought. Height-to-node ratios can be useful when selecting for a variety by soil type combination. Varieties with high HNRs typically work better on tough soils in which it is difficult to grow a good stalk. Low HNR's should be selected for lighter soils in which plant growth can often be excessive. Height-to-node ratio data from 1998 suggest that DP 425 RR, DP 655 B/RR, and DP 5690 RR grow a taller stalk (Tables 4 and 5). These varieties would most likely warrant growth management strategies under high growth conditions. The plant structure with DP 655 B/RR and DP 5690 RR is taller and more columnar plant type (Tables 4 and 5) HNRs indicate that DP 436 RR and DP 458 B/RR are similar to

conventional Deltapine 50 and have a shorter plant structure (Table 4).

End of season first position fruit retention should range from 55 to 60. With the adverse environmental conditions in 1998, final retention's were low across all varieties. Fuller season varieties showed somewhat higher retention compared to DP 436 RR and DP 425 RR (Tables 4 and 5) and is evident in final lint yields (Table 6). Not surprisingly, the two varieties with the Bollgard gene had higher fruit retention compared to the other varieties (Table 4).

Percent first and second position bolls (FP1 + FP2) indicate the percent of total bolls on the plant which originate on first and second position fruiting sites. This can also be interpreted as the percent of total lint yield contributed from first and second position fruiting sites. A high percentage of bolls on FP1 and FP2 sites would indicated a columnar plant with high quality lint and earlier maturity. First and second position fruiting sites generally have higher quality lint and mature sooner compared to vegetative bolls and bolls on third and fourth position fruiting sites. DP 655 B/RR with 99 percent of total bolls on FP1 and FP2 would be a prime example (Table 4). DP 458 B/RR, DP 5415 RR and DP 5690 RR, although less than DP 655 B/RR, have a greater percentage of boll contribution from first and second position fruiting sites compared to DP 436 RR and DP 425 RR (Tables 4 and 5). DP 655 B/RR and to a lesser degree DP 5690 RR, DP 5415 RR and DP 458 B/RR would be better adapted for narrow row production because of the tendency to set the majority of fruit on first and second position fruiting sites.

Lint Yield

Selection of a variety based on lint yields is very important, but all factors that interact and contribute to final yield and profitability should be considered when selecting a variety. Southeast Texas data from the replicated trials indicate that DP 458 B/RR has a significantly greater yield potential compared to the other Deltapine Roundup Ready varieties in southeast Texas (Table 6). DP 5415 RR, although not significant, also yielded at the top of the systems trials across southeast Texas (Table 6).

Table 1. East Texas trial locations by county.

Replicated		Systems	
County	Irrigated	County	Irrigated
Refugio	No	San Patricio	No
Wharton	No	Nueces	No
Williamson	No	Wharton	No
Burleson	Yes	Travis	No
		Willacy	No

Table 2. In-season plant map data, replicated trials.

		Days to	%Retention		
Variety	NFFB*	1ST Bloom[ff]	FB[f]1-5	FB[f]6-10	Ave.
DP 436RR	4.6	60	65%	90%	78%
DP 425RR	4.8	60	63%	88%	76%
DP 458B/RR	5.3	63	68%	95%	82%
DP 655B/RR	5.5	61	70%	93%	82%
DP 50	4.9	59	70%	90%	80%
LSD@0.05	0.23	1.3	5.4	4.6	

*Node first fruiting branch
[f]Fruiting branch
[ff]From day of planting

Table 3. In-season map, system trials.

		Days	%Retention		
Variety	NFFB*	1ST Bloom	FB[f]1-5	FB[f]6-10	Ave.
DP 436 RR	4.5	60	71%	94%	82%
DP 425 RR	4.7	60	72%	90%	81%
DP 5415 RR	5.3	63	69%	94%	81%
DP 5690 RR	5.0	61	70%	93%	81%
LSD@0.05	0.5	1.8	NS	NS	

*Node first fruiting branch
[f]Fruiting branch

Table 4. Final plant map, replicated trials.

Variety	HNR*	%Retn MB 6-15[f]	95% Zone	%FP1/FP2[ff]
DP 436RR	1.33	46%	11.8	73%
DP 425RR	1.39	49%	11.7	76%
DP 458B/RR	1.30	55%	10.9	87%
DP 655B/RR	1.41	61%	11.7	99%
DP 50	1.31	48%	11.4	77%
LSD @0.05	0.08	NA	0.88	NA

*Height to node ratio
[f]Mainstem branch
[ff]Percent of total bolls from 1st and 2nd position fruiting sites

Table 5. Final plant map, system trials.

Variety	HNR*	%Retn MB 6-15[f]	95% Zone	%FP1/FP2[ff]
DP 436RR	1.50	48%	11.1	73%
DP 425RR	1.61	53%	12.4	73%
DP 5415 RR	1.45	54%	12.1	76%
DP 5690 RR	1.56	56%	12.3	75%
LSD @0.05	0.12	NA	NS	NA

*Height to node ratio
[f]Mainstem branch
[ff]Percent of total bolls from 1st and 2nd position fruiting sites

Table 6. Lint yield replicated and systems trials.

	Lint/Acre (lb.)	
Variety	Replicated	System Trials
DP 436 RR	519	565
DP 425 RR	504	586
DP 5415 RR	-	586
DP 5690 RR	-	554
DP 458 B/RR	553	-
DP 655 B/RR	516	-
DP 50	502	-
LSD@0.05	35	NS