IMPACT OF PLANTING RKN-SUSCEPTIBLE VARIETY AFTER MULTI-YEAR PLANTINGS OF RKN-RESISTANT VARIETY IN COTTON

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Abstract

In 2011-2014 two blocks of cotton were continuously planted to establish a high root-knot nematode (RKN) population block planted to a susceptible (SUS) variety and a low RKN population block planted to a resistant (RES) variety. Changes in RKN population were monitored between these two blocks. In 2015 and 2016 both blocks were planted to a SUS variety, DP 1044 B2RF with Acceleron fungicide seed treatment. The objective was to evaluate the impact on lint yield and RKN population both early and late in the season after planting a RKN-SUS cotton variety in a field that was planted four consecutive years with a RKN-RES cotton variety. In 2015, the first year of planting a SUS variety across blocks, there was a 94% reduction in RKN eggs/g dry root (RKNEG) early in the season in the RES block over the SUS block and a 60% yield gain. There were no significant differences in juveniles at harvest (RKNJH) between the RES and SUS blocks indicating a bounce back in RKN population in just one year of planting a SUS variety. In 2016, the second year of planting a SUS variety across blocks, there was an 18% reduction in yield in the RES block over the SUS block. There were no significant differences in RKNEG early in the season or RKNJH at harvest between the RES and SUS blocks. Based on results from this study, the growers may benefit the first year of planting a RKN-SUS variety in a field previously planted to a RKN-RES variety, but could give away that advantage in just one season of planting a RKN-SUS variety.

Introduction

Root-knot nematode (RKN) continues to be among the primary nematode pests of cultivated cotton (*Gossypium hirsutum*) in the United States. More than 500K bales were estimated lost in 2015 due to RKN infestation alone. Monsanto's cotton breeders and enabling teams have been able to introgress two major QTL's into pipeline material using marker assisted selection and have released several RKN-resistant (RES) varieties in the marketplace. Internal studies involving recombinant inbred lines have indicated about a 10-20% yield gain in the RES lines over the susceptible (SUS) lines. However, if a grower decides to plant a RKN-SUS variety on a field that was planted with a RKN-RES variety for several consecutive years, then the logical question to ask is what are the implications of that decision on yield and RKN populations both early and late in the season on that field that given year? In this study, we try to seek answers to that question.

Materials and Methods

Cotton was planted on a field at Tahoka, TX that had a history of high RKN population. In 2011-2014 two blocks were continuously planted to establish a high RKN population block planted to a SUS variety and a low RKN population block planted to a RES variety (with one or two genes). During these four years, changes in RKN population were monitored which consequently lead to opportunistic data the following two years. In 2015 & 2016 both blocks were planted to a RKN-SUS variety, DP 1044 B2RF with Acceleron fungicide seed treatment without a nematicide. Field block schematic is provided in Figure 1.

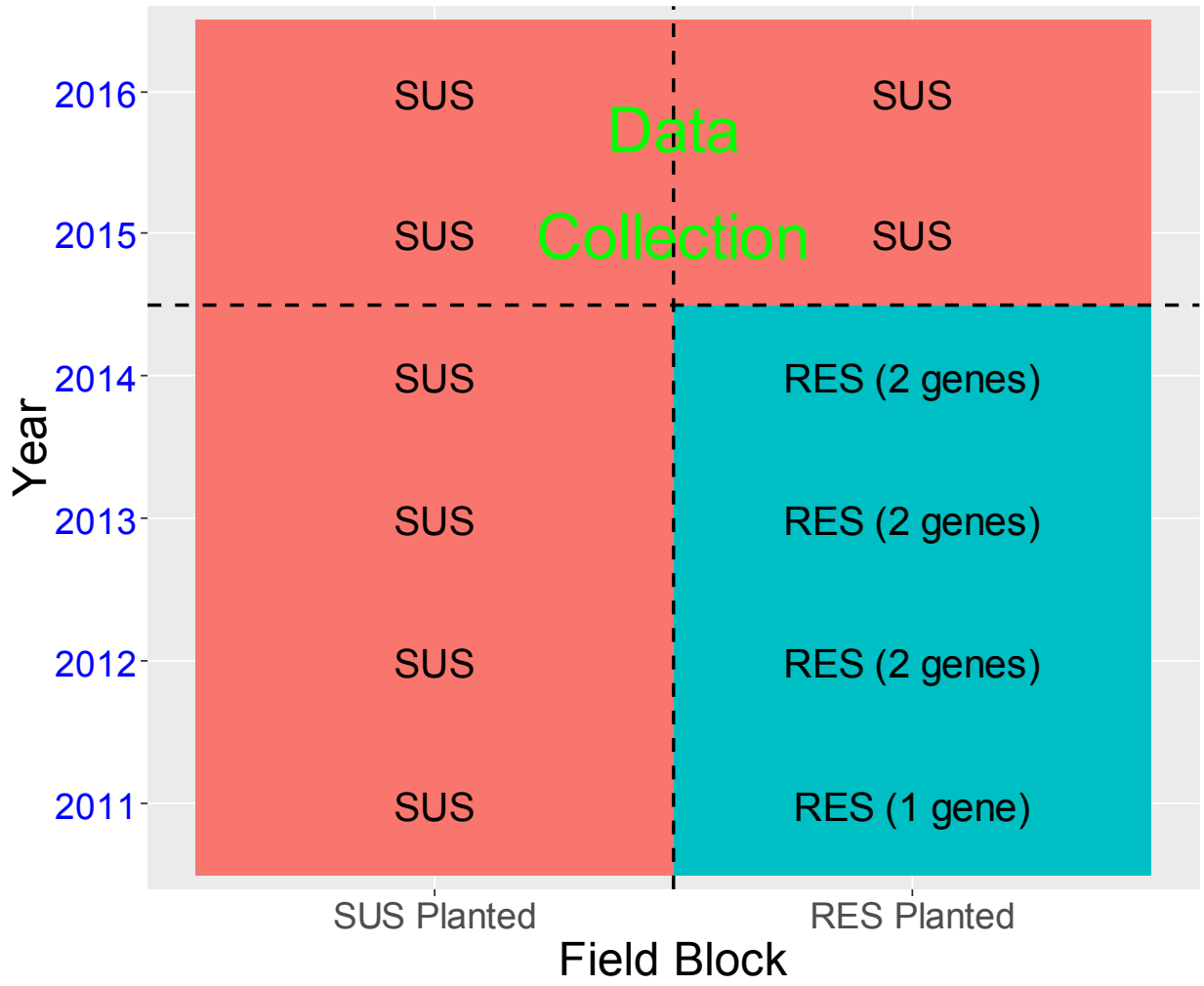

Figure 1. Field block schematic of RKN-SUS variety and RKN-RES varieties.

For early-season evaluation, cotton plant roots were collected to determine RKN egg (RKNEG) population 54 days after planting (DAP) in 2015 and 47 DAP in 2016. Cotton plant root samples were processed at the Monsanto facility in Lubbock, TX and population was quantified in eggs/gram dry root. For late-season evaluation of RKN juvenile populations (RKNJH) soil samples were collected prior to harvest, timed around the last irrigation for ease of sampling. Soil samples were processed at Waters Lab in Georgia and population was quantified as juveniles/pint. Lint yield/acre (LTAC) was taken on small plots 2 x 50' long.

RKNEG & RKNJH data were log transformed and Welch's two sample t-test was used to compare the RES & SUS planted blocks for traits RKNEG, RKNJH & LTAC.

Results and Discussion

In 2015, there were 72 yield comparisons for plots previously planted to the RKN-SUS variety and the RKN-RES variety (Table 1). There were 12 comparisons made for both RKN eggs/g early-season evaluations and RKN juvenile late-season evaluations. In 2016, there were 82 yield comparisons for plots planted to a RKN-SUS variety and 84 to a RKN-RES variety. There were 12 comparisons made in 2016 for both RKN eggs/g early-season evaluations and RKN juvenile late-season evaluations.

Table 1. Number of comparisons for yield, RKN eggs/g root early-season evaluations, and RKN juveniles late-season evaluations.

Year	Field	LTAC	RKNEG	RKNJH
2015	SUS Planted	72	12	12
2015	RES Planted	72	12	12
2016	SUS Planted	82	12	12
2016	RES Planted	84	12	12
LTAC = Lint yield/acre; RKNEG = RKN eggs/g root (early season); RKNJH = RKN juveniles at harvest.				

In 2015, the first year of planting a SUS variety across blocks, the RES planted block had significantly lower RKN eggs early in the season than the SUS planted block (Figures 2, 5). Even though the RES planted block had numerically lower RKN juveniles at harvest than the SUS planted block, there were no significant differences between the blocks (Figures 3, 5) indicating a bounce back in RKN population. Also, the RES planted block had a significantly higher lint yield than the SUS planted block (Figures 4, 5).

In 2016, the second year of planting a SUS variety across blocks, there were no significant differences in RKN eggs early in the season or RKN juveniles at harvest between the RES and SUS planted blocks (Figures 2, 3, 6). However, the RES planted block yielded significantly lower than the SUS planted block (Figures 4, 6).

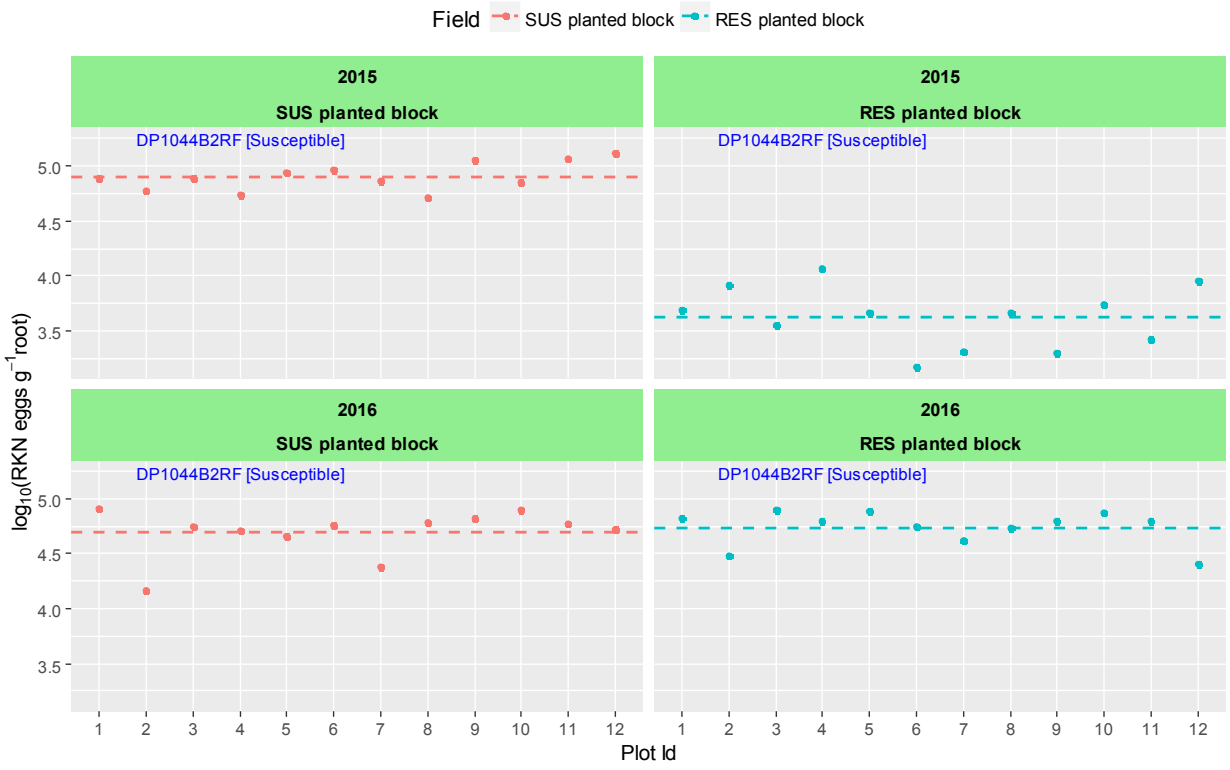

Figure 2. Results for early-season RKN eggs/g root distribution for blocks planted to a RKN-SUS variety and RKN-RES variety. Data has been transformed to log10.

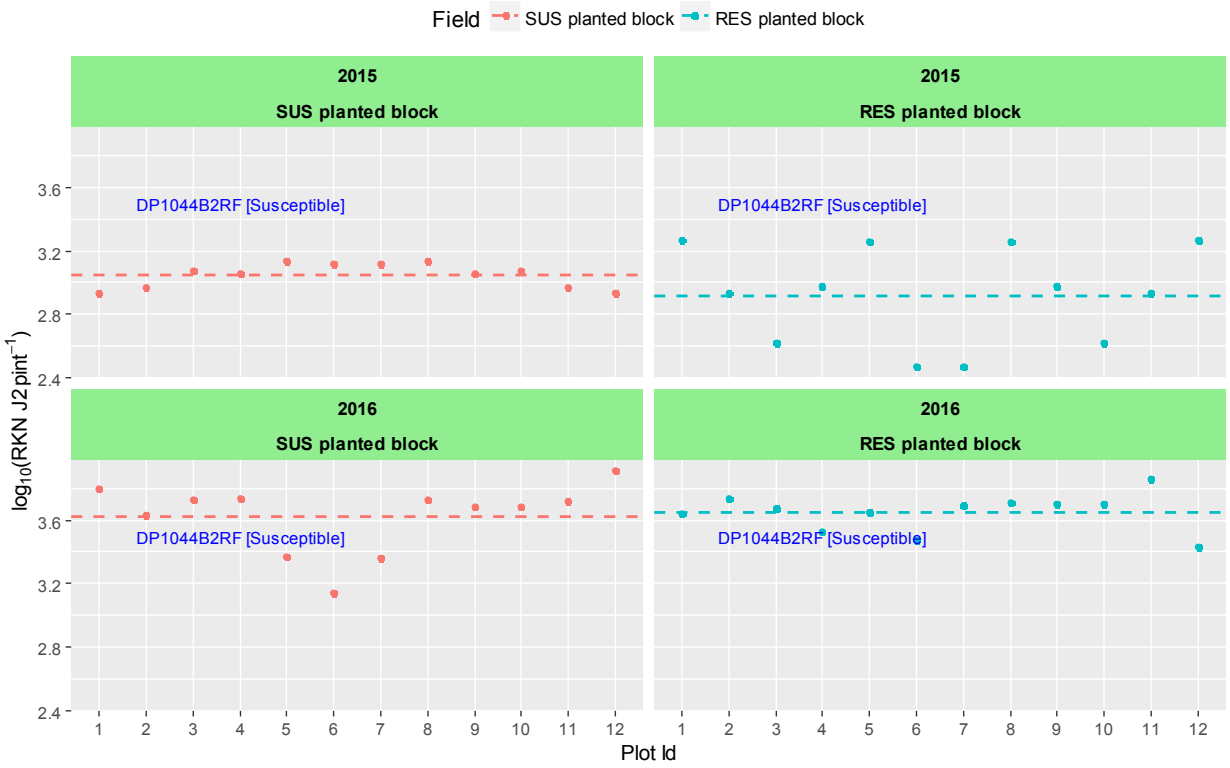

Figure 3. Results for RKN juvenile distribution at harvest for blocks planted to a RKN-SUS variety and a RKN-RES variety. Data has been transformed to log10.

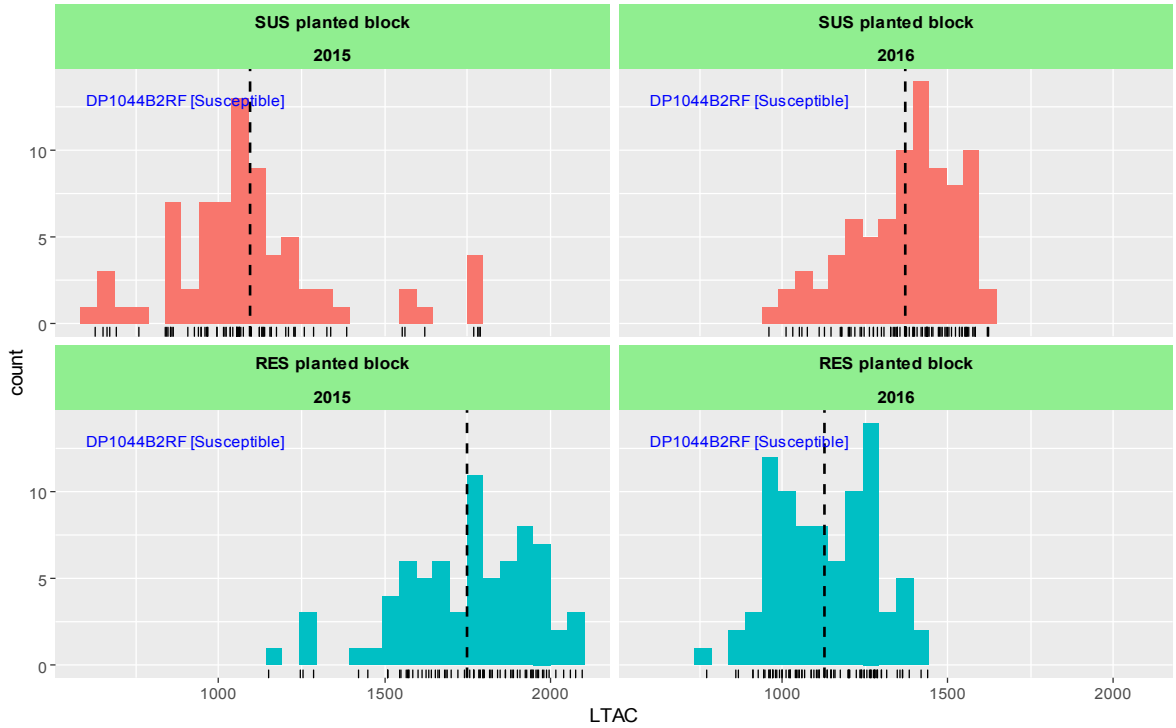

Figure 4. Results for lint yield distribution for blocks planted to a RKN-SUS variety and a RKN-RES variety. LTAC = Lint yield/acre.

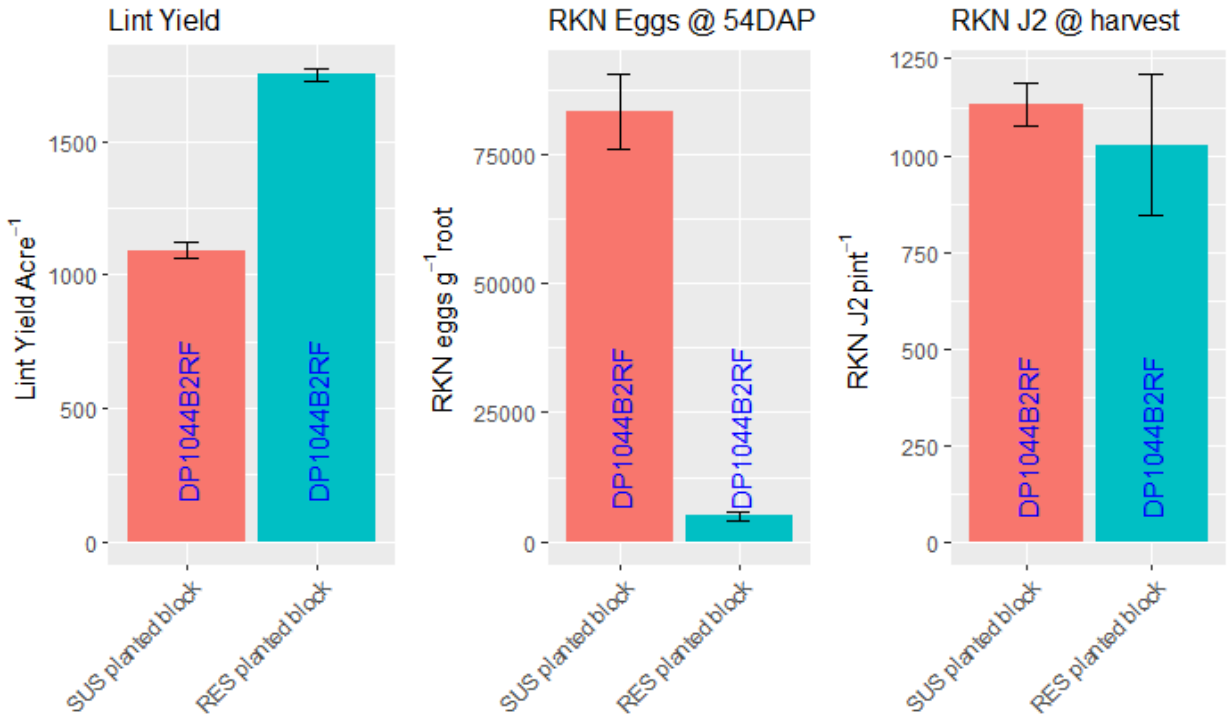

Figure 5. 2015 results for lint yield/acre, early-season RKN eggs/root, and RKN juvenile distribution at harvest for blocks planted to a RKN-SUS variety and a RKN-RES variety.

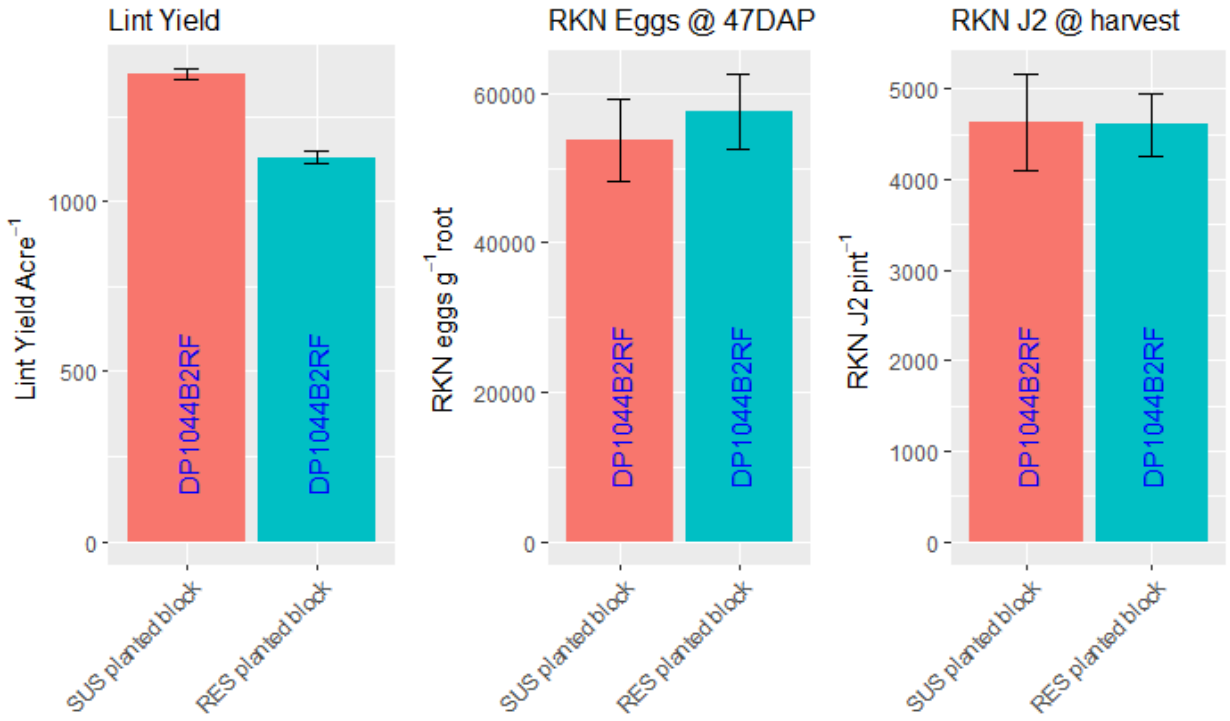

Figure 6. 2016 Results for lint yield/acre, early-season RKN eggs/root, and RKN juvenile distribution at harvest for blocks planted to a RKN-SUS variety and a RKN-RES variety.

When looking at percent change as shown in Table 2, in 2015 there was a 94% RKN egg (RKNEG) reduction, a 9% RKN juvenile (RKNJH) reduction, and a 60% increase in lint yield (LTAC) in the RES planted block compared to the SUS planted block. In 2016 there was a 7% increase in RKN eggs (RKNEG), a 1% decrease in RKN juveniles (RKNJH) at harvest and an 18% yield loss (LTAC) in the RES planted block compared to the SUS planted block.

Table 2. Percent change of lint yield/acre, early-season RKN eggs/g root evaluation, and late-season RKN juvenile evaluation when compared to RKN-SUS plot.

Year	Field	LTAC	RKNEG	RKNJH	LTACΔ	RKNEGΔ	RKNJHΔ
2015	SUS Planted	1093	83288	1131	Control	Control	Control
2015	RES Planted	1751	5008	1028	60%	-94%	-9%
2016	SUS Planted	1373	53677	4636	Control	Control	Control
2016	RES Planted	1129	57568	4611	-18%	7%	-1%

Figure 7 shows the significant difference in cotton early in the season the first year of planting a susceptible variety (2015) across blocks in a field previously planted to a RKN-SUS variety (left) and RKN-RES variety (right) for four consecutive years. Figure 8 shows cotton at harvest the second year of planting a susceptible variety (2016) across blocks in a field previously planted to a RKN-SUS variety (left) and RKN-RES variety (right) for four consecutive years.

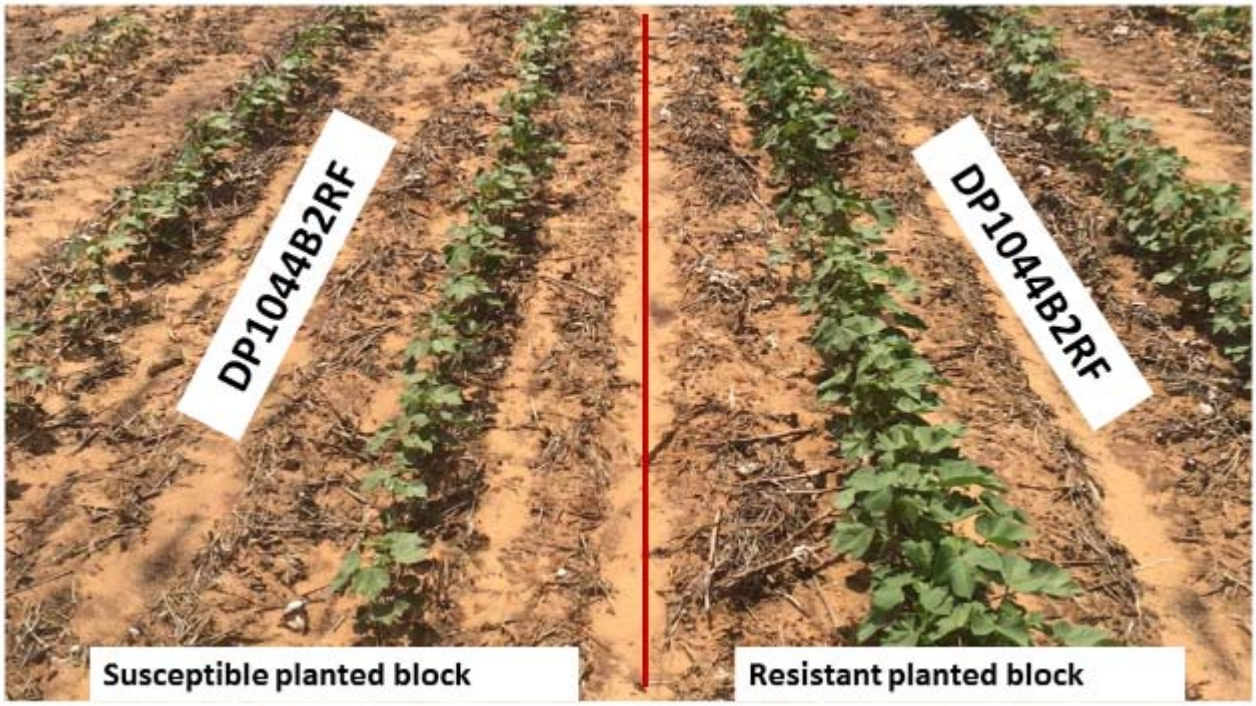

Figure 7. Picture taken in the first season of planting susceptible variety (2015).

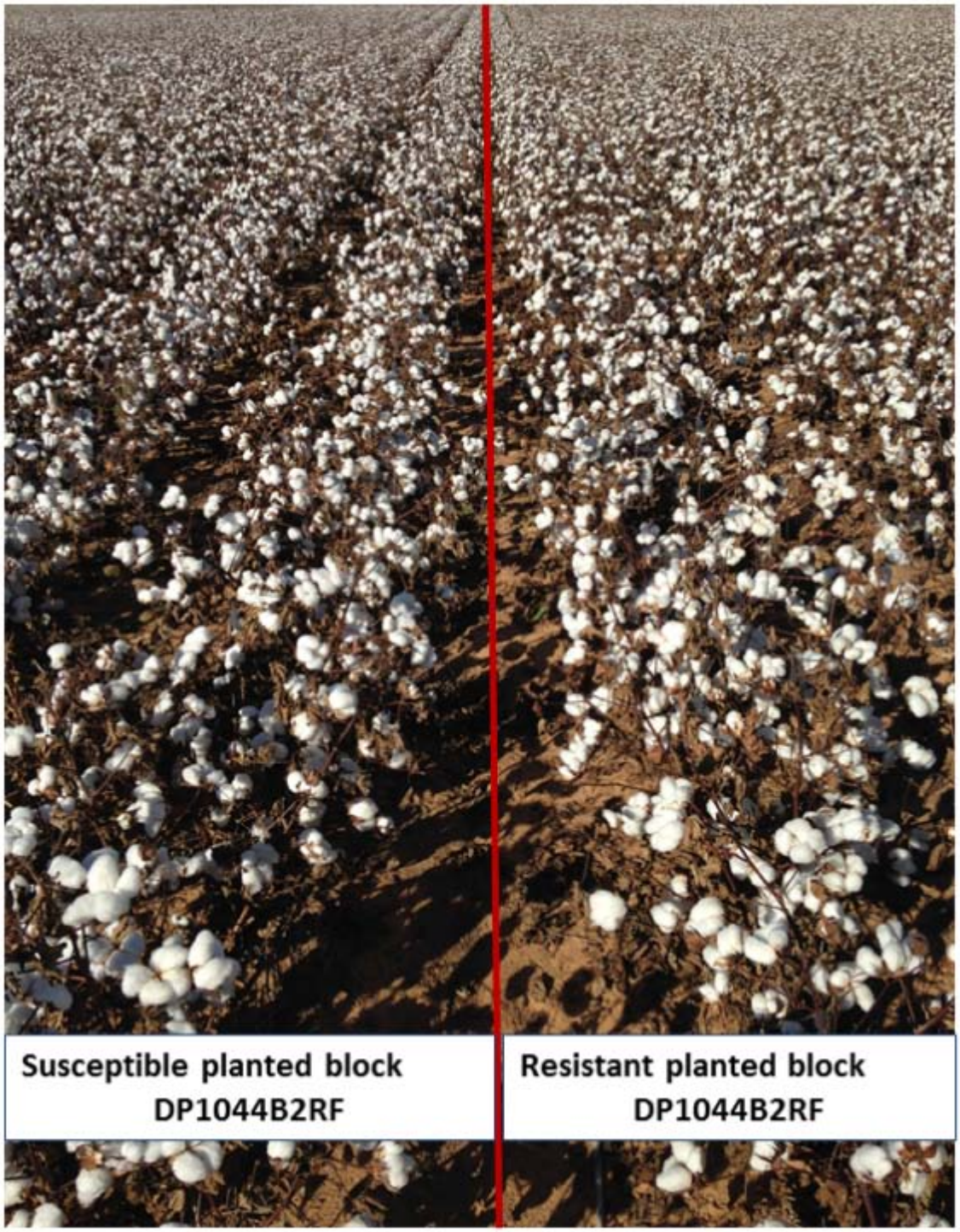

Figure 8. Picture taken before harvest in the second season of planting susceptible variety (2016).

Summary

In testing of RKN-SUS cotton in a field previously planted to RKN-RES cotton there was a 94 percent reduction in RKN eggs early in the season and a 60 percent yield gain in the RKN-RES planted block over the RKN-SUS planted block in the first year of planting a susceptible variety. While significantly lower eggs were found on RKN-RES planted block, there were no significant differences in the number of juveniles harvested between the RES and

SUS planted blocks the first year of planting a RKN-SUS cotton variety. This data would indicate that RKN populations may bounce back in just one year of planting a RKN-SUS cotton variety even though RKN-RES cotton varieties were planted on the ground for four consecutive years.

In evaluations the second year of planting a RKN-SUS cotton variety there was an 18 percent yield loss in the RKN-RES planted block when compared to the RKN-SUS planted block. Also, there were no significant differences for early-season RKN eggs and number of RKN juvenile counts at harvest when comparing the RKN-RES and RKN-SUS planted blocks.

Based on results from this study, growers may benefit from planting a RKN-SUS cotton variety in a field previously planted to a RKN-RES cotton variety the first year, but could give away that advantage in just one season of planting a RKN-SUS cotton variety. The planting of a RKN-SUS cotton variety for even a single growing season may result in loss of any progress made to reducing RKN populations in a field.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.