



Newly Developed Soybean JTN-4307 Has Resistance To Multiple Pathogens

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INTRODUCTION

Soybean [*Glycine max* (L.) Merr.] is a major oil seed crop produced and consumed worldwide. Soybean Cyst Nematode (SCN = *Heterodera glycines* Ichinohe) is a pervasive obligate root parasite on soybean in the USA and in other soybean growing countries. Other fungal diseases including Charcoal rot (CR = *Macrophomina phaseolina* (Tassi) Goidavich) and Frogeye leaf spot (FLS = *Cercospora sojina* K. Hava) are also major causes of yield reduction in soybean. The combined yield losses are estimated at more than \$1 billion in the USA (Koening and Wrather, 2010). Resistant cultivars have stabilized the yield losses for SCN, however, over time variable populations have adapted to them, rendering once resistant cultivars susceptible. Thus the breeding efforts for SCN resistance will continue and will remain a constant challenge.

Recently in Tennessee, FLS has been identified that is highly resistant to several commonly used Strobilurin fungicides (Newman and Donald, 2011). Currently, soybean cultivars with combined resistance to SCN, FLS, and other fungal pathogens are not readily available. We have developed a soybean, JTN-4307, with resistance to multiple pathogens and good yield potential.

MATERIALS & METHODS

JTN-4307 is a selection from the cross S97-1688 X V94-0198. The cross was made in 2001 at the University of Missouri Delta Research Center in Portageville, MO. The pedigree for S97-1688 included S91-1381 X Hartz 5810 (Anand et al., 2004), and S91-1381 is a selection from H5370 X Hartwig. Soybean H5370 is a selection from D70-3115 X Forrest. The pedigree for V94-0198 included DP 415 X Manokin, and Manokin was derived from cross L70L-3048 X D74-7824 (Kenworthy et al., 1996). The pedigree for DP 415 is not available.

Progenies of the cross S97-1688 X V94-0198 were advanced using bulk-row method (Fehr, 1991) in 2002 and in 2003. F_{2,4} were planted in 2004 in Jackson, TN, and two single plants were selected for progeny testing. The progenies (F_{4,5}) were planted in two separate rows during 2005 and bulk harvested separately into two populations. Both had purple flowers and tawny pubescence. DNA samples were collected for marker assisted selection.

Simple Sequence Repeat (SSR) markers associated with SCN resistance on three linkage groups (A2, G, D2) were used to confirm resistance genes *rhg1* and *Rhg4* using PCR method (Figures 1-2). The method was described (Arelli et al., 2010). F_{5,6} progenies were bioassayed in the greenhouse to confirm resistance to SCN populations. Established methods were used for greenhouse bioassays (Arelli and Wang, 2008). The strain that had better resistance score (FI%) for SCN nematode populations (Races 3 and 14) was designated as JTN-4307. Yield evaluations for JTN-4307 were performed initially on station in 2006 and later by entering into USDA Uniform Test for Southern States in 2008, 2009, 2010, and 2012 (Figure 3, Table 1). JTN-4307 has been included in on station field evaluations for FLS reaction since 2008, and has been found to be resistant over multiple years. Resistance was recently confirmed (Figure 4a) using marker assisted selection to identify resistance gene *Rcs3* with SSR marker Satt244 (Mian et al., 2009).

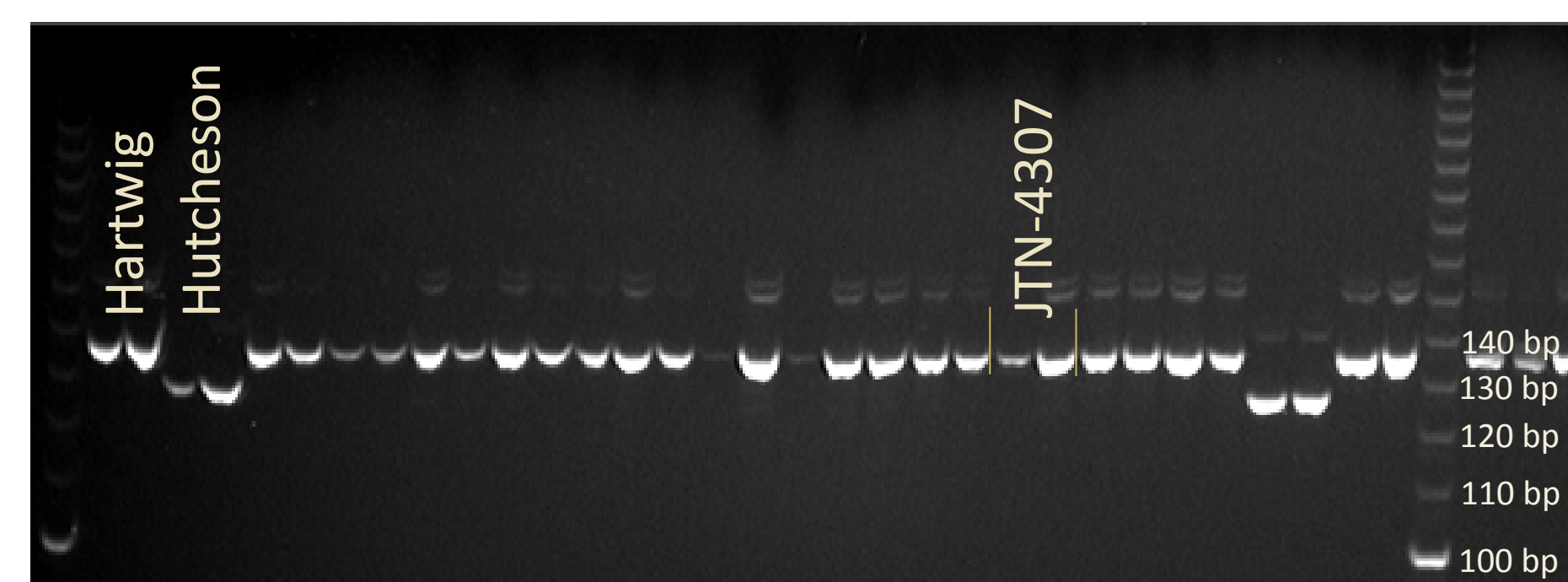


Figure 1. JTN-4307 is compared to SCN-resistant cv. Hartwig and SCN-susceptible cv. Hutcheson with SSR marker Satt309 in a 6% polyacrylamide gel. Satt309 is located on linkage group G and linked to gene *rhg1*.

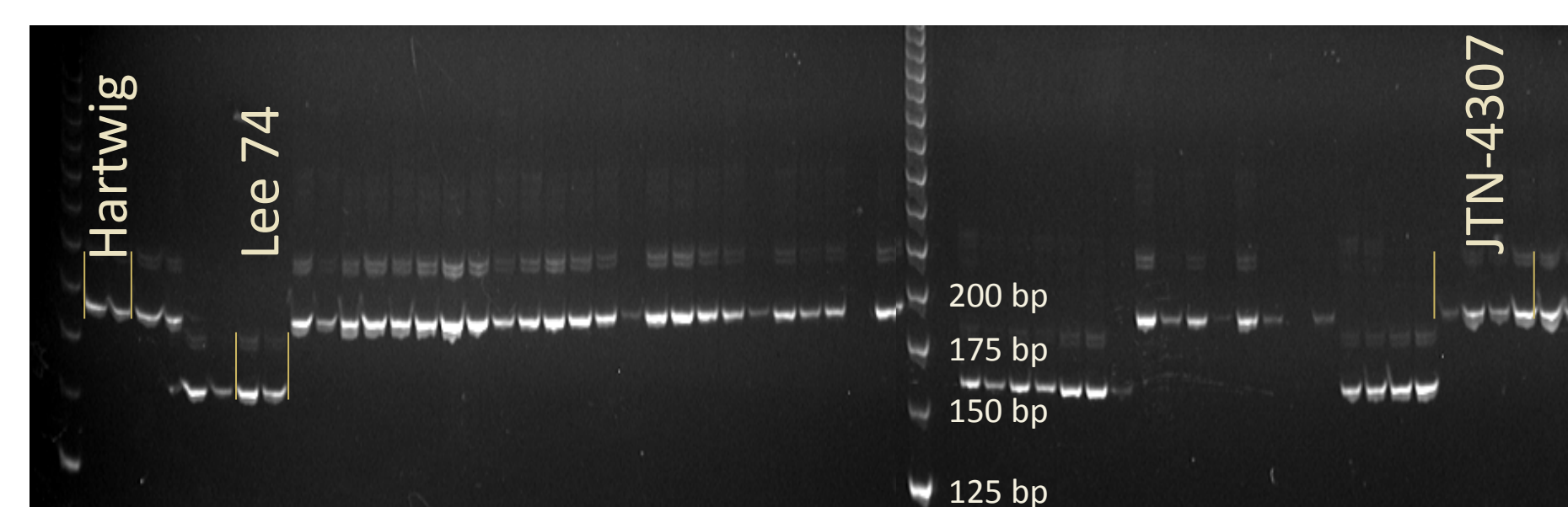


Figure 2. JTN-4307 is compared to SCN-resistant cv. Hartwig and SCN-susceptible cv. Lee 74 with SSR marker Satt574 in a 6% polyacrylamide gel. Satt574 is located on linkage group D2 and linked to quantitative trait locus (QTL) for resistance in cv. Hartwig.

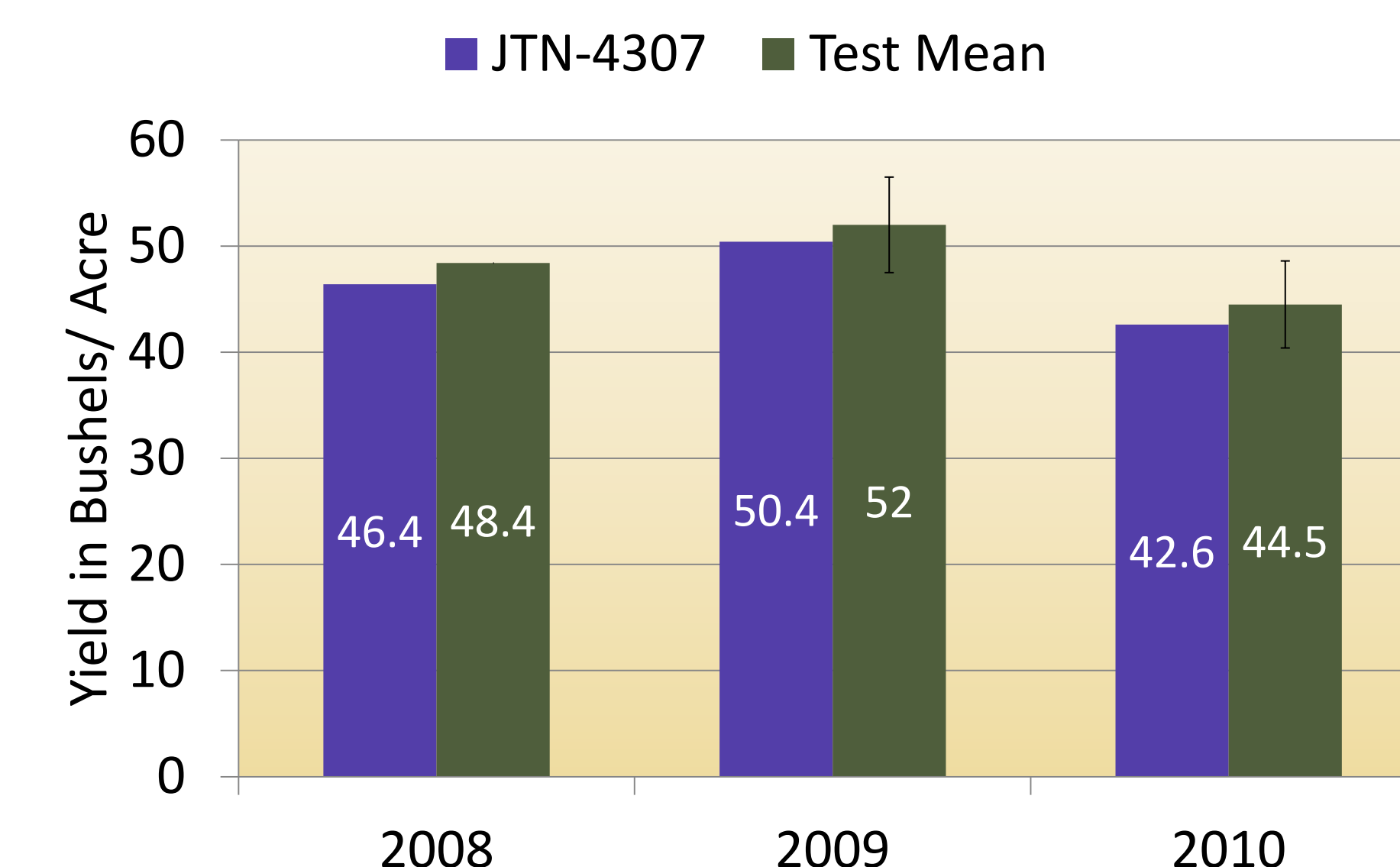


Figure 3. Graph comparing yield of JTN-4307 to the test mean for the Uniform IV-South test of the Uniform Soybean Tests for 2008 – 2010 (Gillen and Shelton, 2008; 2009; 2010). Error bars depict the LSD (0.05) of 4.5 for 2009 and 4.1 for 2010, and show that JTN-4307's yield was not significantly different from the mean. 2008 LSD data was not available. Data for 2012 is not yet available.

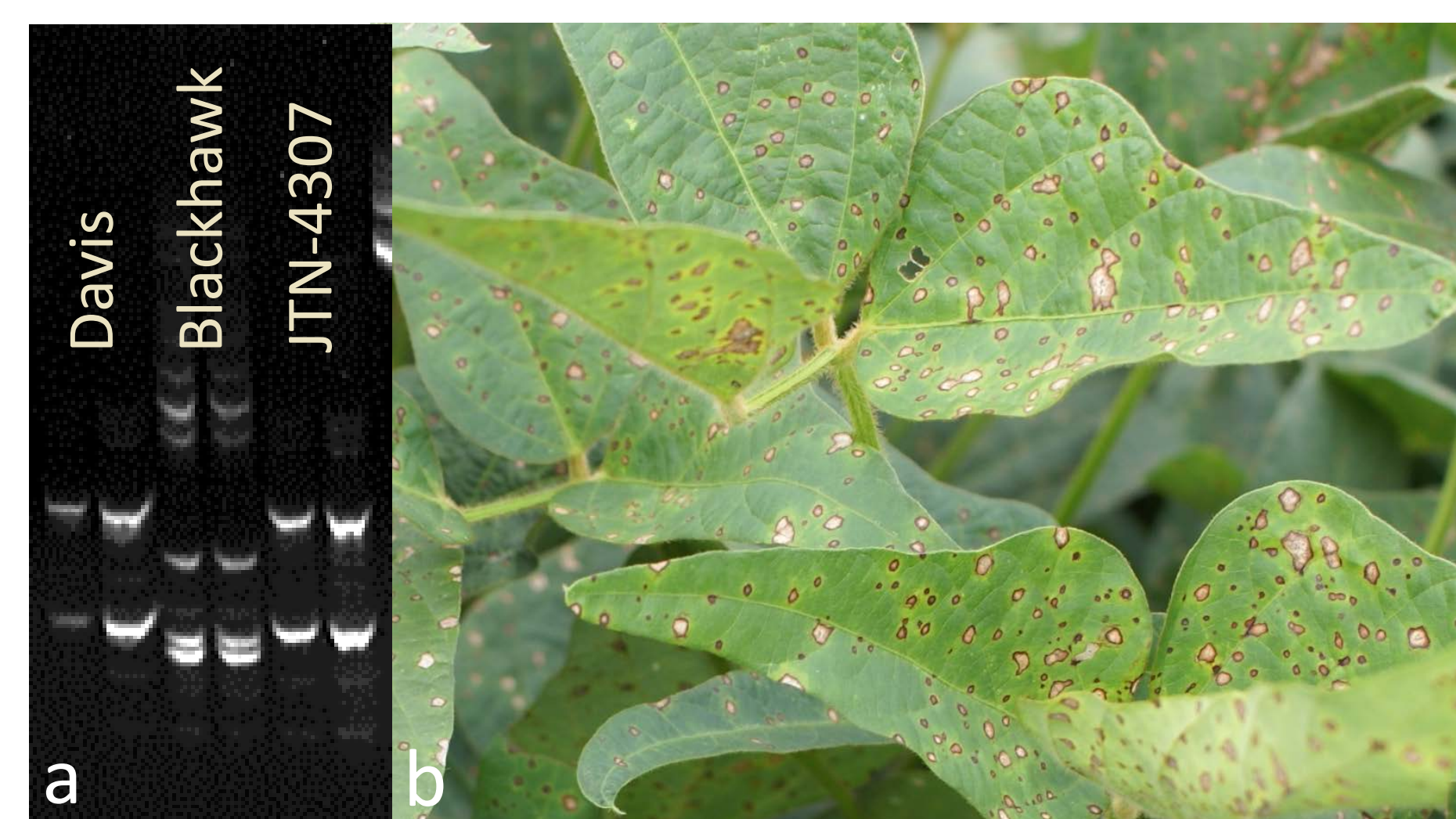


Figure 4a-b. Figure 4a compares the reaction of JTN-4307 to FLS-resistant cv. Davis and FLS-susceptible cv. Blackhawk with SSR marker Satt244 in a 6% polyacrylamide gel. Satt244 is linked to gene *Rcs3*. Figure 4b depicts a susceptible soybean infected with FLS in Milan, TN.

Table 1. JTN-4307 is resistant to multiple races of SCN, as well as Southern root knot nematode and stem canker. Data are from the Southern Uniform Tests (Gillen and Shelton, 2008; 2009; 2010).

Year	SCN HG Type			Southern Root Knot	Stem Canker	
	1.2.5.7	5.7	1.3.6.7		Rating	Score
2008	1	1	1	1	MR	2
2009	1	1	2	1	R	1
2010	1	1	.	1.3	R	1

RESULTS & CONCLUSIONS

JTN-4307 is a maturity group V soybean with resistance to SCN populations (Races 2, 3, and 14) HG Types 1.2.5.7; 0; 1.3.6.7. (Niblack et al., 2002). It is also resistant to FLS (Davies type) combined with resistance to Southern root knot nematode [*Meloidogyne incognita* (Kofoid & White)], Reniform nematode [*Rotylenchulus reniformis*], and Stem Canker [*Diaporthe phaseolorum* (Cooke & Ellis)].

It is determinate in growth habit with purple flowers, tawny pubescence (Figure 5), and black hilum. Seed yields ranged from 42.6-50.4 Bu/A (2865-3389 kg/Ha). With resistance to multiple pathogens, JTN-4307 is an excellent parent material in crosses to develop more desirable cultivars. Growers may also directly plant for seed production where diseases are a more serious problem.



Figure 5. JTN-4307 ready for harvest in Jackson, TN.

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