

Aphid-resistant soybean varieties for Minnesota

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SOYBEAN APHID

Soybean aphid is an invasive pest of soybean that continues to reach economically damaging levels in Minnesota. Foliar insecticides are commonly applied when aphid densities reach 250 aphids per plant to prevent economic loss. Yield loss and control costs can be significant for Minnesota soybean growers.

RESISTANCE TRAITS

Using aphid-resistant soybean varieties holds promise as a more sustainable approach to soybean aphid management. Soybean varieties that possess resistance genes called *Rag* genes (*Rag1*, *Rag2*, etc.) affect colonization and population growth of soybean aphid (Fig. 1).



Fig. 1. Resistance genes can effectively suppress soybean aphid: aphid-susceptible (left) and resistant (right) soybean lines. Photo: A. Hanson, University of Minnesota

Soybean varieties with *Rag1* or *Rag2* genes have significantly suppressed aphid numbers and protected yields in multiple states and

years; varieties with multiple (i.e., pyramided) *Rag* genes can provide further protection (McCarville et al., 2014). Independent university research has shown that varieties can have *Rag1* and *Rag2* genes without yield reduction (e.g., Fig. 2) when compared to similar aphid-susceptible soybean lines not under aphid pressure (Brace & Fehr, 2012).

Resistant varieties offer season-long protection from aphids. In contrast, insecticidal seed treatments (neonicotinoids) only provide temporary protection up to about 40 days after planting (McCarville & O'Neal, 2013), which is typically before aphid populations are established. The likelihood of needing to apply foliar insecticides for soybean aphid is also reduced by using resistant varieties.

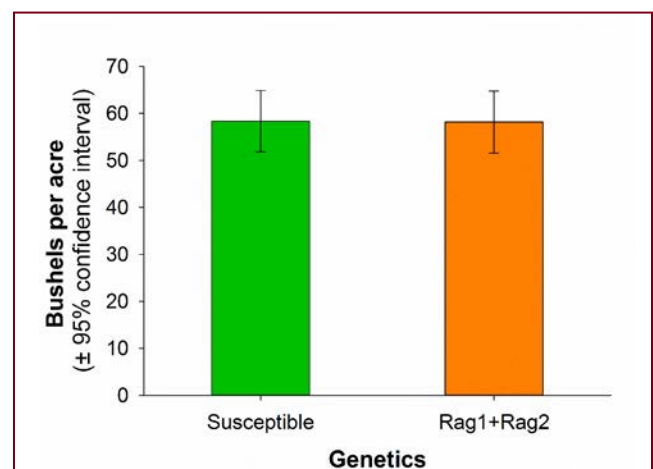


Fig. 2. *Rag1* and *Rag2* resistance genes do not cause yield drag. Yield of soybean varieties IA2104 (aphid-susceptible) and IA2104RA12 (*Rag1* + *Rag2* pyramid) with low aphid pressure (< 20 average aphids per plant at most during the growing season), Rosemount, MN, 2016.

AVAILABILITY AND USE OF APHID-RESISTANT SOYBEAN

Commercial varieties containing *Rag* genes have been available since 2009, but have been uncommon among early-maturity soybean varieties developed for Minnesota. Search of seed catalogs identified several soybean varieties with aphid-resistance (*Rag*) genes in early maturity groups and with other traits potentially suitable for Minnesota soybean growers (Table 1). Please inform us of any additional varieties with resistance that may have been missed in our search.

Scouting aphid-resistant varieties should still occur as aphids can occasionally reach damaging levels on resistant plants. Soybean aphid populations (biotypes) that can overcome aphid-resistance genes do exist,

but their occurrence varies throughout the region and over time (Cooper et al. 2015). Even though soybean varieties with single resistance genes, such as *Rag1* alone, have been effective at suppressing soybean aphid in Minnesota (Hanson et al., 2016), varieties with pyramided resistance genes, such as *Rag1+Rag2*, offer more robust protection from resistance-breaking aphid biotypes (McCarville et al. 2014).

Planting well-adapted aphid-resistant varieties could improve the sustainability of soybean production. It is our hope that this list, which will be updated over time, will allow growers to more easily find aphid-resistant seed.

Table 1. Soybean varieties carrying *Rag* genes available in Minnesota as of November 2016.

Brand names	Company	Relative maturity	Resistance gene(s)	Herbicide resistance trait	Other advertised characteristics
0543	Gold Country	0.5	<i>Rag1</i>	Genuity RR 2 Yield	PRR susceptible; SCN resistance
1114	Seed	1.1	<i>Rag1</i>	Genuity RR 2 Yield	PRR resistance; SCN resistance
LS 10R551N	Legend Seeds	1.0	<i>Rag1</i>	Genuity RR 2 Yield	PRR resistance; SCN resistance
NS1040NR2	NorthStar Genetics	1.1	<i>Rag1</i>	Genuity RR 2 Yield	PRR resistance; SCN resistance
3511 R2YN	Thunder Seed	1.1	<i>Rag1</i>	Genuity RR 2 Yield	IDC tolerance; SCN resistance; PRR resistance
Viking 0.1544AT	Viking Seeds	1.5	<i>Rag1</i>	None	IDC tolerant; SCN susceptible; organic seed
Viking 0.1955AT		1.9	<i>Rag1</i>	None	PRR tolerant; BSR susceptible; organic seed
Viking 2188NAT		2.1	<i>Rag1</i> & <i>Rag2</i>	None	SCN resistance
Viking 0.2188AT12N		2.1	<i>Rag1</i> & <i>Rag2</i>	None	SCN resistance; organic seed
Viking 0.1A2104RA12		2.3	<i>Rag1</i> & <i>Rag2</i>	None	SDS resistance; organic seed
Viking 0.2399AT12N		2.4	<i>Rag1</i> & <i>Rag2</i>	None	SCN resistance; organic seed

RR: Roundup Ready; **PRR:** Phytophthora root rot; **SCN:** soybean cyst nematode; **IDC:** iron deficiency chlorosis; **BSR:** brown stem rot; **SDS:** sudden death syndrome

SELECTED REFERENCES

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4. **McCarville, M.T. and M.E. O'Neal. 2013.** Soybean aphid (Aphididae: Hemiptera) population growth as affected by host plant resistance and an insecticidal seed treatment. *Journal of Economic Entomology* 106: 1302-1309
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