

Prevalence and cropping system impacts on Soybean Vein Necrosis disease in Delaware Soybeans- Results from our 3 year survey

Nathan M. Kleczewski
Extension Plant Pathologist
University of Delaware
Department of Plant and Soil Science
531 S College Avenue
Newark, DE 19716

Bill Cissel
Extension Agent, IPM
University of Delaware
Department of Entomology and Wildlife Ecology
531 S College Avenue
Newark, DE 19716

General summary:

SVNd is a viral disease of soybeans. The virus can cause a foliar symptom that can resemble other diseases or disorders, such as drought stress, stem diseases, nematode damage, nutrient deficiencies, and herbicide damage. The virus is transmitted by at least 3 species of thrips including soybean thrips, a small insect with piercing sucking mouthparts. Thrips can be present in full season soybeans early in the growing season. Although no general impact of SVNd is known, we know that it can impact soybean quality, which may be important for growers producing high oleic soybeans.



To determine the frequency of this disease in Delaware, we conducted a survey of 88 soybean fields (48 full season, 40 double crop) from 2015-2017. We speculated that double crop soybeans would have more severe symptoms of SVNd because they would be exposed to higher populations of thrips earlier in development, and therefore express higher levels of foliar symptoms. Each field was sampled twice per season, targeting the vegetative stage and the early reproductive growth stages. At each field, 20 sites were assessed for disease, and scored as positive or

negative for SVNd if plants at a site expressed symptoms. The presence of the virus was confirmed by testing symptomatic foliage using an assay that involves the use of antibodies. Data were analyzed and are presented below.

	Production System		Soybean Growth Stage	
	Full Season	Double Crop	Vegetative	Reproductive
SVNd Incidence (%)	11.6 ± 3.1	22.8 ± 3.2	4.5 ± 3.3	29.8 ± 3.1

These data indicate several things. First, SVNd is prevalent in Delaware soybeans. It was detected each year, in both cropping systems. We detected more disease in double crop beans when compared to full season beans, which agreed with our initial hypothesis regarding thrips populations and exposure to more virus infected thrips. We also detected more disease in the early reproductive phases, when compared to the early growth stages. What does this mean? You are likely to see foliar symptoms before or right after a fungicide spray was made and as mentioned previously, many things can look like SVNd, and vice versa. However, because this is a virus, fungicides will have no impact. Thus, you could save yourself an application or the grief associated with filing a complaint with the company or applicator by having symptomatic foliage tested by a diagnostic clinic or Agdia Inc. Research conducted here and elsewhere have demonstrated no impact of foliar or seed applied insecticides on SVNd, likely because thrips are present in nearly every environment, can move rapidly from other locations, reproduce quickly, and transmit the virus for the remainder of their lifecycles once they acquire it. Consequently, a small number of thrips can still cause foliar symptoms. The biggest thing to remember is that we have no consistent yield impact associated with this virus. Growers producing typical, grain beans should not be concerned about this disease, but should understand that it is prevalent and easy to misdiagnose. Our data may have additional meaning for producers of high oleic beans, as soybean quality can be impacted by this virus. Our data indicate that full season beans, planted early in the growing season, are less likely to have symptoms of this disease compared to double cropped soybeans. Thus, producers of high oleic soybeans should ensure that beans are planted as early as practical in a given year and avoid planting these varieties in double cropped systems.

Technical Report

Since its discovery in 2008, soybean vein necrosis disease (SVNd) caused by Soybean Vein Necrosis Virus (Family Bunyaviridae; Genus Tospovirus (4)) has become widespread throughout soybean (*Glycine max* (L.) Merr.) production areas in the United States (5, 6). The virus is spread primarily by thrips (3) although some seed transmission has been detected (2). Symptoms of SVNd include vein necrosis and foliar chlorosis starting at the leaf vein. Chlorotic areas turn brown with age. In severe cases, defoliation may occur. Although no consistent impacts of SVNd on soybean yield have been reported, the virus can cause changes in soybean quality (1). The production of high Oleic acid soybeans in the Chesapeake Bay region of the mid-Atlantic including Delaware is becoming increasingly popular. To date, the amount of SVNd in this region is uncharacterized and the effects of cropping system (i.e. full season beans

vs double cropped beans following small grains) is unknown. We speculated that the disease would be widespread in Delaware and that the disease would be more severe in double cropped soybeans compared to full season soybeans as a result of delayed planting and potential exposure to greater numbers of viruliferous thrips during the growing season. From 2015-2017, 88 fields (48 full season, 40 double crop) throughout Delaware were assessed for SVNd incidence. Each site was visited twice, with visits targeting soybean vegetative (V3-V5) and early reproductive (R1-R3) growth stages. Twenty areas were assessed per field visit. At each site, a single soybean plant was evaluated for symptoms of SVNd (Figure 1). Symptomatic foliage from each field was placed into plastic bags on ice and sent overnight for confirmation of the virus using Enzyme Linked Immunosorbant Assays (Agdia, Inc, Loveland, IN). Disease incidence (percent of plants with foliar symptoms of SVNd) was calculated for each field. Data were Log transformed and analyzed using a repeated measures general mixed model with field as a random factor and production system (full season vs double crop) and growth stage (vegetative vs reproductive) and their interaction as fixed factors, with field nested within growth stage using JMP v13 (SAS Inc.). A preliminary analysis indicated no significant impact of year on SVNd incidence and therefore it was not included in the model. Average disease incidence for 2015, 2016, and 2017 were 19.0, 17.0, and 15.5%, respectively. Disease incidence was impacted by main effects of production system ($F = 48.9$; $P < 0.0001$) and soybean growth stage ($F = 9.9$; $P = 0.002$) but not their interaction ($F = 0.7$; $P = 0.4$). When averaged across growth stage, SVNd incidence was 50% lower than double cropped beans (Table 1). Disease incidence was markedly greater in plants assessed during early reproductive compared to vegetative stages of growth (Table 1). These data indicate that SVNd is prevalent in soybeans of the Chesapeake Bay and planting system or planting date may impact the amount of SVNd in fields. Our data indicate that full season soybeans may be at less risk for SVNd related changes in quality when compared to double cropped soybeans. Consequently, we suggest growers avoid planting high oleic soybeans in double crop systems or planting late in the growing season.

Table 1. Least Squares means $\pm$ standard errors for main effects of production system and soybean growth stage on incidence of SVNd assessed from 88 soybean fields in Delaware from 2015-2017.

	Production System		Soybean Growth Stage	
	Full Season	Double Crop	Vegetative	Reproductive
SVNd Incidence (%)	11.6 $\pm$ 3.1	22.8 $\pm$ 3.2	4.5 $\pm$ 3.3	29.8 $\pm$ 3.1

1. Anderson, N. R., Irizarry, M. D., Bloomingdale, C. A., Smith, D. L., Bradley, C. A., Delaney, D. P., Kleczewski, N. M., Sikora, E. J., Mueller, D. S., and Wise, K. A. 2017. Effect of soybean vein necrosis on yield and seed quality of soybean. *Canadian Journal of Plant Pathology* 39:334-341.

2. Groves, C., German, T., Dasgupta, R., Mueller, D., and Smith, D. L. 2016. Seed Transmission of Soybean vein necrosis virus: The First Tospovirus Implicated in Seed Transmission. *Plos One* 11.
3. Keough, S., Han, J. L., Shuman, T., Wise, K., and Nachappa, P. 2016. Effects of Soybean Vein Necrosis Virus on Life History and Host Preference of Its Vector, *Neohydatothrips variabilis*, and Evaluation of Vector Status of *Frankliniella tritici* and *Frankliniella fusca*. *Journal of Economic Entomology* 109:1979-1987.
4. Zhou, J., Kantartzi, S., Wen, R.-H., Newman, M., Hajimorad, M., Rupe, J., and Tzanetakis, I. 2011. Molecular characterization of a new tospovirus infecting soybean. *Virus genes* 43:289.
5. Zhou, J., and Tzanetakis, I. 2011. A new virus disease in the US: Soybean vein necrosis. *Phytopathology* 101:S270-S270.
6. Zhou, J., and Tzanetakis, I. E. 2013. Epidemiology of Soybean vein necrosis-associated virus. *Phytopathology* 103:966-971.