Occurrence and Impact of Soybean Vein Necrosis Disease in Delaware

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Abstract

Soybean Vein Necrosis disease (SVNd) is a recently described, thrips-vectored, viral disease of soybeans. Little is known of the epidemiology, impacts, and management needs/options for SVNd. We surveyed 50 full and double crop soybean fields in the 2015 season for occurrence and severity of the disease. In addition, two small plot research trials were conducted separately to examine the impacts of insecticide treatments on SVNd severity and yield. In 2015, 72% of Delaware soybean fields had detectable levels of SVNd by RS-86, with 69% of full season and 93% of double crop fields affected. Although insecticide treatments significantly reduced thrips numbers there were no effects on SVNd symptoms. SVNd severity was greater in double crop in full season beans (F = 4.282, p = 0.043). In the full season trials, the varieties H313-LR2, 74B42R, and H317-LR40235 had significantly lower SVNd index than other tested varieties. In double crop system SVNd indices were significantly lower in variety 74B42R. In both systems, SVNd indices were greatest in the variety 74B42R employing a noneconomic negative linear relationship between log SVNd index and yield. Survey results indicated that SVNd can be present at high levels in Delaware fields and may be greater in double crop systems. Our data are the first to document the effects of variety and planting date on SVNd index and associated effects on yield, and indicate that the virus may potentially impact yield to some degree. Based on our results, planting date and variety selection may be effective SVNd management practices if required in the future.

Introduction

In 2011, a new Thrips species causing Soybean Vein Necrosis disease (SVNd), was identified in Maryland and Delaware soybean fields (1). Soybean Vein Necrosis Virus is acquired by Soybean thrips during the first two larval stages and transmitted in a persistent, propagative manner (2). Symptoms of SVNd include vein clearing or necrosis, which can spread over the entire foliar surface over time (Fig. 1). SVNd has been associated with grain quality in Midwestern soybean production regions (2); however, the significance of SVNd in Mid-Atlantic soybean production remains unclear.

Objectives:

1. Document SVNd occurrence and severity in Delaware soybeans planted in full and double crop production systems
2. Examine the effects of SVNd on soybean yield using replicated, small plot studies

Materials and Methods

Survey

A total of 60 fields throughout Delaware, comprised of 20 full season and 20 double crop fields surveyed twice to target early (vegetative or early reproductive) and late (mid-to late pod fill) stages in development. Twenty sites consisting of 3 row feet were haphazardly selected and assessed for the incidence of plants with SVNd. Symptomatic trifoliate leaves were collected, placed on ice, and shipped overnight to Agdia Inc. for confirmation of the virus through enzyme Linked Immunosorbant Assays (3). Data were analyzed using repeated measures ANOVA (IBM 22.0).

Trial 1 Effects of Thrips on SVNd and Yield

A trial was conducted to examine the impact of thrips numbers on SVNd and yield. Thrips numbers were manipulated through application of a neonicotinoid seed treatment and sequential foliar insecticide application. The design was a RCB with six replications per treatment (12 treatments included: 1 untreated control; 2 neonicotinoid (Gaucho, 2 fl oz. / 1000 ft²; untreated control) seed treatment, (s), 5 x 5 x 5 foliar application of spinosad (blackhawk; 5 x 2 oz/A; 5 x 5 oz/A; 4 x 5 oz/A; 5 x 5 oz/A; 5 x 5 oz/A; 5 x 5 oz/A; 5 x 5 oz/A), treatments were applied to each row of each plot with a CD2 pressurized backpack sprayer equipped with three nozzle boom delivering 54 gpa. Thrips were monitored every 7-14 days until a week after RS-86. SVNd was determined by assessing incidence of foliar symptoms from 10 randomly selected plants located at the center of each plot. Twenty trifoliate leaves were collected from the upper 1/3 of the plot canopy and rated for percent foliar severity. Disease index was calculated using the formula index = (Incidence x severity) x 100. Plots were harvested and yields adjusted to 13% moisture. Variances were conserved in simultaneous t测试 by Agdia, Inc. Thrips counts were analyzed using repeated measures ANOVA. Yield, SVNd index, and total thrips data were analyzed using a random mixed model analysis of variance (IBM 12.0).

Trial 2 Effects of variety and planting date on SVNd

The 2015 UMD soybean variety trial was used to assess the impacts of variety and cropping system on SVNd severity and yield. All cultivars were planted in a full season and double crop production system at the Wye Research and Education center located in Queenstown, MD in a complete block design with three reps per variety. Ten cultivars were selected from the variety trials based on degree of symptom expression. SVNd index was calculated as in Trial 1. Plants were harvested and yields adjusted to 13% moisture. Data were analyzed using a random mixed model analysis of variance (IBM 12.0).

Results

Survey results indicated that 72% of fields had detectable levels of disease by RS-86, with 69% of full season and 93% of double crop fields affected (data not shown). Statistical analyses indicated significant effects of evaluation time and cropping system on SVNd severity (Cropping System x Stage at Rating P(\(F\)) = 0.014). SVNd developed earlier and to a greater degree in double crop soybeans compared to full season soybeans (Fig. 2). In the full season systems, SVNd incidence at the reproductive stage was similar to the vegetative stage in double crop systems.

Insecticide treatments significantly reduced thrips ups to seven days after treatment on three of the six assessment dates [Time x Treatment; P(\(F\))<0.0001]. Plants receiving three or four insecticide applications had significantly lower total numbers of thrips than other treatments (Table 1). However, thrips reduction did not impact SVNd index or yield (Table 1). Overall, SVNd levels for this trial were very low.

Yield and SVNd index were significantly impacted by soybean cultivar for both cropping systems (Full season and double crop; P(\(F\))<0.0001). Table 2. SVNd index was lowest for cultivar 74B42R in both cropping systems. For a given cultivar, soybean cultivar index was greater for the double crop system when compared to the corresponding full season system in seven of the ten cultivars rated. Across all varieties and systems we detected a modest, but significant negative linear relationship between log SVNd index and yield (P(\(F\)) <0.0001; Fig 4).

Discussion

Our results show that SVNd can be prevalent in soybeans grown in the Mid-Atlantic. Survey and research plot trials support the hypothesis that double crop soybeans may be impacted by SVNd at a greater degree than full season beans. Double crop beans are planted later in the growing season, which may result in exposure to higher levels of thrips and therefore increased SVNd earlier in plant development. Our results show that soybean cultivars may vary significantly in disease expression. Of the ten cultivars, Gaucho 284HR, examined, disease expression was consistently and significantly lower in cultivar 74B42R when compared to other tested cultivars. Our data showed a moderate, but significant relationship between SVNd index and yields. To our knowledge, this is the first report of a negative yield impact associated with SVNd. Although insecticides did reduce thrips numbers, the reduction was not sufficient to reduce SVNd. There is a need for better disease management practices in the future. Our data indicate that cultivar and planting date may be useful components for SVNd management.

References