Analysis of the spread of soybean rust in the western pathway in 2007

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Introduction

The overwintering locations of soybean rust (Phakopsora pachyrhizi Sydow) in Texas and Mexico became a major inoculum source to the soybean production areas in the North Central region. Subsequently, the inoculum for long-distance dissemination of the pathogen from these overwintering locations enabled the establishment of the western pathway of soybean rust. In 2007, northward movement of soybean rust in the Great Plains reached Oklahoma, Kansas, and finally Iowa via this western pathway in the summer. Particularly in Iowa, with the first detection in Dallas County on September 25, soybean rust was reported in 14 Iowa counties across the state by late October.

With the near record precipitations in the Great Plains, an event of favorable weather may either facilitated local disease development and/or long-distance dissemination of the pathogen, which may result in a disease epi-center or a jump of the disease source areas. Following the movement of the disease, field surveys were conducted to obtain more detailed disease information for analyzing the disease movement and validating forecasting of spore dispersal. Also, a comprehensive analysis is necessary to better understand the overall occurrence and northward movement of soybean rust in the Great Plains via the western pathway.

Objectives

1. To understand the establishment of the western pathway of soybean rust and the northward movement of the disease; 2. To examine and validate the forecasts of soybean rust dispersal conducted in the 2007 growing season.

Data and Analysis

August weather in the Great Plains. According to National Climate Data Center, in August, southern Texas, central Oklahoma, and Iowa had wetter-than-normal weather (Fig. 1). Rainfall was frequent and heavy, while temperatures were relatively cool in the south but relatively warm in the north (Fig. 2). These environmental conditions are favorable to soybean rust.

Forecasting spore dispersal in August 2007. During the growing season, forecasts of soybean rust spore movement and possibility of disease occurrence were made weekly. Using these areas as spore resources, our forecast suggested the northward movement of plenty inocula through the western pathway.

Observed disease situation in Iowa in the late season.

Discussion

According to the observed disease occurrence in the Great Plains in 2007, it is clear that the western pathway of soybean rust become a major pathway in soybean rust northward dispersal. In the western pathway, spore sources in Texas and Mexico likely may have greater chances to reach North Central region compared with spore sources in the southeastern states. The favorable weather in 2007 growing season may be the major driving factor for the northward movement of soybean rust in the Great Plains. Major soybean production areas in the south with favorable weather conditions may sever as epi-centers or bridging source areas to provide more inoculum for the spread to the northern states. As weather shifts, spore dispersal or disease occurrence may be wave-like in this region.

In Iowa, it is highly possible that soybean rust has spread to more counties than what were reported as almost all counties where disease sampling was made were positive in disease detections. In Fig. 6, disease gradients from western Iowa to eastern Iowa suggest that the disease reached middle to western Iowa first, such as Fremont County, in August, which is consistent with our forecast of spore dispersal as shown in Fig. 5. The fields infested in western Iowa served as a local epi-center in late August and September. The fresh local inocula were then driven by the intensive local storm events eastward, which resulted in the disease gradients and the statewide occurrence of soybean rust.

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