Performance of Asian soybean rust warning system in different Brazilian regions

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INTRODUCTION

Soybean is the most important agricultural crop in Brazil. This crop is cultivated in large areas all over the country (Figure 1a). After 2001/02 growing season the Asian soybean rust (ASR) became a problem in all producing regions of the country, which remains till the present (Figure 1b).

ASR is controlled by sequential applications of fungicides following a calendar-based system (Figure 1b), approach that considers only aspects of related to the crop, such as phenological phase, disregarding the influence of local weather conditions on the disease progress. Part of this problem is mainly related to the lack of weather data availability, limiting the use of disease warning systems based on these data.

Based on that, the aim of this study was to evaluate the performance of Asian warning system, based on rainfall data in different Brazilian regions.

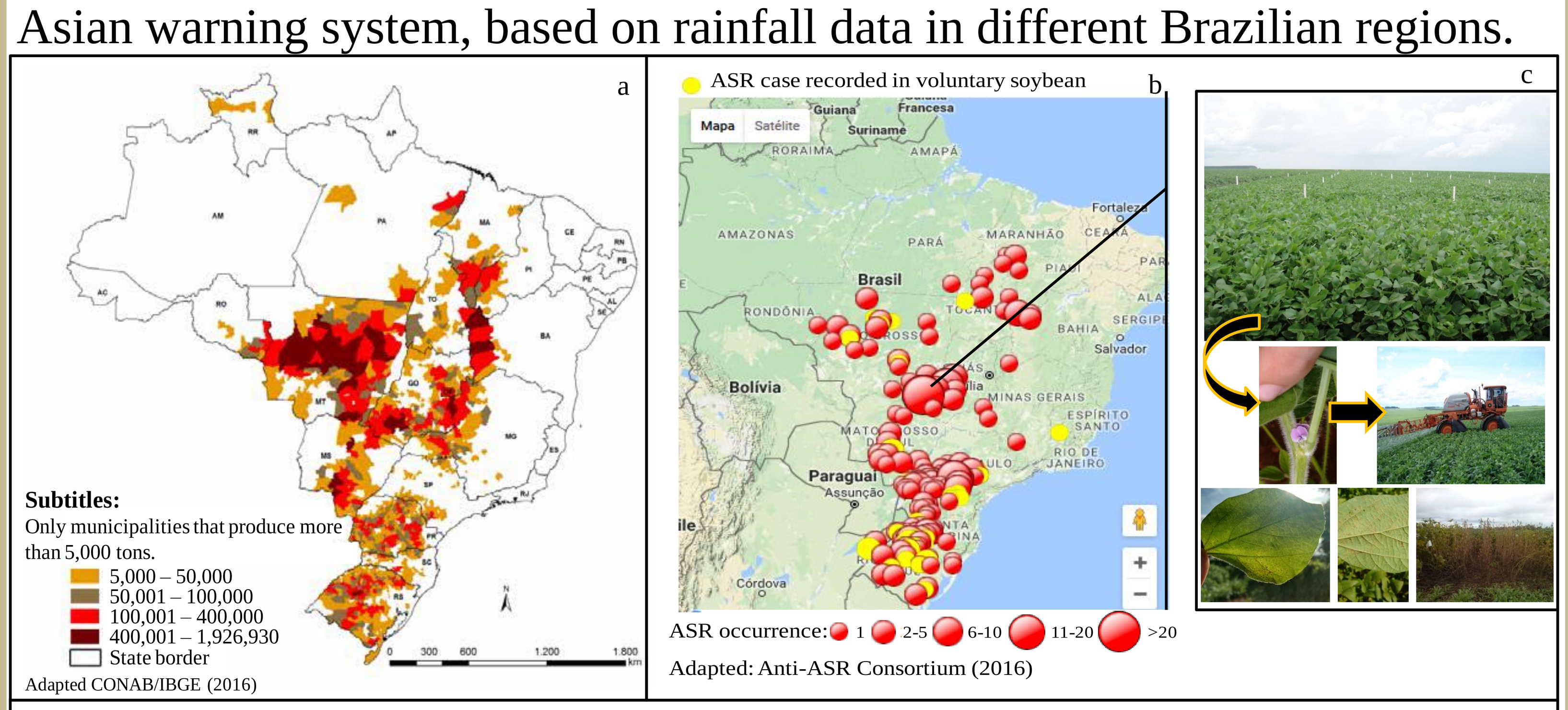


Figure 1 – a) Soybean yield in Brazil in the crop seasons of 2014/15; b) ASR occurrence reported in soybean in the crop seasons of 2014/15; c) ASR management in Brazil and its main symptoms.

MATERIAL AND METHODS

The experimental data was obtained from three trials conducted in different Brazilian regions:

a) Campo Verde – Mato Grosso State:

Köppen climate classification – Aw

Coordinates geographic – 15°24'S, 55°50'W

Altitude – 689 meters

Sowing date - 12th December 2014

b) Piracicaba – Sao Paulo State:

Köppen climate classification – Cwa;

Coordinates geographic – 22°42'S, 47°30'W

Altitude – 546 meters

Sowing date - 12th December 2014

c) Ponta Grossa – Parana State:

Köppen climate classification – Cfb;

Coordinates geographic – 25°05'S, 50°09'W

Altitude – 969 meters

Sowing date - 18th December 2014

All experiments were conducted in a row spacing of 0.45 m and a plant population of 270,000 plants ha^{-1}. The experiments were set in a randomized block design with four repetitions (Figure 2a,b,c). At each experimental site, an automatic weather station was installed close to the crop in order to monitor weather conditions (Figure 2d).

Figure 2 – a. Campo Verde experiment; b. Piracicaba experiment; c. Ponta Grossa experiment; d. Automatic weather station (Campbell Scientific Inc.).

Treatments:

- TEST - unsprayed check treatment;
- CALEND - calendar-based sprays with a 14-day interval from R1 stage;
- PREC system, with threshold for 50% severity cut-off.

(Fungicide: Azoxistrobina + Benzovindiflupir, 150 g ha^{-1}).

Disease assessment was constantly made. At the end of the experiment the yield was evaluated.

RESULTS

For all locations, it was observed that the TEST treatment exhibit higher disease levels (Figure 3a,b; Table 1).

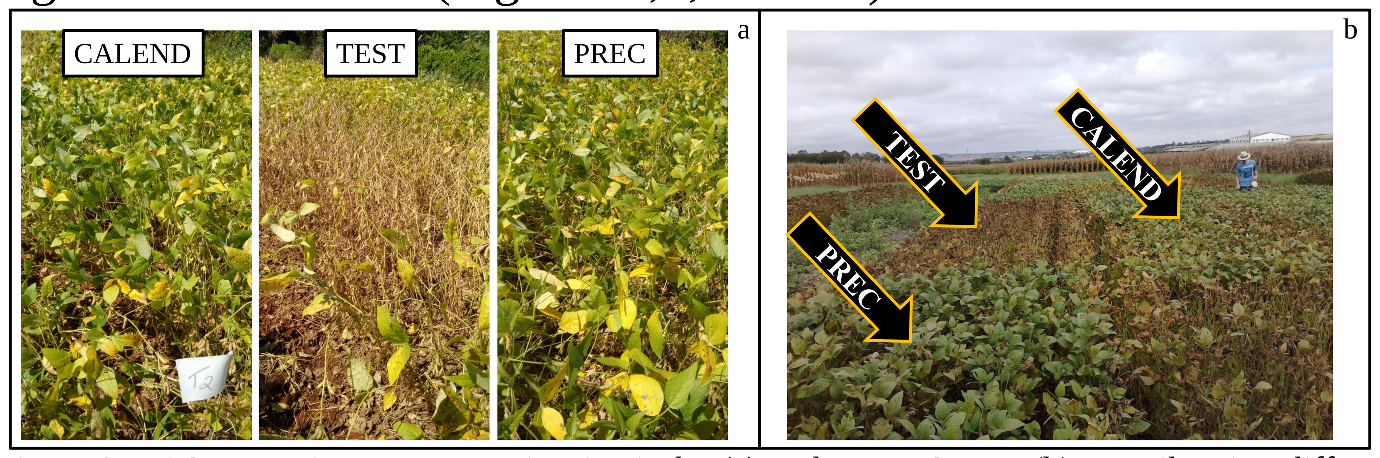


Figure 3 – ASR severity assessment in Piracicaba (a) and Ponta Grossa (b), Brazil, using different treatments to control ASR during 2014/15 crop seasons.

Table 1 – Number of sprays, final severity and defoliation obtained at three experimental areas, using different methodologies to control ASR. Tukey test (α = 0.05).

Treatments	Spray numbers	Final Severity		Defoliation	
Sao Paulo State					
TEST	0	100.0	a	-	
CALEND	5	44..0	b	-	
PREC	3	51.5	b	-	
Parana State					
TEST	0	71.3	a	-	
CALEND	4	48.3	b	-	
PREC	3	15.8	c	-	
Mato Grosso State					
TEST	0	-		100.0	a
CALEND	3	-		100.0	a
PREC	5	-		68.7	b

Analyzing two different approaches for controlling ASR, it was observed different sprays timing (Table 1), probably due to different meteorological conditions (Figure 4a, b, c, d, e, f).

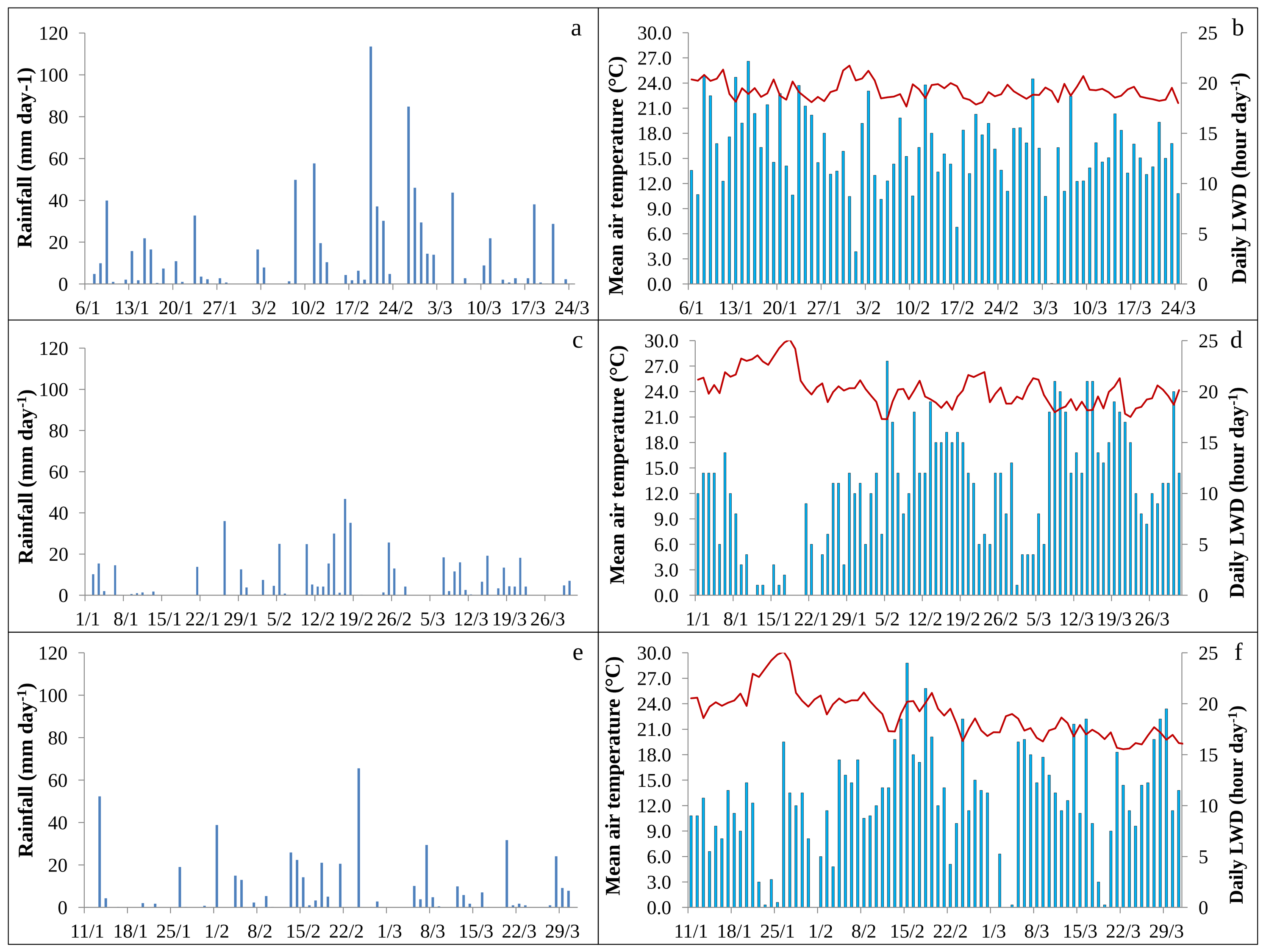
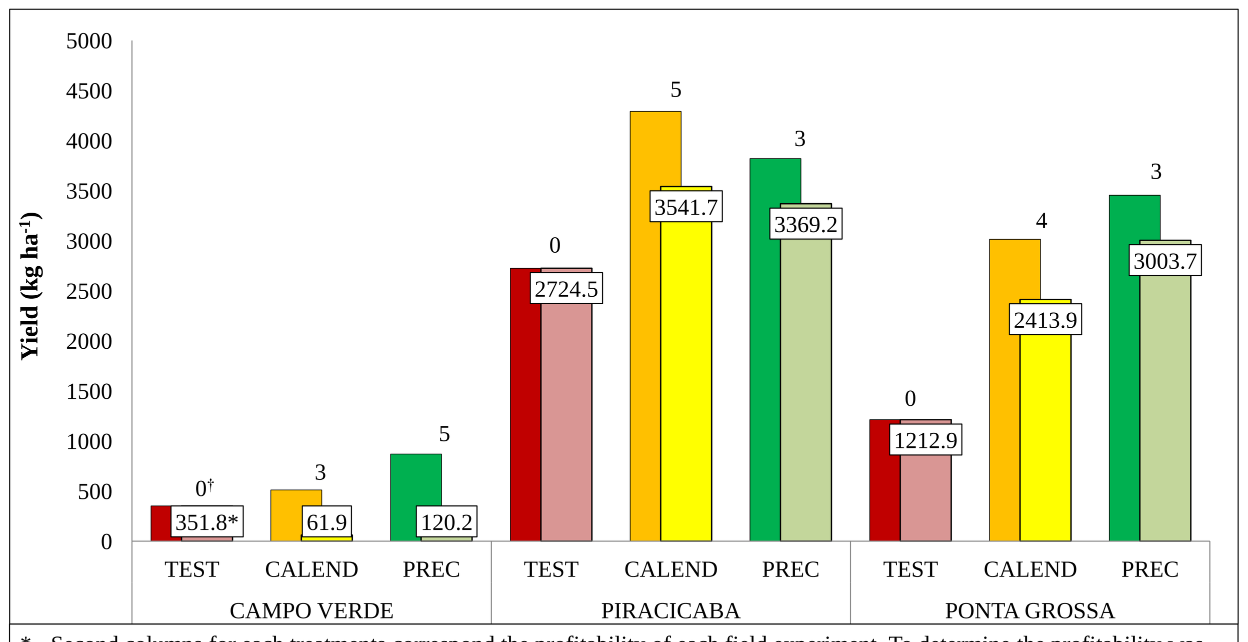


Figure 4 – Weather regime at different field experiments: a) Rainfall; b) Mean air temperature and leaf wetness duration – Campo Verde; c) Rainfall; d) mean air temperature and leaf wetness duration – Piracicaba; e) Rainfall; f) mean air temperature and leaf wetness duration – Ponta Grossa. Brazil.

In all locations the disease warning system based on rainfall data proved to have a better performance in relation to the Calendar. In in Piracicaba and Ponta Grossa the system allowed to reduce the number of sprays and to keep the disease severity al least at the same level of the Calendar system. However, in Campo Verde the warning system was not effective for controlling ASR (Figure 5), which was mainly caused by the high disease pressure in this location during the experiment. Based on these results, we concluded that rainfall disease warning system for Asian soybean rust is a promising approach to rationalize sprays in this crop.



* - Second columns for each treatments correspond the profitability of each field experiment. To determine the profitability was adopted a cost of 150 kg ha-1 for each spraying.

† - Fungicide sprays required to control ASR.

Figure 5 – Yield and profitability obtained in the three experimental areas, using different methodologies for control de ASR.

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