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Chemical Control Strategy of Potato Late Blight Based on the DSS 'China-blight'

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SUMMARY

Potato late blight is the most devastating disease of potato in China. Due to the shortage of resistance of cultivars in most cases, chemical control is still the main method in use today to manage the disease. In order to improve the control efficiency, a web based DSS (Decision support system) on potato late blight management in China --- "China-blight" (www.china-blight.net) was developed in 2008. In order to know when to start spray program could save more sprays, a field trial was carried out in Hebei China during 2012 growing season. The current results showed that when the spray program started according to first late blight symptom forecasting of "China-blight" can save 1 out of 6 sprays compared to the routine spray program.

KEYWORDS

Potato late blight, *Phytophthora infestans*, Chemical control strategy

INTRODUCTION

At present, China has become the top potato production country in the world. Potato, the fourth important food crop in China, is planted mainly in 22 provinces, municipalities and autonomous regions. Potato late blight caused by *Phytophthora infestans* has become the major limitation to potato production worldwide. In China, it causes 10～40% yield loss in common years or even worse in special years (Song and Xie, 1997). Due to the shortage of resistance of cultivars in most cases, chemical control is still the main method in use today to manage the disease. There are two existing strategies to start spray program for late blight management in China: (1) spray program starting at a fixed time or fixed plants height widely used in large scale commercial planting; and (2) spray program starting when late blight epidemic already developed in the field normally two weeks after first symptom appearance. In order to improve the control efficiency, a web based DSS (Decision support system) on potato late blight management in China --- "China-blight" (www.china-blight.net) was developed in 2008 (Hu *et al.*, 2012). A field trial was carried out in Hebei China during 2012 growing season with the aim to compare the control efficacy and fungicide input of spray programs based on "China-blight" as well as the two existed spray strategies.

MATERIALS AND METHODS

Location of the field trial: Weichang, Hebei, China;
Size of plots: 6 rows x 7 meters (35 cm between plants, 65 cm between rows);
Lay out of plots of the field trial: randomized complete block design with 4 replicates;
Potato Cultivar: Favorita (highly susceptible to *P. infestans*);
Fungicide: Infinito (687.5 g/L (propamocarb-HCl + fluopicolide), Bayer Crop Science (China) Co. Ltd.), label dose (a.i 700 g./ha) was used in the field trial;
Treatments: see Table 1 and Table 2.
First symptom of late blight observation: daily check for all plots after emergence till first symptom observed in one of the plots;
Late blight assessment: weekly visual assessment;
Yield assessment: two rows in the center of each plot were harvested for yield assessment, tubers more than 150 grams were weighed as commercial yield.

Table 1. *Treatments in the field trial for the control of potato late blight in 2012*

Treatment	First spray	Followed sprays	Fungicide	Spray interval
A	Plants height ca. 18 cm	Before the risk day according to 'China-blight' (MISP model)	Infinito a.i. 700 g/ ha	See Table 2
B	According to the first symptom appearance forecasted by 'China-blight'			
C	When the first symptom appear in the field			
D	Two weeks after the first symptom appear in the field			
E	—	—	—	—

Table 2. *Spray intervals based on weather conditions*

Number of risk days since last spray	Spray interval / days
0	10-14
1	7-10
≥2	5-7

Note: 1 'highly risk day = 2 risk days', the model used is MISP model developed by Cao et al., 1996.

RESULTS AND DISCUSSION

Time of first late blight symptom appearance in the field
The planting date of all the plots was 5 May 2012, and the date of plant emergence was 1 June 2012. Time of first late blight symptom in the trial field forecasted by "China-blight" was 14 to 21 July 2012, the first symptom was observed in the trial field on 17 July 2012.

Date of first spray and number of total sprays of different treatments

The first spray of treatment A was carried out on 2 July 2012, which was the earliest spray in all the treatments, followed by B with the first spray on 13 July, and then C and D with first spray on 19 July and 30 July respectively. The total sprays in the whole growing season of treatment A, B, C, D and E (unsprayed control) were 6, 5, 4, 2, and 0, respectively. (Table 3)

Table 3. *Spray record of the field trial 2012*

Treatment	Date of spray					
	2 Jul.	13 Jul.	20 Jul.	25 Jul.	30 Jul.	7 Aug.
A	√	√	√	√	√	√
B	—	√	√	√	√	√
C	—	—	√ 19 Jul.	√	√	√
D	—	—	—	—	√	√
E	—	—	—	—	—	—

"√" means spray, "—" means no spray.

Late blight development in different treatments

Late blight progress of different treatments (Figure 1) showed that treatment A, B and C had the same disease level during the whole growing season, the final disease severity were all below 2%. Even though the number of sprays of these treatments were different from each other, with the same control efficacy treatment B saved 1 spray compare to A, and treatment C saved 2 sprays and 1 sprays compare to A and B, respectively. However, treatment D and E had very severe disease epidemics, the final disease severity were more than 88%. Actually there were no significant difference between treatment D and E in terms of late blight control, although the two sprays of D reduced a little of disease severity compared to the unsprayed control (E).

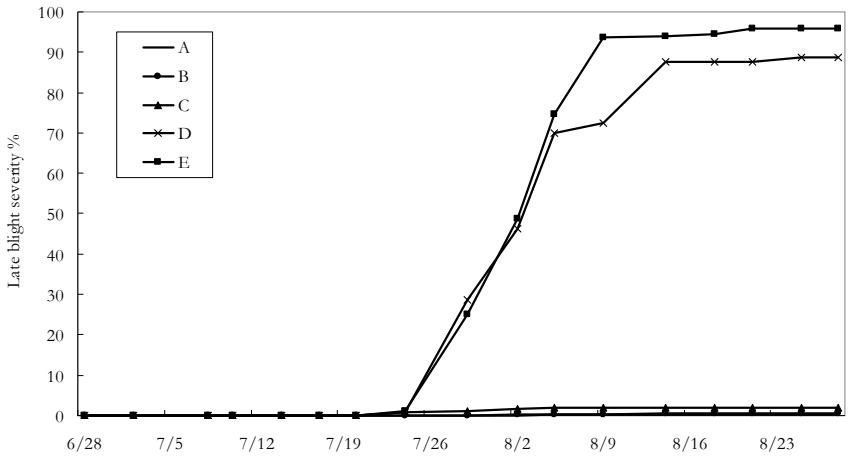

Figure 1. *Disease progress of different treatment in field trial 2012*

Yield of tubers in different treatments

Yield of tubers of different treatments showed in Figure 2, it indicated that treatment A, B and C had the same level of gross yield and marketable yield, and there were no statistical significant difference among them although there were differences among the number of sprays among these treatments during the whole season. Likewise, treatment D and E had the same level of gross yield and marketable yield without statistical significant difference between each other, although there were two sprays for D whereas no spray for E (unsprayed control) during the growing season. However, yield of treatment A, B and C was significantly higher than that of treatment D and E.

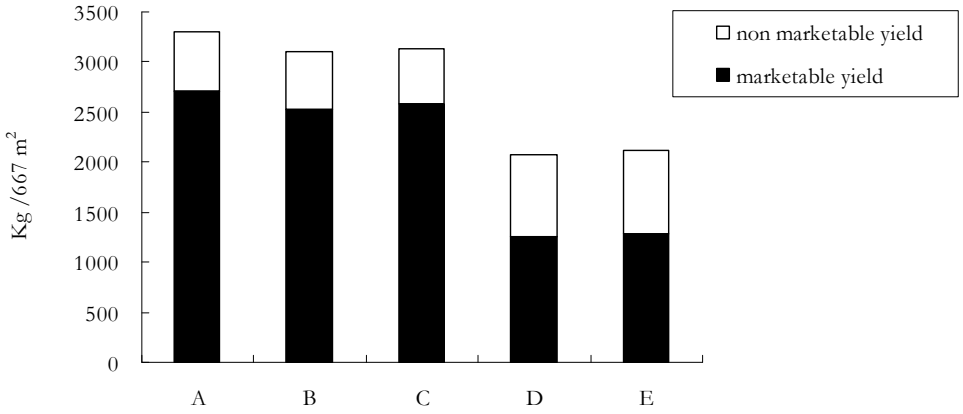

Figure 2. *Yield of different treatment in field trial 2012*

CONCLUSIONS

Based on the field trial of 2012 in Hebei China, some conclusions can be made as follows: (1) Compared to the routine spray program the DSS "China-blight" could save 1 spray (16.7% of total fungicide input) without reduction of control efficacy to potato late blight; (2) Good monitoring of first late blight symptom in the field can help the growers save 33% fungicide input (2 sprays) in the whole growing season compared to the routine spray program; and (3) Spray program started more than 2 weeks after the first symptom appearance in the field could not give meaningful control for potato late blight.

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