Advances in Engineering Research, volume 129
6th International Conference on Energy, Environment and Sustainable Development (ICEESD 2017)

An Effective Intercropping Pattern Reducing the Incidence of Pepper Phyllosticta Leaf Blight in Capsicum Fields

Chun-Yuan Wu[1, 2, a], Dong-Ming Wu[1, 2, b], Gui-Sheng Yang[1, 2, c], Wei Li[1, 2, d], Qin-Fen Li[1, 2, e*]

[1] Environment and Plant Protection Institute, CATAS, Haikou, 571101, China

[2] Danzhou Scientific Observing and Experimental Station of Agro-Environment, Ministry of Agriculture, Danzhou, 571737, China

[a] wuchunyuan1981@126.com, [b] wudomy@126.com, [c] yanggs@126.com

[d] 530243942@qq.com, [e] qinfenli2005@163.com

* Corresponding author

Keywords: Intercropping; Pepper phyllosticta leaf blight; Maize; Soybean; Capsicum

Abstract. Field experiments were conducted to investigate the most effective intercropping pattern of capsicum and maize/soybean to reduce the incidence of pepper phyllosticta leaf blight disease. The treatment combinations were P-mono, P2M1, P4M2, P6M2, P2S1, P4S2, P6M2, P4S1M1 And P6S1M1, (P, Pepper; M, Maize; S, Soybean; 1-6, number of rows of capsicum, maize or soybean per plot). The results showed that combination of C2M1, C4M2 and C6M2 reduced incidence of phyllosticta leaf blight, with the incidence rate from 25.0% to 29.1%, which were significantly over their counterpart mono capsicum treatment (incidence rate, 41.6%). The combination of C2M had the most drastic effect in reducing the disease on pepper. The incidence of the disease increased with increasing number of rows of capsicum in the intercrop combination. The combination of capsicum-soybean had no effect on the incidence of the disease. The disease index ranged from 3.9 % ~ 4.5% in pepper-maize, significantly lower than the other 6 treatments. The efficacy was ranged from 2.4% to 53% at the end of assessment, and the intercropping system of P2M1 achieved the highest efficacy (53%). The results signified that particular agro-ecological systems are effective approach in diseases control on pepper, and the proper intercropping pattern might decrease the input quantity of pesticides in capsicum planting systems.

Introduction

Red cluster pepper is one of the most important spice crop in south of China. The quality and yield of red cluster pepper in the tropical regions is lower than temperate area mainly due to virus infection and many kinds of diseases[1]. Phyllosticta leaf blight is caused by the fungus *Phyllosticta penicillariae*. Leafs affected by the fungus are stunted, yellow, and have numerous small lesions. These lesions have dark brown margins surrounding a light brown necrotic center. This disease can give rise to blossom drop, leaf drop and fruit drop [2]. Once capsicum has the disease, it is really hard to cure it, so prevention is key. Intercropping is an important and effective way in reducing the incidence of disease on pepper [3]. Intercropping reduce the infection of Pepper Veinal Mottle virus (PVMV) incidence when pepper was intercropped with maize, cassava and plantain by 90%, 95% and 92.7%, respectively [4]. Intercropping pattern of pepper, corn and taro reduced the viral

diseases incidence rate on pepper [5]. Intercropping system of pepper-peanut significantly reduced the incidence of pepper anthracnose and peanut leafspot diseases [6].
This study was aimed to investigate the effect of intercropping pattern of capsicum and maize/soybean to reduce the incidence of pepper phyllosticta leaf blight disease, and evaluate the efficacy of the intercropping pattern technique in reducing the effect of the disease on the yield of pepper.

Materials and methods

The experiments were conducted at Hongling Farm, Danzhou City, Hainan Province, South of China. The experiments were carried during the season from November 2015 to April 2016. The designs were randomized complete block with four replications. The most commonly grown red pepper (Yanmei), maize (Jinfei) and soybean (Tai 75) varieties in the area were used in the experiment. Intra spacing of the variety was 0.4, 0.2 and 0.2 m pepper, maize and soybean respectively while inter row spacing for all treatments was 0.6 m. Each plot had a size of 5.6 m × 4.5 m and there were eight rows per plot. Transplanting of pepper seedling was done when they were two weeks old and after planting of maize and soybean. The treatments of the experiment were: a total of two rows of pepper and one row of maize (P2M1); a total of four rows of pepper and two rows of maize (P4M2); a total of six rows of pepper and two rows of maize (P6M2); a total of rows of two rows of pepper and one row of soybean (P2S1); a total of four rows of pepper and two rows of soybean (P4S2); a total of six rows of pepper and two rows of soybean (P6S2); a total of four rows of pepper, one row maize and one row soybean (P4S1M1); a total of six rows of pepper, one row maize and one row soybean (P6S1M1). Mono-pepper as a control (P-mono).
Phyllosticta leaf blight disease incidence and severity were then monitored on the pepper plants in each treatment plot by using a modified formula-grading scheme [4]. The data on disease incidence and yields of pepper were analyzed using the SAS computer package, version 9.4. Fisher's Least Significant Difference (LSD) test at the 0.05 probability level were used for mean comparison.

Results and Discussion

A total of 15 observations were made on the incidence of pepper phyllosticta leaf blight over a period of four months (Fig. 1).

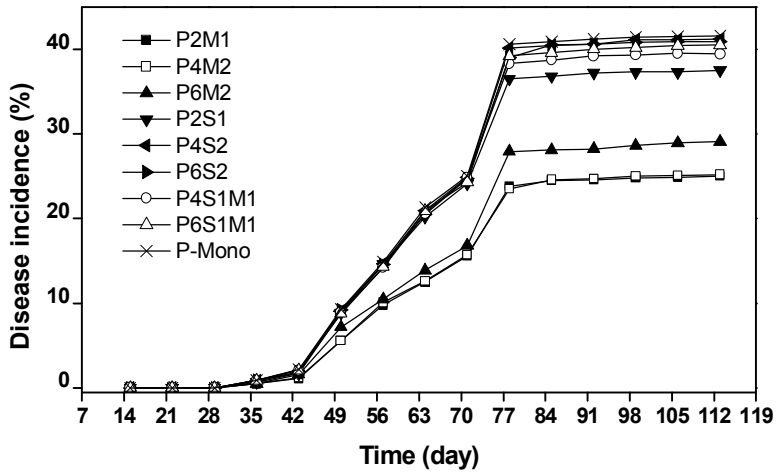

Fig. 1 Effect of intercropping on temporal progress of phyllosticta leaf blight incidence in pepper

Disease incidence remained low up to mid-December regardless of treatments, but showed an increase starting from 16th December across all treatments. However, both the increase and final disease incidence varied among the treatments. At the end of the experiments disease incidence reached 25% ~ 29.1% in pepper-maize intercropping plots and 37.5%~47.6% in the other plots. As shown in Table 1, the use of maize as intercropping with pepper reduced the disease incidence significantly (P<0.5%) as compared to pepper-soybean intercropping and solo-pepper treatments.

Meanwhile, the disease index ranged from 3.9% ~ 4.5% in pepper-maize intercropping to 7.6% ~ 8.3% in the other treatments (Table 1). Progress of the disease had a more or less similar trend with that in Fig. 1. Disease index was low during the first 5 assessments, which was followed by a sharp rise of disease index across treatments before the stabilizes (Fig. 2).

Fig. 3 showed the efficacy against phyllosticta leaf blight. The results suggested that the efficacy of pepper-maize intercropping got to 45.8% ~ 53%, and the efficacy of all 9 treatments was followed as P2M1 (53%) > P4M2 (50.6%) > P6M2 (45.8%) > P4S1M1 (9.6%) > P6S1M1 & P2S1 (8.4%) > P6S2 (7.2%) > P4S2 (2.4%).

Table 1 Percentage diseases incidence, disease index and efficacy against phyllosticta leaf blight on pepper intercropped with maize and soybean (data from the 15th assessment)

Treatment	Disease incidence (%)	Disease index	Efficacy (%)
P2M1	25±0.83 f	3.9±0.09 c	53±0.48 a
P4M2	25.2±0.32 f	4.1±0.32 c	50.6±2.58 b
P6M2	29.1±0.44 e	4.5±0.18 c	45.8±2.58 c
P2S1	37.5±0.37 d	7.6±0.79 b	8.4±0.18 d
P4S2	41.2±0.29 ab	8.1±0.42 ab	2.4±0.37 e
P6S2	40.9±0.43 ab	7.7±0.56 ab	7.2±0.14 f
P4S1M1	39.4±0.29 c	7.5±0.24 b	9.6±0.31 g
P6S1M1	40.5±0.0.37 b	7.6±0.34 b	8.4±0.37 d
P-Mono	41.6±0.29 a	8.3±0.22 a	0

Means with the same letter are not significantly different from each other at 5% level of probability.

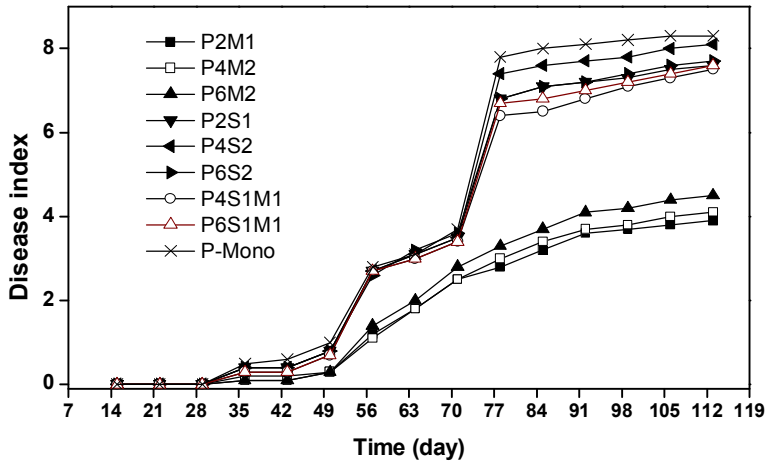

Fig. 2 Effect of intercropping on temporal progress of phyllosticta leaf blight disease index in pepper

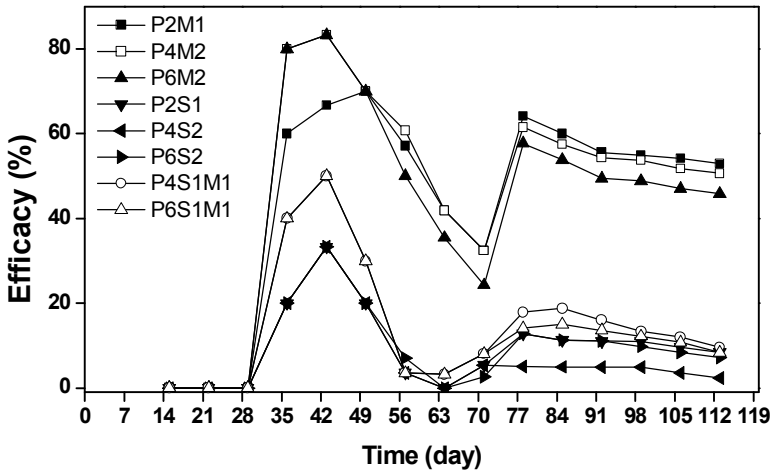

Fig. 3 Effect of intercropping on temporal progress of efficacy of intercropping against pepper phyllosticta leaf blight disease.

Conclusions

In this field experiments, planting of pepper in mono-pepper leaded to higher incidence and disease index of phyllosticta leaf blight disease than pepper-maize intercropping pattern, but the pepper intercropped with soybean had no positive effect on controlling the disease. The use of maize as intercropping plant of red cluster pepper with two rows of pepper and one row maize (P2M1) and four rows of pepper and two rows of maize (P4M2) is effective in protecting pepper fields from phyllosticta leaf blight disease. Compaing with chemical control, this intercropping technique is a more sustainable approach in controlling pepper phyllosticta leaf blight. In consideration of fruit weight and economic benefit, P4M2 pattern is better than P2M1. Therefore, farmers living in tropical areas can practice P4M2 or P4M1 intercropping owing to the above advantages.

Acknowledgements

This work was financially supported by the Special Fund for Agro-scientific Research in the Public Interest (201503107-14).

References

[1] Y. Sun, T.F. Zhou, Y.Y. Wang, J.B. Chen, X.H. He, C.Y. Li, Y.Y. Zhu. Acta Horticulturae Sinica, Vol. 33 (2006), p. 995-1000.
[2] J.H. Shen, Q. Nie, D.R. Huang, G.J. Liu, L.X. Tao. Acta Phytophylacica Sinica, Vol. 34 (2007), p. 209-216.
[3] A. Matiku, A. Chala, Y. Beyene. International Journal of Technology Enhancements and Emerging Engineering Research, Vol. 1 (2013), p. 68-73.
[4] A.A. Fajinmi, O.B. Fajinmi. Agricultural Journal, Vol. 5(2010), p. 205-210.
[5] F.W. Liu, Z.Z. Song, Li Zhong, R. Qin, L.Q. Zhang, Y. Zhao, W.Z. Yuan, W.F. Li. Southwest China Journal of Agricultural Sciences, Vol. 22 (2009), p. 659-662.
[6] Y.D. Xi, Y.J. Xiang, J. Wu, H.X. Peng, H.H. Li, B.W. Liu, G.H. Chen. Southwest China Journal of Agricultural Sciences, Vol. 28 (2015), p. 150-154.