Control Effect and Application Technology of Mandipropamid on Red Taro Blight

Huifu WANG[1*], Yongbin ZHAO[1], Weidong QU[1], Hui FANG[2], Huiqin ZHANG[3]

1. Taizhou Academy of Agricultural Sciences, Linhai 317000, China; 2. Planting Industry Management Office of Linhai Municipal Bureau of Agriculture, Linhai 317000, China; 3. Plant Protection and Quarantine Station of Xianju County, Xianju 317300, China

Abstract The field experiment results showed that 250 g/l mandipropamid suspension had good control effect on red taro blight, and the 1: 1500 suspension was applied twice continuously during the early period (June 25) and culmination period (July 12) of taro blight; the control effect 23 d after the last application reached 79.28%, significantly better than that of conventional pesticide, and it was safe, so it had good prospects for the development and application in production.

Key words 250 g/l mandipropamid suspension, Red taro blight, Control effect, Safety

1 Introduction

Taro blight is one of the major diseases in taro production, and it is caused by the infection of Phytophthora colocasiae which prefers warm, humid environmental conditions[1]. In recent years, with the adjustment of planting structure and increase of comparative economic benefits, the taro planting area has been expanding in Xianju, Linhai and Huangyan, but due to successive years of cultivation, the taro blight is aggravating year by year. According to investigation, from late May (earthing up taro) to late June, the shoot grew rapidly, the mother of taro expanded rapidly, and the child and grandchild of taro began to form. Coinciding with the local continuous rainy days, the disease incidence in the disease-stricken plots was 100%, and the disease index reached more than 60%. The plant's leaves and stems were severely damaged due to disease infection, significantly affecting the yield and quality of taro, and farmers were baffled. According to data, 250 g/l mandipropamid suspension can effectively inhibit the Phytophthora colocasiae spore germination and mycelial growth. The mechanism is as follows: firstly, the active ingredient is adsorbed on taro waxy layer, and it is resistant to rain drop erosion after drying of droplet; secondly, the active ingredient can realize cross-layer conduction after absorption, so that the upper and lower leaves have a disease-resistant effect; thirdly, the active ingredient is redistributed near the absorption point, to protect the growth of leaves. To solve the taro blight prevention difficulty in current production, in 2015, we used 250 g/l mandipropamid suspension to conduct field efficacy test on red taro blight control in the taro planting area of Baita Town in Xianju County, and took the conventional local fungicide application and non-application as a control. By experiment, we determined the control effect of 250 g/l mandipropamid suspension on red taro blight, suitable concentration, key application time and frequency, as well as the impact on red taro growth, in order to provide technical support for the popularization and application in production[2-3].

Received: November 2, 2016 Accepted: January 1, 2017
Supported by Taizhou Science and Technology Plan Project (Agriculture) (131-ky24/16ny05).
* Corresponding author. E-mail: tznkywhf@126.com

2 Materials and methods

2.1 Overview of experiment The experiment was done in the taro fields of Xiacui Shangzhai Village, Baita Town, Xianju County, where terrain is flat and drainage and irrigation are easy, but the severe taro blight has occurred over the years. The test soil is loam soil with medium fertility, a bit more acidic, and taro is mainly planted around the test site. The test variety is red taro. After planting, it was earthed up on May 18, and taro was in the three-leaf or four-leaf stage.

2.2 Experimental design and arrangement

2.2.1 Test fungicides. Main fungicide: 250 g/l mandipropamid suspension, brand name of Ruifan, produced by Syngenta and provided by Taizhou Agricultural Material Co., Ltd. Control fungicide: 70% thiophanate-methyl wettable powder, 70% dimethomorph · cymoxanil (water dispersible granule), produced by Jiangsu Lanfeng Biological and Chemical Co., Ltd. and Jiangxi Shipurun Agrochemical Co., Ltd., respectively (commercially available).

2.2.2 Treatment design. The treatment design is shown in Table 1.

2.2.3 Arrangement. The experiment included four treatments, randomly arranged, without replication. The area for each treatment was 230 m^2 (4 lines), and the protection lines were set around the test area. The fungicide was applied separately under different treatments, and the solution was not sprayed to the adjacent treatment, so as not to affect the test results. The spraying equipment was the electric knapsack sprayer, with operating pressure of 1.5 atm and spray piece aperture of 1.5 mm. The taro plants were uniformly sprayed with fungicide until the taro leaves and stems were wet.

Table 1 Treatment design

Treatment No.	Fungicides and concentration	Application method (time, frequency)
1	1∶1500 250 g/l mandipropamid suspension	Applying the fungicide after earthing up the taro (May 19), applying the fungicide 15 d after the previous application (June 4), applying the fungicide for the third time on June 25, and applying the fungicide for the fourth time on July 12 (after typhoon).
2	1∶1500 250 g/l mandipropamid suspension	Applying the fungicide at the early stage of blight (June 25), applying the fungicide for the second time on July 12 (after typhoon).
3	Local conventional fungicides	Applying 1∶1000 thiophonate-methyl at the early stage of blight (June 25), and applying 1∶1000 dimethomorph · cymoxanil on July 12 (after typhoon).
4	Clean water (control)	Without fungicide application in the entire process.

2.3 Investigation methods

2.3.1 Safety investigation. During the whole observation period, we observed whether there was injury to the red taro leaves and stems after fungicide application, and whether there were adverse effects on the growth of the red taro.

2.3.2 Control effect investigation. It was investigated three times in this experiment. The disease index was investigated for the first time before the fungicide application on June 25; the disease index was investigated for the second time in the disease culmination period before the fungicide application on July 12 (significant disease compared with control); the disease index was investigated for the third time 23 days after the fungicide application on July 12 (August 4, stable disease condition). As for the investigation methods, each treatment was divided into three equal parts as three replicates before investigation, 20 clusters were selected in each replicate, and 3 fully expanded leaves in each cluster from top to bottom were investigated, a total of 60 leaves. The disease incidence and disease index of each leaf were recorded, respectively; the corrected control effect was calculated based on disease index growth rate; DMRT was used for significant difference analysis. Taro blight disease classification standard: Level 0, no disease spots; Level 1, disease spot area accounting for less than 5% of the entire leaf area; Level 3, disease spot area accounting for 6 – 15% of the entire leaf area; Level 5, disease spot area accounting for 16 – 25% of the entire leaf area; Level 7, disease spot area accounting for 26 – 50% of the entire leaf area; Level 9, disease spot area accounting for more than 50% of the entire leaf area. The control effect was calculated as follows: disease index = [∑ (number of diseased leaves at each level × representative value at this level) ÷ (total number of the leaves investigated × representative value at the highest level)] × 100; disease index growth rate (%) = [(disease index after control – disease index before control) ÷ disease index before control] × 100; control effect (%) = [(disease index growth rate in the control area – disease index growth rate in the prevention area) ÷ disease index growth rate in the control area] × 100.

3 Results and analysis

3.1 Safety During the whole experimental period, it was observed that the test fungicides had no damage to the leaves and stalks of red taro, and the red taro could grow normally.

3.2 Control effect From Table 2, the analysis of variance showed that during the investigation in the disease culmination period before fungicide application on July 12, the control effect was 90.76 % under Treatment 1, 87.69% under Treatment 2, and only 35.29% under Treatment 3. The control effect under Treatment 1 was 3.07% higher than under Treatment 2, but there was no significant difference; the control effect under Treatment 1, 2 was significantly higher than under Treatment 3. During the investigation in stable disease phase 23 days after fungicide application on July 12, the control effect was 84.54% under Treatment 1, 79.29% under Treatment 2 and only 17.62% under Treatment 3. The control effect under Treatment 1 was 5.26% higher than under Treatment 2, but there was no significant difference; similarly, the control effect under Treatment 1, 2 was significantly higher than under Treatment 3. In this experiment, applying 1∶1500 250 g/l mandipropamid suspension 2 – 4 times had good control effect on red taro blight at the early and culmination stages of taro blight, or after earthing up taro, before disease incidence; applying 1∶1000 70% thiophonate-methyl WP and 1∶1000 70% dimethomorph · cymoxanil WDG one time had poor control effect at the early and culmination stages of taro blight.

Table 1 Experimental results about the control effect of mandipropamid on red taro blight

Treatment No.	Disease index base	The second investigation (July 12)		The third investigation (August 4)	
		Disease index	Control effect//%	Disease index	Control effect//%
Treatment 1	1.23	1.36	90.76 aA	9.38	84.54 aA
Treatment 2	2.71	3.82	87.69 aA	27.04	79.28 aA
Treatment 3	1.48	11.61	35.29 bB	61.11	17.62 bB
Treatment 4	0.99	11.36	/	47.28	/

Note: The data in the table were the average of three investigations, and the upper and lower case letters indicated significant difference at the level 0.01 and 0.05, respectively.

4 Conclusions and discussions

The field experiment results showed that 250 g/l mandipropamid suspension had good control effect on red taro blight, and the 1∶1500 suspension was applied twice continuously during the early period (June 25) and culmination period (July 12) of taro blight; the control effect 23 d after the last application reached 79.28%. Applying 1∶1000 70% thiophonate-methyl WP and 1∶1000 70% dimethomorph · cymoxanil WDG one time had poor control effect (only 17.62%) at the early and culmination stages of taro blight. Moreover, at the early stage of taro blight, if we applied 1∶1500 250 g/l mandipropamid suspension for control once again, the control effect on taro blight could be increased by 5.26%. At the same time, the field observation showed that in the 250 g/l mandipropamid suspension treatment area, the taro leaves and stalks were fresh and the upper functional leaves were largely intact and green; in the local conventional fungicide treatment area, the taro blight was serious; in the water control area, the upper functional leaves were basically necrotic and withered. Therefore, 250 g/l mandipropamid suspension had good prospects for the development and application in production. In mid-June, there were many consecutive rainy days in the city and then it entered the rainy season during which the temperature was suitable and humidity was high, and the early stage of taro blight was around mid-June, so it was very conducive to the occurrence and spread of taro blight. It was recommended to apply fungicide after earthing up taro for the first time (late May to early June), apply fungicide at the early stage of taro blight for the second time (late June), and apply fungicide for the third time (early July) according to the disease progress and rain situation. We could spray 1∶1500 250 g/l mandipropamid suspension evenly on the taro plant until the taro leaves and stems were wet, to ensure that the lower taro leaves and stems were fresh and upper functional leaves were intact, so as to achieve high quality, high yield and high efficiency.

References

[1] WU HX, WU DP, SHENG XQ. Tuble vegetable and fresh maize diseases and pests colour atlas[M]. Hangzhou: Zhejiang Science and Technology Publishing House, 2005, 6: 9 – 11. (in Chinese).

[2] ZHU DJ. The pharmacodynamic test of 50% dimethomorph water dispersible granule to control *Dasheen anthracnosee* pidemic diseases[J]. Modern Agricultural Science and Technology, 2009(13): 151. (in Chinese).

[3] CHEN XR, WU W, CHANG YY, *et al.* Study on the control effect of seed treatment with different bactericides on *Dasheen anthracnose* and its epidemic diseases[J]. Modern Agricultural Science and Technology, 2015 (2): 130 – 132. (in Chinese).

(From page 77)

that the combination with great height generally has high node; environmental correlation coefficient (r_e) is −0.1602, not significant; phenotypic correlation coefficient (r_p) is 0.3309, reaching a highly significant level; r_g and r_p have consistent sign and are highly significant, showing that the phenotypic correlation and genetic correlation of plant height and node are consistent.

Table 4 Estimation of correlation coefficients

Correlation coefficients	Estimated values
Genetic correlation coefficient of male parent (r_m)	0.7198
Genetic correlation coefficient of female parent (r_f)	0.7168
Genetic correlation coefficient of male and female parent interaction (r_{mf})	0.9838**
Total genetic correlation coefficient (r_g)	0.6634**
Environmental correlation coefficient (r_e)	−0.1602
Phenotypic correlation coefficient (r_p)	0.3309*

Note: *, ** indicate significance at the 0.05 and 0.01 levels, respectively.

4 Discussions

In this paper, according to stochastic model of variance and covariance analysis, we calculate different genetic components, and further decompose the genetic correlation coefficient into genetic correlation coefficient of male parent, genetic correlation coefficient of female parent and genetic correlation coefficient of male and female parent interaction, with simple meaning, easy to accept. However, the correlation coefficients exactly distributed in this paper are not truly obtained, so in theory, we can not perform the corresponding hypothesis test on the significance of difference. In the practical application, we can do approximation test. The mixed linear genetic model developed by Zhu Jun[3] makes detailed decomposition of genetic correlation coefficient, which is feasible in theory, but it seems to be questionable in practice. For example, the additive and environmental interaction correlation coefficient, or the dominant and environmental interaction correlation coefficient between traits may be generally small[4], which may be of little practical significance in the actual genetic breeding.

References

[1] LI JN. An outline of quantitative genetics[M]. Chongqing: Southwest China Normal University Press, 1995: 153 – 155. (in Chinese).

[2] MA YH. The foundation of quantitative genetics of plant breeding[M]. Nanjing: Jiangsu Science and Technology Publishing House, 1982: 337 – 340. (in Chinese).

[3] ZHU J. New approaches of genetic analysis for quantitative traits and their applications in breeding[J]. Journal of Zhejiang University (Agriculture & Life Sciences), 2000, 26(1): 1 – 6. (in Chinese).

[4] XIAO BG, ZHU J, LU XP, *et al.* Genetic and correlation analysis for agronomic traits in flue-cured tobacco (*Nicotiana tabacum* L.)[J]. Hereditas, 2006, 28(3): 317 – 323. (in Chinese).

[5] MO HD. The experiment design of quantitative character genetic research [J]. Jiangsu Agricultural Research, 1986, 7(3): 51 – 56. (in Chinese).

[6] GUO PZ. Quantitative genetic analysis[M]. Beijing Normal University Publishing House, 1987: 37 – 50. (in Chinese).

[7] MO HD. The genetic analysis of covariance[J]. Jiangsu Agricultural Research, 1985, 6(4): 51 – 56. (in Chinese).

[8] MO HD. Agricultural experimental statistics[M]. Shanghai: Shanghai Science and Technique Publishing House, 1992: 394 – 395. (in Chinese).