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(54) **Titre : COMPOSITION FONGICIDE SYNERGETIQUE RENFERMANT DU BENZISOTHIAZOLINONE**

(54) **Title: SYNERGISTIC FUNGICIDE COMPOSITION COMPRISING BENZISOTHIAZOLINONE**

(57) **Abrégé/Abstract:**

A synergistic fungicide composition, a formulation method and a use thereof are provided. The composition contains two active components A and B, where the active component A is benziotiazolinone, the active component B is iprodione, and the weight ratio of the two components is 1:50 to 50:1, and preferably 1:30 to 30:1. Test results show that, the fungicide composition has a significant synergistic effect, and more importantly, the application amount and the use-cost are reduced. The fungicide composition is effective in preventing and treating certain fungal diseases of crops such as food crops, vegetables and fruits.



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Les corrections suivantes
sont faites en raison de
l'article 8 de la *Loi sur les
brevets* et le document
doit être lu tel que corrigé.

The following corrections
are made pursuant to
section 8 of the *Patent Act*
and the document should
read as corrected.

In the Patent Grant:

**The word "benzothiazolinone" on the abstract and on pages 1, 1a, 3, and 7 to 32 of the
description should be read as "benzisothiazolinone".**

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ABSTRACT

A synergistic fungicide composition, a formulation method and a use thereof are provided. The composition contains two active components A and B, where the active component A is benziothiazolinone, the active component B is iprodione, and the weight ratio of the two components is 1:50 to 50:1, and preferably 1:30 to 30:1. Test results show that, the fungicide composition has a significant synergistic effect, and more importantly, the application amount and the use-cost are reduced. The fungicide composition is effective in preventing and treating certain fungal diseases of crops such as food crops, vegetables and fruits.

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**SYNERGISTIC FUNGICIDE COMPOSITION
COMPRISING BENZISOTHIAZOLINONE**

This application is a division of Canadian Application Serial No. 2,881,512 (parent application), filed August 20, 2012.

- 5 It should be understood that the expression “the present invention” or the like used in this specification may encompass not only the subject matter of this divisional application, but that of the parent application also.

BACKGROUND

Technical Field

- 10 The present invention belongs to the field of agricultural plant protection, particularly to a fungicide composition with improved performance, and specifically relates to a fungicide composition containing two active components.

Related Art

- 15 Benziothiazolinone is a fungicide and has the following functions and features: being a novel broad-spectrum fungicide, and being effective in preventing and treating fungal diseases. In the fungicidal process, the nucleus structure of the pathogenic fungi is destroyed, resulting lost of the heat part and death due to failure, the metabolism of the pathogenic fungus cells was interfered, resulting in physiologic disorders, and finally, leading to death. The pathogenic fungi are completely killed, and the desired effect of eradicating pathogenic
- 20 fungi is achieved. Benziothiazolinone is mainly used in preventing and treating cucumber downy mildew, pear scab, apple scab, orange anthracnose, grape anthracnose, and is effective in preventing and treating various bacterial diseases and fungal diseases.

- 25 Dimethomorph is a morpholine-based broad-spectrum fungicide, has a unique mode of action on fungi of *Peronosporales* and *Peronophthoraceae* of phycomycetes, and is mainly to cause degradation of sporangium wall, so as to cause death of fungi. Dimethomorph is fungicide dedicated to oomycetes fungi, and has the functions and features of destroying the



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formation of cell membrane, having effects in all stages of life cycle of oomycetes, being particularly sensitive in the formation stages of sporangiophores and oospores, being inhibited at a very low concentration (0.25 µg/ml), and having no cross resistance with phenylamides reagents.

- 5 Dithianon is a protective fungicide used for various leaf diseases of many pomefruits and stone fruits, has multi-mechanism. By reacting with a sulfur-containing groups and



SUMMARY

In view of the problems of fungicide resistance and residual in soil in practical applications, the technical problem to be solved by the present invention is: screening two fungicides of different fungicidal principles for combination, to improve the prevention and treatment effect of the fungicide, delay the emergence of resistance, reduce the application amount and prevention and treatment costs.

In order to solve the above technical problems, the present invention provides a fungicide composition. The composition contains two active components A and B, the active component A is benziothiazolinone, and the active component B is one selected from dithianon, dimethomorph, iprodione and epoxiconazol. The inventers find from experiments that the fungicide composition has a significant synergistic effect, and more importantly, the application amount and the use-cost are reduced. Compounds containing the component A and the component B have different structures, different mechanisms of action, the fungicidal spectrum can be expanded by combination of the two components, and the emergence and development speed of resistance of the pathogenic fungi is delayed, and moreover, the component A and the component B have no cross resistance.

Another objective of the present invention is to provide a method for preparing a fungicide composition containing two active components A and B and a use of the fungicide composition containing two active components A and B in the preventing and treating food crop diseases in the field of agriculture.

In the fungicide composition, the weight ratio of the component A and the component B is 1:50 to 50:1, and preferably 1:30 to 30:1.

The fungicide composition of the present invention is composed of 6 wt% to 92 wt% of active components and 94 wt% to 8 wt% of fungicide adjuvants.

The present invention provides a use of a fungicide composition containing a component A (benziothiazolinone) and a component B (one selected from dithianon, dimethomorph, iprodione and epoxiconazol) in preventing and treating plant diseases.

The composition further contains a support, an adjuvant and/or a surfactant. During



(I) Processing of water dispersible granule and Embodiments

The active component benziotiazolinone and one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with an adjuvant and a filler at the formula ratio, the mixture was pulverized into wettable powder by airflow, and the wettable powder
 5 was mixed with a certain amount of water and then subjected to extrusion granulation, drying and sieving, to obtain the water dispersible granule product.

Embodiment 1: 62% benziotiazolinone·dithianon water dispersible granule

60% benziotiazolinone, 2% dithianon, 4% sodium alkyl naphthalene sulfonate, 3% sodium dodecyl sulfonate, 3% ammonium sulfate, complemented to 100% with light
 10 calcium carbonate.

Embodiment 2: 65% benziotiazolinone·dithianon water dispersible granule

2% benziotiazolinone, 63% dithianon, 5% sodium lignosulfonate, 7% sodium methyl naphthalene sulfonate-formaldehyde condensate, 3% sodium dodecyl sulfate, complemented to 100% with diatomite.

15 **Embodiment 3:** 65% benziotiazolinone·dimethomorph water dispersible granule

63% benziotiazolinone, 2% dimethomorph, 6% sodium lignosulfonate, 3% sodium dodecyl sulfonate, 1% xanthan gum, 1% sodium carboxymethyl starch, complemented to 100% with attapulgate.

Embodiment 4: 85% benziotiazolinone·dimethomorph water dispersible granule

20 2% benziotiazolinone, 83% dimethomorph, 1% ammonium sulfate, 2% alginate, 1% sodium methyl naphthalene sulfonate-formaldehyde condensate, 1% organosilicone, complemented to 100% with bentonite.

Embodiment 5: 62% benziotiazolinone·iprodione water dispersible granule

60% benziotiazolinone, 2% iprodione, 2% sodium dodecyl sulfonate, 2% sodium
 25 alkyl naphthalene sulfonate, 3% ammonium sulfate, complemented to 100% with light calcium carbonate.



Embodiment 6: 75% benziothiazolinone·iprodione water dispersible granule

2% benziothiazolinone, 73% iprodione, 5% sodium methyl naphthalene sulfonate-formaldehyde condensate, 4% sodium lignosulfonate, 3% sodium dodecyl sulfate, complemented to 100% with diatomite.

5 **Embodiment 7:** 62% benziothiazolinone·epoxiconazol water dispersible granule

60% benziothiazolinone, 2% epoxiconazol, 1% sodium carboxymethyl starch, 4% sodium dodecyl sulfonate, 4% sodium lignosulfonate, 1% xanthan gum, complemented to 100% with attapulgate.

Embodiment 8: 62% benziothiazolinone·epoxiconazol water dispersible granule

10 2% benziothiazolinone, 60% epoxiconazol, 1% ammonium sulfate, 2% alginate, 1% sodium methyl naphthalene sulfonate-formaldehyde condensate, 1% organosilicone, complemented to 100% with bentonite.

(II) Processing of suspension and embodiments

15 The active component benziothiazolinone and one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with the components such as a dispersant, a wetting agent, a thickener and water at the formula ratio, the mixture was then subjected to sanding and/or high-speed shearing, to obtain a semi-finished product, and the semi-finished product was fully mixed water after analysis and filtered, to obtain the finished product.

20 **Embodiment 9:** 35% benziothiazolinone·dithianon suspension

25% benziothiazolinone, 100% dithianon, 7% sodium lignosulfonate, 0.8% xanthan gum, 3% bentonite, 1% magnesium aluminum silicate, 4% ethylene glycol, complemented to 100% with water.

Embodiment 10: 36% benziothiazolinone·dithianon suspension

25 12% benziothiazolinone, 24% dithianon, 6% sodium methyl naphthalene sulfonate-formaldehyde condensate, 4% bentonite, 5% glycerol, complemented to 100% with water.

Embodiment 11: 42% benziothiazolinone·dimethomorph suspension

40% benziothiazolinone, 2% dimethomorph, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

5 **Embodiment 12:** 32% benziothiazolinone·dimethomorph suspension

5% benziothiazolinone, 27% dimethomorph, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

Embodiment 13: 55% benziothiazolinone·iprodione suspension

10 50% benziothiazolinone, 5% iprodione, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

Embodiment 14: 42% benziothiazolinone·iprodione suspension

2% benziothiazolinone, 40% iprodione, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

15 **Embodiment 15:** 55% benziothiazolinone·epoxiconazol suspension

50% benziothiazolinone, 5% epoxiconazol, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

Embodiment 16: 55% benziothiazolinone·epoxiconazol suspension

20 5% benziothiazolinone, 50% epoxiconazol, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

(III) Processing of wettable powder and embodiments

25 The active component A benziothiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with various adjuvants and fillers at ratios, and the mixture was pulverized by an ultrafine pulverizer, to obtain a wettable powder.



Embodiment 17: 90% benziothiazolinone·dithianon wettable powder

2% benziothiazolinone, 88% dithianon, 2% calcium lignosulphonate, 1% sodium dodecylbenzene sulfonate, 2% bentonite, complemented to 100% with attapulgate.

Embodiment 18: 88% benziothiazolinone·dithianon wettable powder

5 86% benziothiazolinone, 2% dithianon, 1% polyoxyethylene alkyl ether sulfonate, 2% nekal, 1.5% bentonite, 2% white carbon black, complemented to 100% with diatomite 100%.

Embodiment 19: 55% benziothiazolinone·dithianon wettable powder

25% benziothiazolinone, dithianon 30%, 6% alkyl sulfonate, 6% sodium lignosulfonate,
10 11% white carbon black, complemented to 100% with kaolin.

Embodiment 20: 88% benziothiazolinone·dimethomorph wettable powder

86% benziothiazolinone, 2% dimethomorph, 2% polyoxyethylene octyl phenyl ether, 6% sodium lignosulfonate, 4% white carbon black, complemented to 100% with diatomite.

Embodiment 21: 50% benziothiazolinone·dimethomorph wettable powder

15 25% benziothiazolinone, 25% dimethomorph, 7% calcium lignosulphonate, 5% white carbon black, 3% sodium dodecylbenzene sulfonate, complemented to 100% with attapulgate.

Embodiment 22: 62% benziothiazolinone·dimethomorph wettable powder

2% benziothiazolinone, 60% dimethomorph, 5% calcium lignosulphonate, 4%
20 bentonite, 3% polyoxyethylene octyl phenyl ether, complemented to 100% with attapulgate.

Embodiment 23: 85% benziothiazolinone·iprodione wettable powder

83% benziothiazolinone, 2% iprodione, 1% polyoxyethylene octyl phenyl ether, 2% sodium lignosulfonate, 3% white carbon black, complemented to 100% with diatomite.

Embodiment 24: 50% benziothiazolinone·iprodione wettable powder

25 25% benziothiazolinone, 25% iprodione, 3% sodium dodecylbenzene sulfonate, 5% white carbon black, 7% calcium lignosulphonate, complemented to 100% with attapulgate.



Embodiment 25: 85% benziothiazolinone·iprodione wettable powder

3% benziothiazolinone, 82% iprodione, 5% calcium lignosulphonate, 4% bentonite, 3% polyoxyethylene octyl phenyl ether, complemented to 100% with attapulgate.

Embodiment 26: 88% benziothiazolinone·epoxiconazol wettable powder

5 2% benziothiazolinone, 86% epoxiconazol, 2% sodium dodecylbenzene sulfonate, 1% bentonite, 2% calcium lignosulphonate, complemented to 100% with attapulgate.

Embodiment 27: 86% benziothiazolinone·epoxiconazol wettable powder

84% benziothiazolinone, 2% epoxiconazol, 1% nekal, 2% polyoxyethylene alkyl ether sulfonate, 15% bentonite, 2% white carbon black, complemented to 100% with
10 diatomite 100%.

Embodiment 28: 50% benziothiazolinone·epoxiconazol wettable powder

25% benziothiazolinone, 25% epoxiconazol, 6% sodium lignosulfonate, 6% alkyl sulfonate, 11% white carbon black, complemented to 100% with kaolin.

(IV) Processing of microemulsion and embodiments

15 The active component A benziothiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were completely dissolved in a solvent, and at the same time, an emulsifier, a synergistic effect adjuvant and a cryoprotectant were added with stirring, after the system was fully mixed, water was slowly added to the mixture, and the mixture was fully stirred, to obtain a microemulsion of
20 different contents.

Embodiment 29: 18% benziothiazolinone·dithianon microemulsion

3% benziothiazolinone, 15% dithianon, 15% acetone, 0.5% compound sodium nitrophenolate, 5% alkyl polyoxyethylene ether and nonylphenol polyoxyethylene ether, 1% propylene glycol, 2% urea, complemented to 100% with water.

25 **Embodiment 30:** 30% benziothiazolinone·dithianon microemulsion

25% benziothiazolinone, 5% dithianon, 4% polyoxyethylene aliphate and phenethyl



phenol polyoxyethylene ether, 2% glycerol, 11% methanol, 1% azone, complemented to 100% with water.

Embodiment 31: 15% benziotiazolinone·dimethomorph microemulsion

5 5% benziotiazolinone, 10% dimethomorph, 16% alkyl benzene sulfonate and alkyl naphthalene sulfonate, 1% thiazone, 16% ethyl acetate, 1% propylene glycol, complemented to 100% with water.

Embodiment 32: 15% benziotiazolinone·dimethomorph microemulsion

10 10% benziotiazolinone, 5% dimethomorph, 8% calcium dodecylbenzene sulfonate, 0.5% thiazone, 14% sorbic acid, 3% polyethylene glycol, complemented to 100% with water.

Embodiment 33: 18% benziotiazolinone·iprodione microemulsion

6% benziotiazolinone, 12% iprodione, 15% acetone, 0.5% compound sodium nitrophenolate, 5% alkyl polyoxyethylene ether and nonylphenol polyoxyethylene ether, 1% propylene glycol, 2% urea, complemented to 100% with water.

15 **Embodiment 34:** 21% benziotiazolinone·iprodione microemulsion

20% benziotiazolinone, 1% iprodione, 4% polyoxyethylene aliphataate and phenethyl phenol polyoxyethylene ether, 2% glycerol, 11% methanol, 1% azone, complemented to 100% with water.

Embodiment 35: 12% benziotiazolinone·epoxiconazol microemulsion

20 2% benziotiazolinone, 10% epoxiconazol, 1% propylene glycol, 13% alkyl benzene sulfonate and alkyl naphthalene sulfonate, 1% thiazone, 11% ethyl acetate, complemented to 100% with water.

Embodiment 36: 15% benziotiazolinone·epoxiconazol microemulsion

25 10% benziotiazolinone, 5% epoxiconazol, 14% sorbic acid, 1% thiazone, 7% calcium dodecylbenzene sulfonate, 2% polyethylene glycol, complemented to 100% with water.

(V) Processing of emulsion in water and embodiments



In an emulsifying kettle, the active component A benziotiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with a solvent and an adjuvant under mechanical stirring, an emulsifier and a stabilizer were then added and fully stirred, finally, water was added, and the mixture was stirred for 10 to 30 min at a rotation rate of 100 to 12000 rpm, to obtain a uniform emulsion product.

Embodiment 37: 42% benziotiazolinone·dithianon emulsion in water

40% benziotiazolinone, 2% dithianon, 4% dimethyl N-phthalate, 3% nonylphenol phenoxy vinyl ether, 2% 2,6-tert-butyl-4-methylphenol, 3% ethylene glycol, 1% polyvinyl alcohol, 1% calcium benzoate, 0.8% organic silicon defoamer, complemented to 100% with water.

Embodiment 38: 44% benziotiazolinone·dithianon emulsion in water

4% benziotiazolinone, 40% dithianon, 4% butylhydroxyanisole, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 2% propylene glycol, 3% xanthan gum, 1% polyvinyl alcohol, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 39: 22% benziotiazolinone·dimethomorph emulsion in water

20% benziotiazolinone, 2% dimethomorph, 3% polyoxyethylene block copolymer, 1% propylene glycol, 2% xanthan gum, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 40: 22% benziotiazolinone·dimethomorph emulsion in water

2% benziotiazolinone, 20% dimethomorph, 2% N-dodecylpyrrolidone, 1% polyoxyethylene castor oil, 3% glycerol, 12% polyvinyl alcohol, 1% calcium benzoate, 2% isooctanol, complemented to 100% with water.

Embodiment 41: 30% benziotiazolinone·iprodione emulsion in water

25% benziotiazolinone, 5% iprodione, 1% 2,6-tert-butyl-4-methylphenol, 2% nonylphenol phenoxy vinyl ether, 3% ethylene glycol, 1% calcium benzoate, 2% dimethyl N-phthalate, 1% polyvinyl alcohol, 1% organic silicon defoamer, complemented to 100%



with water.

Embodiment 42: 42% benziothiazolinone-iprodone emulsion in water

2% benziothiazolinone, 40% iprodione, 2% propylene glycol, 3% butylhydroxyanisole, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 3% xanthan gum, 1%
5 polyvinyl alcohol, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 43: 21% benziothiazolinone-epoxiconazol emulsion in water

20% benziothiazolinone, 1% epoxiconazol, 1% propylene glycol, 1% xanthan gum, 2% polyisobutylene anhydride-polyethylene glycol copolymer, 2% polyoxyethylene block copolymer, 1.5% organic silicon defoamer, complemented to 100% with water.

10 **Embodiment 44:** 42% benziothiazolinone-epoxiconazol emulsion in water

2% benziothiazolinone, 40% epoxiconazol, 2% polyoxyethylene castor oil, 1% N-dodecylpyrrolidone, 2% glycerol, 1.1% polyvinyl alcohol, 2% calcium benzoate, 1% isooctanol, complemented to 100% with water.

(VI) Processing of oil suspension and embodiments

15 The active component A benziothiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were mixed with various components such as a dispersant, a stabilizer, a defoamer and a solvent at the formula ratio, and the mixture was placed in a sanding kettle for milling, then sent to a homogenizer and fully mixed, to obtain the finished product.

20 **Embodiment 45:** 42% benziothiazolinone-dithianon oil suspension

2% benziothiazolinone, 40% dithianon, 8% sodium lignosulfonate, 4% bentonite, 1% xanthan gum, 2% organic silicon defoamer, complemented to 100% with soybean oil.

Embodiment 46: 55% benziothiazolinone-dithianon oil suspension

50% benziothiazolinone, 5% dithianon, 8% nekal, 5% bentonite, 2% organosilicone,
25 complemented to 100% with engine oil.

Embodiment 47: 30% benziothiazolinone-dimethomorph oil suspension

25% benziotiazolinone, 5% dimethomorph, 8% naphthalene sulfonic acid-formaldehyde condensate, 5% diatomite, 2% aluminium-magnesium silicate, complemented to 100% with dichloroethane.

Embodiment 48: 42% benziotiazolinone·dimethomorph oil suspension

5 2% benziotiazolinone, 40% dimethomorph, 11% sodium lignosulfonate, 4% aerosil, 2% aluminium-magnesium silicate, complemented to 100% with castor oil.

Embodiment 49: 18% benziotiazolinone·iprodione oil suspension

3% benziotiazolinone, 15% iprodione, 1% organic silicon defoamer, 3% bentonite, 7% sodium lignosulfonate, 1% xanthan gum, complemented to 100% with soybean oil.

10 **Embodiment 50:** 22% benziotiazolinone·iprodione oil suspension

20% benziotiazolinone, 2% iprodione, 3% bentonite, 7% nekal, 2% organosilicone, complemented to 100% with engine oil.

Embodiment 51: 30% benziotiazolinone·epoxiconazol oil suspension

15 25% benziotiazolinone, 5% epoxiconazol, 8% naphthalene sulfonic acid-formaldehyde condensate, 5% diatomite, 2% aluminium-magnesium silicate, complemented to 100% with dichloroethane.

Embodiment 52: 45% benziotiazolinone·epoxiconazol oil suspension

15% benziotiazolinone, 30% epoxiconazol, 11% sodium lignosulfonate, 4% aerosil, 2% aluminium-magnesium silicate, complemented to 100% with castor oil.

20 **II) Efficacy verification test**

(I) Biological assay embodiments

1. Test of toxicity of compound benziotiazolinone and dithianon on cucumber downy mildew pathogenic fungi

Subjects for test: cucumber downy mildew pathogenic fungi

25 The incidence of whole cucumber leaves was investigated according to test grading level, and the disease index and the prevention and treatment effect were calculated.



The prevention and treatment effect was converted into probability values (y), the heights of the chemicals ($\mu\text{g/ml}$) were converted into logarithm values (x), the toxicity equation and the median inhibition concentration EC_{50} were calculated by the least square method, and the toxicity index level co-toxicity coefficient (CTC) of the chemicals was calculated according to the Sun Yunpei's method.

Actual toxicity index (ATI)=(EC_{50} of the standard reagent/ EC_{50} of the test reagent) x 100

Theoretical toxicity index (TTI)=the toxicity index of chemical A x the percentage of A in the mixture + the toxicity index of chemical B x the percentage of B in the mixture

Co-toxicity coefficient (CTC)=[Actual toxicity index (ATI) of the mixture/Theoretical toxicity index (TTI) of the mixture] x 100

$\text{CTC} \leq 80$, indicating that the composition had the antagonistic effect, $80 < \text{CTC} < 120$, indicating that the composition had the additive effect, and $\text{CTC} \geq 120$, indicating that the composition had the synergistic effect.

Table 1 Analysis of results of test of toxicity of benziethiazolinone, dithianon and compound benziethiazolinone and dithianon on cucumber downy mildew

Names of reagents	EC_{50} ($\mu\text{g/ml}$)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziethiazolinone	3.25	100.0	/	/
Dithianon	5.41	60.1	/	/
Benziethiazolinone:dithianon ratio=50:1	2.37	137.13	99.215	138.215
Benziethiazolinone:dithianon ratio=30:1	1.91	170.16	98.67	172.454
Benziethiazolinone:dithianon ratio=10:1	1.58	205.69	96.37	213.438
Benziethiazolinone:dithianon ratio=1:1	2.08	156.25	80.05	195.191
Benziethiazolinone:dithianon ratio=1:10	2.26	143.81	63.73	225.655
Benziethiazolinone:dithianon ratio=1:30	3.79	85.61	61.43	139.358

Benziothiazolinone:dithianon ratio=1:50	4.18	77.76	60.88	127.720
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The results (Table 1) show that, the compound benziotiazolinone and dithianon has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziotiazolinone and dithianon is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziotiazolinone and dithianon is 135 and more, and the synergistic effect is significant.

2. Test of toxicity of compound benziotiazolinone and dimethomorph on cucumber downy mildew

Table 2 Analysis of results of test of toxicity of benziotiazolinone, dimethomorph and compound benziotiazolinone and dimethomorph on cucumber downy mildew

Names of reagents	EC ₅₀ (µg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziothiazolinone	4.08	100.0	/	/
Dimethomorph	6.36	63.9	/	/
Benziothiazolinone:dimethomorph ratio=50:1	2.99	136.5	99.29	137.48
Benziothiazolinone:dimethomorph ratio=30:1	2.40	170.0	98.835	172.00
Benziothiazolinone:dimethomorph ratio=10:1	2.12	192.4	96.718	198.93
Benziothiazolinone:dimethomorph ratio=1:1	2.01	203.0	81.95	247.71
Benziothiazolinone:dimethomorph ratio=1:10	2.91	140.2	67.18	208.69
Benziothiazolinone:dimethomorph ratio=1:30	3.33	122.5	65.17	187.97
Benziothiazolinone:dimethomorph ratio=1:50	4.87	83.8	64.6	129.72

The results (Table 2) show that, the compound benziotiazolinone and dimethomorph has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber

downy mildew pathogenic fungi. Especially when the ratio of benziothiazolinone and dimethomorph is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziothiazolinone and dithianon is 170 and more, and the synergistic effect is significant.

3. Test of toxicity of compound benziothiazolinone and iprodione on cucumber downy mildew

Table 3 Analysis of results of test of toxicity of benziothiazolinone, iprodione and compound benziothiazolinone and iprodione on cucumber downy mildew

Names of reagents	EC ₅₀ (µg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziothiazolinone	4.21	100.00	/	/
Iprodione	5.82	72.34	/	/
Benziothiazolinone:dimethomorph ratio=50:1	3.32	126.81	99.458	127.50
Benziothiazolinone:iprodione ratio=30:1	3.05	138.03	99.108	139.27
Benziothiazolinone:iprodione ratio=10:1	2.29	183.84	97.485	188.58
Benziothiazolinone:iprodione ratio=1:1	2.07	203.38	86.170	236.02
Benziothiazolinone:iprodione ratio=1:10	2.54	165.75	74.855	221.43
Benziothiazolinone:iprodione ratio=1:30	4.18	100.72	73.232	137.54
Benziothiazolinone:iprodione ratio=1:50	4.62	91.13	72.882	125.04

The results (Table 3) show that, the compound benziothiazolinone and iprodione has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziothiazolinone and iprodione is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziothiazolinone and iprodione is 135 and more, and the synergistic effect is significant.

4. Test of toxicity of compound benziothiazolinone and epoxiconazol on cucumber downy mildew

Table 4 Analysis of results of test of toxicity of benziotiazolinone, epoxiconazol and compound benziotiazolinone and epoxiconazol on cucumber downy mildew

Names of reagents	EC ₅₀ (µg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziotiazolinone	3.81	100.00	/	/
Epoxiconazol	4.25	89.65	/	/
Benziotiazolinone:Epoxiconazol ratio=50:1	2.90	131.343	99.797	131.61
Benziotiazolinone:epoxiconazol ratio=30:1	2.56	148.722	99.666	149.22
Benziotiazolinone:epoxiconazol ratio=10:1	1.97	193.680	99.059	195.52
Benziotiazolinone:epoxiconazol ratio=1:1	1.59	240.106	94.825	253.21
Benziotiazolinone:epoxiconazol ratio=1:10	1.94	196.383	90.591	216.78
Benziotiazolinone:epoxiconazol ratio=1:30	3.02	126.274	89.645	140.86
Benziotiazolinone:epoxiconazol ratio=1:50	3.51	108.403	89.353	121.32

The results (Table 4) show that, the compound benziotiazolinone and epoxiconazol has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziotiazolinone and epoxiconazol is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziotiazolinone and epoxiconazol is 140 and more, and the synergistic effect is significant.

10 (II) Field efficacy verification test

Test method: In the early period, the reagent was immediately sprayed for the first time, and 7 days later, the reagent was applied for the second time, each treatment had 4 sections, and each section had a size of 20 m². The incidence was investigated before application of the reagent and 10 days after the second application of the reagent, each section was randomly sampled at 5 points, 5 crops were investigated at each point, the percentage of the

lesion area in the leaf area of each leave on the whole crop was investigated, the leaves were graded, and the disease index and the prevention and treatment effect were calculated.

$$\text{Disease index} = \frac{\sum(\text{Incidence of leaves of various levels} \times \text{Representative value of this level})}{\text{The total number of leaves} \times \text{Representative value of the highest level}} \times 100$$

$$\text{Prevention and treatment effect (\%)} = \left(1 - \frac{\text{Pre-reagent control disease index} \times \text{Post-reagent treatment disease index}}{\text{Post-reagent control disease index} \times \text{Pre-reagent treatment disease index}}\right) \times 100$$

- 5 Expected control efficiency (%) = $X + Y - XY/100$ (where X and Y are control efficiency of single reagent)

Grading standard:

0 grade: Having no lesion;

1 grade: having less than 5 leaf lesions, and the length of lesions being less than 1 cm;

- 10 3 grade: having 6 to 10 leaf lesions, and the length of some lesions being greater than 1 cm;

5 grade: having 11 to 25 leaf lesions, some lesions being contiguous, and the area of the lesions being 10% to 25% of the leaf area;

- 15 7 grade: having 26 and more leaf lesions, lesions being contiguous, and the area of the lesions being 26% to 50% of the leaf area;

9 grade: lesions being contiguous, and the area of the lesions being 50% and more of the leaf area or the entire leave withering up.

(1) Field efficacy verification test of compound benziothiazolinone and dithianon on grape downy mildew

- 20 Table 5 Prevention and treatment effect of compound benziothiazolinone and dithianon mixture on grape downy mildew

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency (%)

Embodiment 1	15% benziotiazolinone emulsion in water	125.8	2.79	6.46	85.8
	50% dithianon suspension	4.2	3.21	50.51	3.5
	Expected control efficiency after mixing the two components	-	-	-	86.3
	62% benziotiazolinone·dithianon water dispersible granule (benziotiazolinone:dithianon=60:2)	130.0	3.02	3.05	93.8
Embodiment 2	15% benziotiazolinone emulsion in water	4	2.81	40.00	12.7
	50% dithianon suspension	126	2.9	11.25	76.2
	Expected control efficiency after mixing the two components	-	-	-	79.2
	65% benziotiazolinone·dithianon water dispersible granule (benziotiazolinone:dithianon=2:63)	130.0	2.88	4.60	90.2
Embodiment 9	15% benziotiazolinone emulsion in water	92.8	2.69	10.75	75.5
	50% dithianon suspension	37.2	2.79	39.26	13.7
	Expected control efficiency after mixing the two components	-	-	-	78.9
	35% benziotiazolinone·dithianon suspension (benziotiazolinone:dithianon=25:10)	130.0	2.72	2.35	94.7
Embodiment 10	15% benziotiazolinone emulsion in water	43.4	2.85	23.56	49.3
	50% dithianon suspension	86.6	2.98	30.37	37.5
	Expected control efficiency after mixing the two components	-	-	-	68.3
	36% benziotiazolinone·dithianon suspension (benziotiazolinone:dithianon=12:24)	130.0	2.83	2.17	95.3
Embodiment 17	15% benziotiazolinone emulsion in water	2.9	2.76	40.87	9.2
	50% dithianon suspension	127.1	3.04	11.15	77.5
	Expected control efficiency after mixing the two components	-	-	-	79.6
	90% benziotiazolinone·dithianon wettable powder (benziotiazolinone:dithianon=2:88)	130.0	2.93	5.83	87.8

Embodiment 18	15% benziotiazolinone emulsion in water	127	3	6.75	86.2
	50% dithianon suspension	3	2.87	45.35	3.1
	Expected control efficiency after mixing the two components	-	-	-	86.6
	88% benziotiazolinone·dithianon wettable powder (benziotiazolinone:dithianon=86:2)	130.0	2.91	4.65	90.2
Embodiment 19	15% benziotiazolinone emulsion in water	59	2.79	20.15	55.7
	50% dithianon suspension	71	2.85	31.46	32.3
	Expected control efficiency after mixing the two components	-	-	-	70.0
	55% benziotiazolinone·dithianon wettable powder (benziotiazolinone:dithianon=25:30)	130.0	3.02	4.19	91.5
Embodiment 29	15% benziotiazolinone emulsion in water	21.6	2.68	28.63	34.5
	50% dithianon suspension	108.4	2.89	22.01	53.3
	Expected control efficiency after mixing the two components	-	-	-	69.4
	18% benziotiazolinone·dithianon microemulsion (benziotiazolinone:dithianon=3:15)	130.0	2.75	3.36	92.5
Embodiment 30	15% benziotiazolinone emulsion in water	108.4	2.87	10.06	78.5
	50% dithianon suspension	21.6	2.93	43.62	8.7
	Expected control efficiency after mixing the two components	-	-	-	80.37
	30% benziotiazolinone·dithianon microemulsion (benziotiazolinone:dithianon=25:5)	130.0	2.85	3.63	92.2
Embodiment 37	15% benziotiazolinone emulsion in water	123.8	2.68	6.86	84.3
	50% dithianon suspension	6.2	2.89	45.15	4.2
	Expected control efficiency after mixing the two components	-	-	-	84.96
	42% benziotiazolinone·dithianon microemulsion (benziotiazolinone:dithianon=40:2)	130.0	2.75	3.86	91.4

Embodiment 38	15% benziothiazolinone emulsion in water	11.8	2.76	34.34	23.7
	50% dithianon suspension	118.2	2.85	16.03	65.5
	Expected control efficiency after mixing the two components	-	-	-	73.7
	44% benziothiazolinone-dithianon microemulsion (benziothiazolinone:dithianon=4:40)	130.0	3.11	3.14	93.8
Embodiment 45	15% benziothiazolinone emulsion in water	6.2	2.9	39.11	17.3
	50% dithianon suspension	123.8	2.85	14.36	69.1
	Expected control efficiency after mixing the two components	-	-	-	74.4
	42% benziothiazolinone-dithianon microemulsion (benziothiazolinone:dithianon=2:40)	130	2.79	4.32	90.5
Embodiment 46	15% benziothiazolinone emulsion in water	118.2	3.05	9.05	81.8
	50% dithianon suspension	11.8	3.25	49.23	7.1
	Expected control efficiency after mixing the two components	-	-	-	83.1
	55% benziothiazolinone-dithianon microemulsion (benziothiazolinone:dithianon=50:5)	130	2.99	3.17	93.5
Water control (CK)	-	-	2.93	46.93	-

Test results (Table 5) show that, the compound benziothiazolinone and dithianon has significantly improved control efficiency on grape downy mildew, indicating that the compound of the two has a significant synergistic effect on grape downy mildew.

(2) Field efficacy verification test of compound benziothiazolinone and dimethomorph on litchi blight

Table 6 Prevention and treatment effect of compound benziothiazolinone and dimethomorph on litchi blight

Serial	Chemicals for treatment	Application amount	Disease index	11 days after second application of
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number		(a.i.g/ha)	before application of reagents	chemicals	
				Disease index	Control efficiency (%)
Embodiment 3	15% benziotiazolinone emulsion in water	145.4	2.51	5.95	81.2
	50% dimethomorph wettable powder	19.6	2.63	30.89	6.8
	Expected control efficiency after mixing the two components	-	-	-	82.5
	65% benziotiazolinone·dimethomorph water dispersible granule (benziotiazolinone:dimethomorph=63:2)	150.0	2.52	3.52	88.9
Embodiment 4	15% benziotiazolinone emulsion in water	3.5	2.32	28.50	2.5
	50% dimethomorph wettable powder	146.5	2.29	6.95	75.9
	Expected control efficiency after mixing the two components	-	-	-	76.5
	85% benziotiazolinone·dimethomorph water dispersible granule (benziotiazolinone:dimethomorph=2:83)	150	2.52	4.51	85.8
Embodiment 11	15% benziotiazolinone emulsion in water	142.9	2.45	6.14	80.1
	50% dimethomorph wettable powder	7.1	2.38	28.40	5.3
	Expected control efficiency after mixing the two components	-	-	-	81.2
	42% benziotiazolinone·dimethomorph suspension (benziotiazolinone:dimethomorph=40:2)	150.0	2.53	4.50	85.9
Embodiment 12	15% benziotiazolinone emulsion in water	23.4	2.26	21.47	24.6
	50% dimethomorph wettable powder	126.6	2.64	12.81	61.5
	Expected control efficiency after mixing the two components	-	-	-	71.0
	32% benziotiazolinone·dimethomorph suspension (benziotiazolinone:dimethomorph=5:27)	150	2.65	4.37	86.9
Embodiment 20	15% benziotiazolinone emulsion in water	146.6	2.54	5.60	82.5
	50% dimethomorph wettable powder	3.4	2.52	30.90	2.7
	Expected control efficiency after mixing the two components	-	-	-	83.0
	88% benziotiazolinone·dimethomorph wettable powder (benziotiazolinone:dimethomorph=86:2)	150.0	2.51	4.36	86.2

Embodiment 21	15% benziotiazolinone emulsion in water	75.0	2.72	14.29	58.3
	50% dimethomorph wettable powder	75.0	2.81	23.79	32.8
	Expected control efficiency after mixing the two components	-	-	-	72.0
	benziotiazolinone-dimethomorph wettable powder (benziotiazolinone:dimethomorph=25:25)	150.0	2.41	3.49	88.5
Embodiment 22	15% benziotiazolinone emulsion in water	4.8	2.36	28.58	3.9
	50% dimethomorph wettable powder	145.2	2.32	7.54	74.2
	Expected control efficiency after mixing the two components	-	-	-	75.2
	50% benziotiazolinone-dimethomorph wettable powder (benziotiazolinone:dimethomorph=2:60)	150.0	2.55	4.88	84.8
Embodiment 31:	15% benziotiazolinone emulsion in water	50.0	2.82	21.07	40.7
	50% dimethomorph wettable powder	100.0	2.53	16.74	47.5
	Expected control efficiency after mixing the two components	-	-	-	68.9
	15% benziotiazolinone-dimethomorph microemulsion	150.0	2.63	3.48	89.5
	(benziotiazolinone:dimethomorph=5:10)				
Embodiment 32	15% benziotiazolinone emulsion in water	100.0	2.66	10.66	68.2
	50% dimethomorph wettable powder	50.0	2.39	22.86	24.1
	Expected control efficiency after mixing the two components	-	-	-	75.9
	15% benziotiazolinone-dimethomorph microemulsion (benziotiazolinone:dimethomorph=10:5)	150.0	2.35	3.58	87.9
Embodiment 39	15% benziotiazolinone emulsion in water	136.4	2.56	6.90	78.6
	50% dimethomorph wettable powder	13.6	2.25	26.91	5.1
	Expected control efficiency after mixing the two components	-	-	-	79.7
	22% benziotiazolinone-dimethomorph emulsion in water (benziotiazolinone:dimethomorph=20:2)	150.0	3.01	5.20	86.3
Embodiment 40	15% benziotiazolinone emulsion in water	13.6	2.51	27.14	14.2
	50% dimethomorph wettable powder	136.4	2.62	10.63	67.8

	Expected control efficiency after mixing the two components	-	-	-	72.4
	22% benziothiazolinone-dimethomorph emulsion in water (benziothiazolinone:dimethomorph=2:20)	150.0	2.51	3.83	87.9
Embodiment 47	15% benziothiazolinone emulsion in water	125.0	2.52	8.35	73.7
	50% dimethomorph wettable powder	25.0	2.35	26.77	9.6
	Expected control efficiency after mixing the two components	-	-	-	76.2
	30% benziothiazolinone-dimethomorph oil suspension (benziothiazolinone:dimethomorph=25:5)	150.0	2.69	4.91	85.5
Embodiment 48	15% benziothiazolinone emulsion in water	7.1	2.55	29.95	6.8
	50% dimethomorph wettable powder	142.9	2.21	8.02	71.2
	Expected control efficiency after mixing the two components	-	-	-	73.2
	42% benziothiazolinone-dimethomorph oil suspension (benziothiazolinone:dimethomorph=2:40)	150.0	2.36	4.10	86.2
Water control(CK)	-	-	2.58	32.51	-

Test results (Table 6) show that, the compound benziothiazolinone and dimethomorph has significantly improved control efficiency on litchi blight, indicating that the compound of the two has a significant synergistic effect on litchi blight.

(3) Field efficacy verification test of compound benziothiazolinone and iprodione on pepper cinerea

Table 7 Prevention and treatment effect of compound benziothiazolinone and iprodione on pepper cinerea

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency (%)
Embodiment 5	15% benziothiazolinone emulsion in water	174.2	3.32	9.60	75.8

	50% iprodione suspension	5.8	3.11	35.98	3.2
	Expected control efficiency after mixing the two components	-	-	-	76.6
	62% benziotiazolinone: iprodione water dispersible granule (benziotiazolinone:iprodione=60:2)	180.0	3.52	6.77	83.9
Embodiment 6	15% benziotiazolinone emulsion in water	4.8	3.32	35.91	9.5
	50% iprodione suspension	175.2	3.89	14.09	69.7
	Expected control efficiency after mixing the two components	-	-	-	72.6
	75% benziotiazolinone: iprodione water dispersible granule (benziotiazolinone:iprodione=2:73)	180.0	3.51	7.26	82.7
Embodiment 13	15% benziotiazolinone emulsion in water	163.6	2.85	10.01	70.6
	50% iprodione suspension	16.4	2.98	32.30	9.3
	Expected control efficiency after mixing the two components	-	-	-	73.3
	55% benziotiazolinone: iprodione suspension (benziotiazolinone:iprodione=50:5)	180.0	3.11	5.91	84.1
Embodiment 14	15% benziotiazolinone emulsion in water	8.6	3.21	32.30	15.8
	50% iprodione suspension	171.4	3.14	13.81	63.2
	Expected control efficiency after mixing the two components	-	-	-	69.0
	42% benziotiazolinone: iprodione suspension (benziotiazolinone:iprodione=2:40)	180.0	3.15	6.55	82.6
Embodiment 23	15% benziotiazolinone emulsion in water	175.8	2.84	8.11	76.1
	50% iprodione suspension	4.2	2.92	33.88	2.9
	Expected control efficiency after mixing the two components	-	-	-	76.8
	85% benziotiazolinone: iprodione wettable powder (benziotiazolinone:iprodione=83:2)	180.0	2.82	5.59	83.4
Embodiment 24	15% benziotiazolinone emulsion in water	90.0	3.76	23.68	47.3

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	50% iprodione suspension	90.0	3.24	26.60	31.3
	Expected control efficiency after mixing the two components	-	-	-	63.8
	50% benziothiazolinone-iprodione wettable powder (benziothiazolinone:iprodione=25:25)	180.0	3.35	4.88	87.8
Embodiment 25	15% benziothiazolinone emulsion in water	4.2	3.31	35.68	9.8
	50% iprodione suspension	175.8	3.22	13.70	64.4
	Expected control efficiency after mixing the two components	-	-	-	67.9
	85% benziothiazolinone-iprodione wettable powder (benziothiazolinone:iprodione=2:83)	180.0	3.45	7.38	82.1
Embodiment 33	15% benziothiazolinone emulsion in water	60.0	3.72	30.90	30.5
	50% iprodione suspension	120.0	3.13	18.25	51.2
	Expected control efficiency after mixing the two components	-	-	-	66.1
	18% benziothiazolinone-iprodione microemulsion (benziothiazolinone:iprodione=6:12)	180.0	3.42	4.82	88.2
Embodiment 34	15% benziothiazolinone emulsion in water	171.4	3.26	10.05	74.2
	50% iprodione suspension	8.6	3.11	35.20	5.3
	Expected control efficiency after mixing the two components	-	-	-	75.6
	21% benziothiazolinone-iprodione microemulsion (benziothiazolinone:iprodione=20:1)	180.0	3.32	6.55	83.5
Embodiment 41	15% benziothiazolinone emulsion in water	150.0	3.56	15.91	62.6
	50% iprodione suspension	30.0	3.25	31.19	19.7
	Expected control efficiency after mixing the two components	-	-	-	70.0
	30% benziothiazolinone-iprodione emulsion in water (benziothiazolinone:iprodione=25:5)	180.0	3.41	5.34	86.9
Embodiment 42	15% benziothiazolinone emulsion in water	8.6	3.51	35.44	15.5

	50% iprodione suspension	171.4	3.12	14.43	61.3
	Expected control efficiency after mixing the two components	-	-	-	67.3
	42% benziothiazolinone-iprodione emulsion in water (benziothiazolinone:iprodione=2:40)	180.0	3.11	6.28	83.1
Embodiment 49	15% benziothiazolinone emulsion in water	30.0	3.22	30.48	20.8
	50% iprodione suspension	150.0	2.96	13.69	61.3
	Expected control efficiency after mixing the two components	-	-	-	69.3
	18% benziothiazolinone-iprodione oil suspension (benziothiazolinone:iprodione=3:15)	180.0	2.90	3.99	88.5
Embodiment 50	15% benziothiazolinone emulsion in water	163.6	2.86	10.36	69.7
	50% iprodione suspension	16.4	2.91	31.44	9.6
	Expected control efficiency after mixing the two components	-	-	-	72.6
	22% benziothiazolinone-iprodione oil suspension (benziothiazolinone:iprodione=20:2)	180.0	3.19	6.33	83.4
	Water control (CK)	-	-	3.21	38.36

Test results (Table 7) show that, the compound benziothiazolinone and iprodione has significantly improved control efficiency on pepper cinerea, indicating that the compound of the two has a significant synergistic effect on pepper cinerea.

5 (4) Field efficacy verification test of compound benziothiazolinone and epoxiconazol mixture on sigatoka

Table 8 Prevention and treatment effect of compound benziothiazolinone and epoxiconazol on sigatoka

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency

					(%)
Embodiment 7	15% benziotiazolinone emulsion in water	96.8	3.11	9.90	76.2
	50% epoxiconazol suspension	3.2	3.23	41.45	4.1
	Expected control efficiency after mixing the two components	-	-	-	77.2
	62% benziotiazolinone-epoxiconazol water dispersible granule (benziotiazolinone:epoxiconazol ratio=60:2)	100.0	3.52	7.49	84.1
Embodiment 8	15% benziotiazolinone emulsion in water	3.2	3.81	47.26	7.3
	50% epoxiconazol suspension	96.8	3.92	17.41	66.8
	Expected control efficiency after mixing the two components	-	-	-	69.2
	62% benziotiazolinone-epoxiconazol water dispersible granule (benziotiazolinone:epoxiconazol ratio=2:60)	100.0	3.28	7.55	82.8
Embodiment 15	15% benziotiazolinone emulsion in water	90.9	3.69	13.77	72.1
	50% epoxiconazol suspension	9.1	3.72	46.44	6.7
	Expected control efficiency after mixing the two components	-	-	-	74.0
	55% benziotiazolinone-epoxiconazol suspension (benziotiazolinone:epoxiconazol ratio=50:5)	100.0	3.71	7.10	85.7
Embodiment 16	15% benziotiazolinone emulsion in water	9.1	3.55	38.52	18.9
	50% epoxiconazol suspension	90.9	3.88	20.40	60.7
	Expected control efficiency after mixing the two components	-	-	-	68.1
	55% benziotiazolinone-epoxiconazol suspension (benziotiazolinone:epoxiconazol ratio=5:50)	100.0	3.83	7.28	85.8
Embodiment 26	15% benziotiazolinone emulsion in water	2.3	3.56	44.82	5.9
	50% epoxiconazol suspension	97.7	3.34	14.39	67.8
	Expected control efficiency after mixing the two components	-	-	-	69.7
	88% benziotiazolinone-epoxiconazol wettable	100.0	3.63	8.21	83.1

	powder (benzothiazolinone:epoxiconazol ratio=2:86)				
Embodiment 27	15% benzothiazolinone emulsion in water	97.3	3.55	11.16	76.5
	50% epoxiconazol suspension	2.3	3.87	49.76	3.9
	Expected control efficiency after mixing the two components	-	-	-	77.4
	86% benzothiazolinone:epoxiconazol wetable powder (benzothiazolinone:epoxiconazol ratio=84:2)	100.0	3.93	9.04	82.8
Embodiment 28	15% benzothiazolinone emulsion in water	50.0	3.59	25.22	47.5
	50% epoxiconazol suspension	50.0	3.55	30.97	34.8
	Expected control efficiency after mixing the two components	-	-	-	65.8
	50% benzothiazolinone:epoxiconazol wetable powder (benzothiazolinone:epoxiconazol ratio=25:25)	100.0	3.42	6.96	84.8
Embodiment 35	15% benzothiazolinone emulsion in water	16.7	3.83	37.00	27.8
	50% epoxiconazol suspension	83.3	3.89	24.72	52.5
	Expected control efficiency after mixing the two components	-	-	-	65.7
	12% benzothiazolinone:epoxiconazol microemulsion (benzothiazolinone:epoxiconazol ratio=2:10)	100.0	3.65	6.40	86.9
Embodiment 36	15% benzothiazolinone emulsion in water	66.7	3.87	25.73	50.3
	50% epoxiconazol suspension	33.3	3.93	41.28	21.5
	Expected control efficiency after mixing the two components	-	-	-	61.0
	15% benzothiazolinone:epoxiconazol microemulsion (benzothiazolinone:epoxiconazol ratio=10:5)	100.0	3.65	800.92	83.6
Embodiment 43	15% benzothiazolinone emulsion in water	95.2	3.68	12.41	74.8
	50% epoxiconazol suspension	4.8	3.89	49.34	5.2
	Expected control efficiency after mixing the two components	-	-	-	76.1

	21% benziotiazolinone:epoxiconazol emulsion in water (benziotiazolinone:epoxiconazol ratio=20:1)	100.0	2.75	5.78	84.3
Embodiment 44	15% benziotiazolinone emulsion in water	4.8	3.76	45.38	9.8
	50% epoxiconazol suspension	95.2	3.55	15.86	66.6
	Expected control efficiency after mixing the two components	-	-	-	69.9
	42% benziotiazolinone:epoxiconazol emulsion in water (benziotiazolinone:epoxiconazol ratio=2:40)	100.0	3.31	6.60	85.1
Embodiment 51	15% benziotiazolinone emulsion in water	83.3	3.69	18.51	62.5
	50% epoxiconazol suspension	16.7	3.82	43.29	15.3
	Expected control efficiency after mixing the two components	-	-	-	68.2
	30% benziotiazolinone:epoxiconazol oil suspension (benziotiazolinone:epoxiconazol ratio=25:5)	100.0	3.79	7.51	85.2
Embodiment 52	15% benziotiazolinone emulsion in water	33.3	3.55	31.78	33.1
	50% epoxiconazol suspension	66.7	3.65	29.20	40.2
	Expected control efficiency after mixing the two components	-	-	-	60.0
	45% benziotiazolinone:epoxiconazol oil suspension (benziotiazolinone:epoxiconazol ratio=15:30)	100.0	3.49	6.44	86.2
Water control (CK)	-	-	3.58	47.9	-

Test results (Table 8) show that, the compound benziotiazolinone and epoxiconazol has significantly improved control efficiency on sigatoka, indicating that the compound of the two has a significant synergistic effect on sigatoka.

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ABSTRACT

A synergistic fungicide composition, a formulation method and a use thereof are provided. The composition contains two active components A and B, where the active component A is benziothiazolinone, the active component B is iprodione, and the weight ratio of the two components is 1:50 to 50:1, and preferably 1:30 to 30:1. Test results show that, the fungicide composition has a significant synergistic effect, and more importantly, the application amount and the use-cost are reduced. The fungicide composition is effective in preventing and treating certain fungal diseases of crops such as food crops, vegetables and fruits.

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SYNERGISTIC FUNGICIDE COMPOSITION COMPRISING BENZISOTHIAZOLINONE

This application is a division of Canadian Application Serial No. 2,881,512 (parent application), filed August 20, 2012.

- 5 It should be understood that the expression “the present invention” or the like used in this specification may encompass not only the subject matter of this divisional application, but that of the parent application also.

BACKGROUND

Technical Field

- 10 The present invention belongs to the field of agricultural plant protection, particularly to a fungicide composition with improved performance, and specifically relates to a fungicide composition containing two active components.

Related Art

- 15 Benziothiazolinone is a fungicide and has the following functions and features: being a novel broad-spectrum fungicide, and being effective in preventing and treating fungal diseases. In the fungicidal process, the nucleus structure of the pathogenic fungi is destroyed, resulting lost of the heat part and death due to failure, the metabolism of the pathogenic fungus cells was interfered, resulting in physiologic disorders, and finally, leading to death. The pathogenic fungi are completely killed, and the desired effect of eradicating pathogenic
20 fungi is achieved. Benziothiazolinone is mainly used in preventing and treating cucumber downy mildew, pear scab, apple scab, orange anthracnose, grape anthracnose, and is effective in preventing and treating various bacterial diseases and fungal diseases.

- Dimethomorph is a morpholine-based broad-spectrum fungicide, has a unique mode of action on fungi of *Peronosporales* and *Peronophthoraceae* of phycomycetes, and is mainly to
25 cause degradation of sporangium wall, so as to cause death of fungi. Dimethomorph is fungicide dedicated to oomycetes fungi, and has the functions and features of destroying the

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formation of cell membrane, having effects in all stages of life cycle of oomycetes, being particularly sensitive in the formation stages of sporangiophores and oospores, being inhibited at a very low concentration (0.25 µg/ml), and having no cross resistance with phenylamides reagents.

- 5 Dithianon is a protective fungicide used for various leaf diseases of many pomefruits and stone fruits, has multi-mechanism. By reacting with a sulfur-containing groups and

interfering with cell respiration, dithianon inhibits a series of fungal enzymes, and finally causes death of fungi. Dithianon has good protective activity and a certain therapeutic activity. Suitable fruit crops include pomefruits and stone fruits such as apple, pear, peach, apricots, cherry, citrus, coffee, grape, strawberry and hop. Except powdery mildew, objects of prevention and treatment include almost all fruit tree diseases such as scab, mildew disease, leaf spot, rust, anthracnose, scab, downy mildew and brown rot.

Iprodione is a high-efficient dicarbonylimides broad-spectrum contact-type fungicide, has a certain treatment and prevention effect, and can be absorbed through roots and exert the systemic action. Iprodione is effective in preventing and treating fungi resistant to benzimidazoles absorption-type fungicides, and is suitable in preventing and treating diseases such as early leaf disease, gray mold and early blight of various fruit trees, vegetables, fruits and other crops.

Epoxiconazol is an absorption-type triazoles fungicide, has the mechanism of action of inhibiting synthesis of ergosterol pathogenic fungus and hindering the formation of the cell wall of pathogenic fungi. Epoxiconazol not only has good protecting, treating and eradicating activity, but also has absorption and good residual activity. Epoxiconazol can improve the chitinase activity of crops, thereby causing shrink of fungal haustoria, and inhibiting the invasion of pathogenic fungi, which is the unique characteristic of epoxiconazol among all triazoles products. Epoxiconazol has a good prevention and treatment effect on diseases such as leaf spot, powdery mildew and rust of crops such as bananas, garlic, celery, beans, melons, asparagus, peanuts and sugar beet and anthracnose, white rot of grapes.

Actual experiences of fungicide have shown that repeat application of one specific active compound to prevent and treat fungi will results in quick selectivity of fungal strains in many cases, in order to lower risk of selectivity of fungal strains, a mixture of compounds of different activities are commonly used to prevent and treat harmful fungi presently. Active compounds having different mechanisms of action are combined to delay the generation of resistance, and reduce the application amount and prevention and treatment costs.

SUMMARY

In view of the problems of fungicide resistance and residual in soil in practical applications, the technical problem to be solved by the present invention is: screening two fungicides of different fungicidal principles for combination, to improve the prevention and treatment effect of the fungicide, delay the emergence of resistance, reduce the application amount and prevention and treatment costs.

In order to solve the above technical problems, the present invention provides a fungicide composition. The composition contains two active components A and B, the active component A is benziothiazolinone, and the active component B is one selected from dithianon, dimethomorph, iprodione and epoxiconazol. The inventers find from experiments that the fungicide composition has a significant synergistic effect, and more importantly, the application amount and the use-cost are reduced. Compounds containing the component A and the component B have different structures, different mechanisms of action, the fungicidal spectrum can be expanded by combination of the two components, and the emergence and development speed of resistance of the pathogenic fungi is delayed, and moreover, the component A and the component B have no cross resistance.

Another objective of the present invention is to provide a method for preparing a fungicide composition containing two active components A and B and a use of the fungicide composition containing two active components A and B in the preventing and treating food crop diseases in the field of agriculture.

In the fungicide composition, the weight ratio of the component A and the component B is 1:50 to 50:1, and preferably 1:30 to 30:1.

The fungicide composition of the present invention is composed of 6 wt% to 92 wt% of active components and 94 wt% to 8 wt% of fungicide adjuvants.

The present invention provides a use of a fungicide composition containing a component A (benziothiazolinone) and a component B (one selected from dithianon, dimethomorph, iprodione and epoxiconazol) in preventing and treating plant diseases.

The composition further contains a support, an adjuvant and/or a surfactant. During

application, a common adjuvant can be mixed with the composition.

Suitable adjuvants may be a solid or liquid, and are generally a substance commonly used in formulation processing process, for example, natural or regenerated minerals, solvents, dispersing agents, wetting agents, adhesives, thickeners, binders or fertilizers.

- 5 A method for applying the composition of the present invention includes: applying the composition of the present invention on the aboveground part of plants, especially the leaves or foliages. The frequency of application and application amount depend on the biological characteristics and the climate survival conditions of the pathogen. A liquid formulation containing the composition may be used to wet the plant growing place such as
10 rice field, or the composition may be applied in the soil in the solid form, such as in the granular form (soil application), so that the composition can get into the plant body (systemic action) through the plant roots from the soil.

- These compositions may merely contain the active components and be applied, and may also mixed with additives for use, so the composition of the present invention may be
15 formulated into various formulations, for example, wettable powder, a suspension, an oil suspension, a water dispersible granule, an emulsion in water and a microemulsion. According to the properties of these compositions and the purpose to be achieved by applying the composition as well as the environmental conditions, the method for applying the composition may be selected to be spraying, atomizing, dusting, scattering or pouring
20 and the like.

The composition of the present invention can be formulated into various formulations by known methods, the active components and an adjuvant such as a solvent and a solid support may be fully mixed with a surfactant and granulated when required, and formulated into a desired formulation.

- 25 The solvent may be selected from: aromatic hydrocarbons, and preferably aromatic hydrocarbons containing 8 to 12 carbon atoms, for example, xylene mixture or substituted benzene; phthalates, for example, dibutyl phthalates and dioctyl phthalate; aliphatic hydrocarbons, for example, cyclohexane and paraffins; alcohols and glycols and ethers and

esters thereof, for example, ethanol, ethylene glycol, ethylene glycol monomethyl; ketones, for example, cyclohexanone; strongly polar solvent, for example, N-methyl-2-pyrrolidone, dimethyl sulfoxide and dimethylformamide; and vegetable oils, for example, soybean oil.

The solid supports useful in powder and dispersible granule are generally natural
 5 mineral fillers, for example, talc, kaolin, montmorillonite and attapulgite. For the control of the physical performance of the composition, highly dispersed silicic acid or a highly dispersed adsorbing polymer support such as a granular adsorbing support and non-adsorbing support may be added, where a suitable granular adsorbing support is porous, for example, pumice, bentonite and bentonite; a suitable non-adsorbing support is, for
 10 example, calcite and sand. Furthermore, a large amount of inorganic or organic preformed granular materials, especially, dolomite, may be used as support.

According to the chemical properties of the active components in the composition of the present invention, a suitable surfactant is lignosulfonic acid, naphthalenesulfonic acid, phenolsulfonic acid, alkaline earth metal or ammonium salts, alkylaryl sulfonates, alkyl
 15 sulfates, alkyl sulfonates, fatty alcohol sulphates and fatty acids and sulfated fatty alcohol ethylene glycol esters, condensates of sulfonated naphthalene and naphthalene derivatives with formaldehyde, condensates of naphthalene or naphthalenesulfonic acid with phenol and formaldehyde, polyoxyethylene octyl phenyl ether, ethoxylated iso-octyl phenol, octyl phenol, nonylphenol, alkylaryl polyglycol ethers, triethylbenzene polyglycol ethers,
 20 tristearylphenyl polyglycol ethers, alkylaryl polyether alcohols, ethoxylated castor oil, polyoxyethylene alkyl ethers, ethylene oxide condensates, ethoxylated polyoxypropylene, lauric acid polyethylene glycol ether acetal, sorbate, lignosulphite wastewater and methylcellulose.

The two active components in the composition of the present invention has a
 25 synergistic effect, and the activity of the composition is more significant than the sum of the expected activity of using single compounds and the individual activity of single compounds. Due to the synergistic effect, the application amount is decreased, and the fungicidal control spectrum is broadened, the prevention and treatment effects can be achieved quickly and last longer, so that by merely one or several times of application, the

fungi harmful to plants can be controlled better, and the possible application interval is widened. There features are specially required in the practice process of controlling plant fungi. The composition of the present invention is especially effective for the following food crop diseases: cucumber downy mildew pathogenic fungi, cucumber gray mold, sigatoka, grape downy mildew and litchi blight.

The fungicide composition of the present invention also has other features: 1. the mixture of composition of the present invention has a significant synergistic effect; 2, since the two single components of the composition have great difference in structure, and completely different mechanisms of action, and have no cross resistance, the resistance generated when the two single components are used alone can be delayed; 3. the composition of the present invention is safe to crops and has a good prevention and treatment effect. It is proved by test that, the fungicide composition of the present invention has stable chemical properties and significant synergistic effect, and exhibits a significant synergistic effect and complementary effect on prevention and treatment targets.

BRIEF DESCRIPTION OF THE DRAWINGS

No drawings.

DETAILED DESCRIPTION

In order to make the objective, technical solutions and advantages of the present invention clearer and more comprehensive, the present invention is further described in detail below with the following embodiments. It should be understood that, the specific embodiment described herein are merely used to illustrate the present invention, but are not intended to limit the present invention, and any modification, equivalent replacement and improvement made within the spirit and principle of the present invention shall all fall within the protection scope of the present invention.

Percentages in all formulas in the following embodiments all are weight percentages. Processes for processing the preparations of the composition of the present invention all are existing technologies, and may vary according to different conditions.

I) Embodiments of preparation of formulations

(I) Processing of water dispersible granule and Embodiments

The active component benziethiazolinone and one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with an adjuvant and a filler at the formula ratio, the mixture was pulverized into wettable powder by airflow, and the wettable powder
 5 was mixed with a certain amount of water and then subjected to extrusion granulation, drying and sieving, to obtain the water dispersible granule product.

Embodiment 1: 62% benziethiazolinone·dithianon water dispersible granule

60% benziethiazolinone, 2% dithianon, 4% sodium alkyl naphthalene sulfonate, 3% sodium dodecyl sulfonate, 3% ammonium sulfate, complemented to 100% with light
 10 calcium carbonate.

Embodiment 2: 65% benziethiazolinone·dithianon water dispersible granule

2% benziethiazolinone, 63% dithianon, 5% sodium lignosulfonate, 7% sodium methyl naphthalene sulfonate-formaldehyde condensate, 3% sodium dodecyl sulfate, complemented to 100% with diatomite.

Embodiment 3: 65% benziethiazolinone·dimethomorph water dispersible granule

63% benziethiazolinone, 2% dimethomorph, 6% sodium lignosulfonate, 3% sodium dodecyl sulfonate, 1% xanthan gum, 1% sodium carboxymethyl starch, complemented to 100% with attapulgate.

Embodiment 4: 85% benziethiazolinone·dimethomorph water dispersible granule

20 2% benziethiazolinone, 83% dimethomorph, 1% ammonium sulfate, 2% alginate, 1% sodium methyl naphthalene sulfonate-formaldehyde condensate, 1% organosilicone, complemented to 100% with bentonite.

Embodiment 5: 62% benziethiazolinone·iprodione water dispersible granule

60% benziethiazolinone, 2% iprodione, 2% sodium dodecyl sulfonate, 2% sodium
 25 alkyl naphthalene sulfonate, 3% ammonium sulfate, complemented to 100% with light calcium carbonate.

Embodiment 6: 75% benziothiazolinone·iprodione water dispersible granule

2% benziothiazolinone, 73% iprodione, 5% sodium methyl naphthalene sulfonate-formaldehyde condensate, 4% sodium lignosulfonate, 3% sodium dodecyl sulfate, complemented to 100% with diatomite.

5 **Embodiment 7:** 62% benziothiazolinone·epoxiconazol water dispersible granule

60% benziothiazolinone, 2% epoxiconazol, 1% sodium carboxymethyl starch, 4% sodium dodecyl sulfonate, 4% sodium lignosulfonate, 1% xanthan gum, complemented to 100% with attapulgate.

Embodiment 8: 62% benziothiazolinone·epoxiconazol water dispersible granule

10 2% benziothiazolinone, 60% epoxiconazol, 1% ammonium sulfate, 2% alginate, 1% sodium methyl naphthalene sulfonate-formaldehyde condensate, 1% organosilicone, complemented to 100% with bentonite.

(II) Processing of suspension and embodiments

15 The active component benziothiazolinone and one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with the components such as a dispersant, a wetting agent, a thickener and water at the formula ratio, the mixture was then subjected to sanding and/or high-speed shearing, to obtain a semi-finished product, and the semi-finished product was fully mixed water after analysis and filtered, to obtain the finished product.

20 **Embodiment 9:** 35% benziothiazolinone·dithianon suspension

25% benziothiazolinone, 100% dithianon, 7% sodium lignosulfonate, 0.8% xanthan gum, 3% bentonite, 1% magnesium aluminum silicate, 4% ethylene glycol, complemented to 100% with water.

Embodiment 10: 36% benziothiazolinone·dithianon suspension

25 12% benziothiazolinone, 24% dithianon, 6% sodium methyl naphthalene sulfonate-formaldehyde condensate, 4% bentonite, 5% glycerol, complemented to 100% with water.

Embodiment 11: 42% benziothiazolinone·dimethomorph suspension

40% benziothiazolinone, 2% dimethomorph, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

5 **Embodiment 12:** 32% benziothiazolinone·dimethomorph suspension

5% benziothiazolinone, 27% dimethomorph, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

Embodiment 13: 55% benziothiazolinone·iprodione suspension

50% benziothiazolinone, 5% iprodione, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

Embodiment 14: 42% benziothiazolinone·iprodione suspension

2% benziothiazolinone, 40% iprodione, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

15 **Embodiment 15:** 55% benziothiazolinone·epoxiconazol suspension

50% benziothiazolinone, 5% epoxiconazol, 7% polyoxyethylene fatty alcohol ether phosphate, 3% white carbon black, 6% glycerol, 2% calcium benzoate, complemented to 100% with water.

Embodiment 16: 55% benziothiazolinone·epoxiconazol suspension

5% benziothiazolinone, 50% epoxiconazol, 7% sodium lignosulfonate, 3% white carbon black, 6% ethylene glycol, 1% xanthan gum, complemented to 100% with water.

(III) Processing of wettable powder and embodiments

The active component A benziothiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with various adjuvants and fillers at ratios, and the mixture was pulverized by an ultrafine pulverizer, to obtain a wettable powder.

Embodiment 17: 90% benziotiazolinone·dithianon wettable powder

2% benziotiazolinone, 88% dithianon, 2% calcium lignosulphonate, 1% sodium dodecylbenzene sulfonate, 2% bentonite, complemented to 100% with attapulgate.

Embodiment 18: 88% benziotiazolinone·dithianon wettable powder

5 86% benziotiazolinone, 2% dithianon, 1% polyoxyethylene alkyl ether sulfonate, 2% nekal, 1.5% bentonite, 2% white carbon black, complemented to 100% with diatomite 100%.

Embodiment 19: 55% benziotiazolinone·dithianon wettable powder

25% benziotiazolinone, dithianon 30%, 6% alkyl sulfonate, 6% sodium lignosulfonate,
10 11% white carbon black, complemented to 100% with kaolin.

Embodiment 20: 88% benziotiazolinone·dimethomorph wettable powder

86% benziotiazolinone, 2% dimethomorph, 2% polyoxyethylene octyl phenyl ether, 6% sodium lignosulfonate, 4% white carbon black, complemented to 100% with diatomite.

Embodiment 21: 50% benziotiazolinone·dimethomorph wettable powder

15 25% benziotiazolinone, 25% dimethomorph, 7% calcium lignosulphonate, 5% white carbon black, 3% sodium dodecylbenzene sulfonate, complemented to 100% with attapulgate.

Embodiment 22: 62% benziotiazolinone·dimethomorph wettable powder

2% benziotiazolinone, 60% dimethomorph, 5% calcium lignosulphonate, 4%
20 bentonite, 3% polyoxyethylene octyl phenyl ether, complemented to 100% with attapulgate.

Embodiment 23: 85% benziotiazolinone·iprodione wettable powder

83% benziotiazolinone, 2% iprodione, 1% polyoxyethylene octyl phenyl ether, 2% sodium lignosulfonate, 3% white carbon black, complemented to 100% with diatomite.

Embodiment 24: 50% benziotiazolinone·iprodione wettable powder

25 25% benziotiazolinone, 25% iprodione, 3% sodium dodecylbenzene sulfonate, 5% white carbon black, 7% calcium lignosulphonate, complemented to 100% with attapulgate.

Embodiment 25: 85% benziotiazolinone·iprodone wettable powder

3% benziotiazolinone, 82% iprodione, 5% calcium lignosulphonate, 4% bentonite, 3% polyoxyethylene octyl phenyl ether, complemented to 100% with attapulgite.

Embodiment 26: 88% benziotiazolinone·epoxiconazol wettable powder

5 2% benziotiazolinone, 86% epoxiconazol, 2% sodium dodecylbenzene sulfonate, 1% bentonite, 2% calcium lignosulphonate, complemented to 100% with attapulgite.

Embodiment 27: 86% benziotiazolinone·epoxiconazol wettable powder

84% benziotiazolinone, 2% epoxiconazol, 1% nekal, 2% polyoxyethylene alkyl ether sulfonate, 15% bentonite, 2% white carbon black, complemented to 100% with
10 diatomite 100%.

Embodiment 28: 50% benziotiazolinone·epoxiconazol wettable powder

25% benziotiazolinone, 25% epoxiconazol, 6% sodium lignosulfonate, 6% alkyl sulfonate, 11% white carbon black, complemented to 100% with kaolin.

(IV) Processing of microemulsion and embodiments

15 The active component A benziotiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were completely dissolved in a solvent, and at the same time, an emulsifier, a synergistic effect adjuvant and a cryoprotectant were added with stirring, after the system was fully mixed, water was slowly added to the mixture, and the mixture was fully stirred, to obtain a microemulsion of
20 different contents.

Embodiment 29: 18% benziotiazolinone·dithianon microemulsion

3% benziotiazolinone, 15% dithianon, 15% acetone, 0.5% compound sodium nitrophenolate, 5% alkyl polyoxyethylene ether and nonylphenol polyoxyethylene ether, 1% propylene glycol, 2% urea, complemented to 100% with water.

25 **Embodiment 30:** 30% benziotiazolinone·dithianon microemulsion

25% benziotiazolinone, 5% dithianon, 4% polyoxyethylene aliphate and phenethyl

phenol polyoxyethylene ether, 2% glycerol, 11% methanol, 1% azone, complemented to 100% with water.

Embodiment 31: 15% benziotiazolinone·dimethomorph microemulsion

5 5% benziotiazolinone, 10% dimethomorph, 16% alkyl benzene sulfonate and alkyl naphthalene sulfonate, 1% thiazone, 16% ethyl acetate, 1% propylene glycol, complemented to 100% with water.

Embodiment 32: 15% benziotiazolinone·dimethomorph microemulsion

10 10% benziotiazolinone, 5% dimethomorph, 8% calcium dodecylbenzene sulfonate, 0.5% thiazone, 14% sorbic acid, 3% polyethylene glycol, complemented to 100% with water.

Embodiment 33: 18% benziotiazolinone·iprodione microemulsion

6% benziotiazolinone, 12% iprodione, 15% acetone, 0.5% compound sodium nitrophenolate, 5% alkyl polyoxyethylene ether and nonylphenol polyoxyethylene ether, 1% propylene glycol, 2% urea, complemented to 100% with water.

15 **Embodiment 34:** 21% benziotiazolinone·iprodione microemulsion

20% benziotiazolinone, 1% iprodione, 4% polyoxyethylene aliphate and phenethyl phenol polyoxyethylene ether, 2% glycerol, 11% methanol, 1% azone, complemented to 100% with water.

Embodiment 35: 12% benziotiazolinone·epoxiconazol microemulsion

20 2% benziotiazolinone, 10% epoxiconazol, 1% propylene glycol, 13% alkyl benzene sulfonate and alkyl naphthalene sulfonate, 1% thiazone, 11% ethyl acetate, complemented to 100% with water.

Embodiment 36: 15% benziotiazolinone·epoxiconazol microemulsion

25 10% benziotiazolinone, 5% epoxiconazol, 14% sorbic acid, 1% thiazone, 7% calcium dodecylbenzene sulfonate, 2% polyethylene glycol, complemented to 100% with water.

(V) Processing of emulsion in water and embodiments

In an emulsifying kettle, the active component A benziotiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were fully mixed with a solvent and an adjuvant under mechanical stirring, an emulsifier and a stabilizer were then added and fully stirred, finally, water was added, and the mixture was stirred for 10 to 30 min at a rotation rate of 100 to 12000 rpm, to obtain a uniform emulsion product.

Embodiment 37: 42% benziotiazolinone·dithianon emulsion in water

40% benziotiazolinone, 2% dithianon, 4% dimethyl N-phthalate, 3% nonylphenol phenoxy vinyl ether, 2% 2,6-tert-butyl-4-methylphenol, 3% ethylene glycol, 1% polyvinyl alcohol, 1% calcium benzoate, 0.8% organic silicon defoamer, complemented to 100% with water.

Embodiment 38: 44% benziotiazolinone·dithianon emulsion in water

4% benziotiazolinone, 40% dithianon, 4% butylhydroxyanisole, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 2% propylene glycol, 3% xanthan gum, 1% polyvinyl alcohol, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 39: 22% benziotiazolinone·dimethomorph emulsion in water

20% benziotiazolinone, 2% dimethomorph, 3% polyoxyethylene block copolymer, 1% propylene glycol, 2% xanthan gum, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 40: 22% benziotiazolinone·dimethomorph emulsion in water

2% benziotiazolinone, 20% dimethomorph, 2% N-dodecylpyrrolidone, 1% polyoxyethylene castor oil, 3% glycerol, 12% polyvinyl alcohol, 1% calcium benzoate, 2% isooctanol, complemented to 100% with water.

Embodiment 41: 30% benziotiazolinone·iprodione emulsion in water

25% benziotiazolinone, 5% iprodione, 1% 2,6-tert-butyl-4-methylphenol, 2% nonylphenol phenoxy vinyl ether, 3% ethylene glycol, 1% calcium benzoate, 2% dimethyl N-phthalate, 1% polyvinyl alcohol, 1% organic silicon defoamer, complemented to 100%

with water.

Embodiment 42: 42% benziothiazolinone·iprodone emulsion in water

2% benziothiazolinone, 40% iprodione, 2% propylene glycol, 3% butylhydroxyanisole, 3% polyisobutylene anhydride-polyethylene glycol copolymer, 3% xanthan gum, 1%
5 polyvinyl alcohol, 1.2% organic silicon defoamer, complemented to 100% with water.

Embodiment 43: 21% benziothiazolinone·epoxiconazol emulsion in water

20% benziothiazolinone, 1% epoxiconazol, 1% propylene glycol, 1% xanthan gum, 2% polyisobutylene anhydride-polyethylene glycol copolymer, 2% polyoxyethylene block copolymer, 1.5% organic silicon defoamer, complemented to 100% with water.

10 **Embodiment 44:** 42% benziothiazolinone·epoxiconazol emulsion in water

2% benziothiazolinone, 40% epoxiconazol, 2% polyoxyethylene castor oil, 1% N-dodecylpyrrolidone, 2% glycerol, 1.1% polyvinyl alcohol, 2% calcium benzoate, 1% isooctanol, complemented to 100% with water.

(VI) Processing of oil suspension and embodiments

15 The active component A benziothiazolinone and the active component B of one of dithianon, dimethomorph, iprodione and epoxiconazol were mixed with various components such as a dispersant, a stabilizer, a defoamer and a solvent at the formula ratio, and the mixture was placed in a sanding kettle for milling, then sent to a homogenizer and fully mixed, to obtain the finished product.

20 **Embodiment 45:** 42% benziothiazolinone·dithianon oil suspension

2% benziothiazolinone, 40% dithianon, 8% sodium lignosulfonate, 4% bentonite, 1% xanthan gum, 2% organic silicon defoamer, complemented to 100% with soybean oil.

Embodiment 46: 55% benziothiazolinone·dithianon oil suspension

50% benziothiazolinone, 5% dithianon, 8% nekal, 5% bentonite, 2% organosilicone,
25 complemented to 100% with engine oil.

Embodiment 47: 30% benziothiazolinone·dimethomorph oil suspension

25% benziotiazolinone, 5% dimethomorph, 8% naphthalene sulfonic acid-formaldehyde condensate, 5% diatomite, 2% aluminium-magnesium silicate, complemented to 100% with dichloroethane.

Embodiment 48: 42% benziotiazolinone·dimethomorph oil suspension

5 2% benziotiazolinone, 40% dimethomorph, 11% sodium lignosulfonate, 4% aerosil, 2% aluminium-magnesium silicate, complemented to 100% with castor oil.

Embodiment 49: 18% benziotiazolinone·iprodione oil suspension

3% benziotiazolinone, 15% iprodione, 1% organic silicon defoamer, 3% bentonite, 7% sodium lignosulfonate, 1% xanthan gum, complemented to 100% with soybean oil.

10 **Embodiment 50:** 22% benziotiazolinone·iprodione oil suspension

20% benziotiazolinone, 2% iprodione, 3% bentonite, 7% nekal, 2% organosilicone, complemented to 100% with engine oil.

Embodiment 51: 30% benziotiazolinone·epoxiconazol oil suspension

15 25% benziotiazolinone, 5% epoxiconazol, 8% naphthalene sulfonic acid-formaldehyde condensate, 5% diatomite, 2% aluminium-magnesium silicate, complemented to 100% with dichloroethane.

Embodiment 52: 45% benziotiazolinone·epoxiconazol oil suspension

15% benziotiazolinone, 30% epoxiconazol, 11% sodium lignosulfonate, 4% aerosil, 2% aluminium-magnesium silicate, complemented to 100% with castor oil.

20 **II) Efficacy verification test**

(I) Biological assay embodiments

1. Test of toxicity of compound benziotiazolinone and dithianon on cucumber downy mildew pathogenic fungi

Subjects for test: cucumber downy mildew pathogenic fungi

25 The incidence of whole cucumber leaves was investigated according to test grading level, and the disease index and the prevention and treatment effect were calculated.

The prevention and treatment effect was converted into probability values (y), the heights of the chemicals ($\mu\text{g/ml}$) were converted into logarithm values (x), the toxicity equation and the median inhibition concentration EC_{50} were calculated by the least square method, and the toxicity index level co-toxicity coefficient (CTC) of the chemicals was calculated according to the Sun Yunpei's method.

Actual toxicity index (ATI)=(EC_{50} of the standard reagent/ EC_{50} of the test reagent) x 100

Theoretical toxicity index (TTI)=the toxicity index of chemical A x the percentage of A in the mixture + the toxicity index of chemical B x the percentage of B in the mixture

Co-toxicity coefficient (CTC)=[Actual toxicity index (ATI) of the mixture/Theoretical toxicity index (TTI) of the mixture] x 100

$\text{CTC} \leq 80$, indicating that the composition had the antagonistic effect, $80 < \text{CTC} < 120$, indicating that the composition had the additive effect, and $\text{CTC} \geq 120$, indicating that the composition had the synergistic effect.

Table 1 Analysis of results of test of toxicity of benziothiazolinone, dithianon and compound benziothiazolinone and dithianon on cucumber downy mildew

Names of reagents	EC_{50} ($\mu\text{g/ml}$)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziothiazolinone	3.25	100.0	/	/
Dithianon	5.41	60.1	/	/
Benziothiazolinone:dithianon ratio=50:1	2.37	137.13	99.215	138.215
Benziothiazolinone:dithianon ratio=30:1	1.91	170.16	98.67	172.454
Benziothiazolinone:dithianon ratio=10:1	1.58	205.69	96.37	213.438
Benziothiazolinone:dithianon ratio=1:1	2.08	156.25	80.05	195.191
Benziothiazolinone:dithianon ratio=1:10	2.26	143.81	63.73	225.655
Benziothiazolinone:dithianon ratio=1:30	3.79	85.61	61.43	139.358

Benziothiazolinone:dithianon ratio=1:50	4.18	77.76	60.88	127.720
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The results (Table 1) show that, the compound benziethiazolinone and dithianon has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziethiazolinone and dithianon is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziethiazolinone and dithianon is 135 and more, and the synergistic effect is significant.

2. Test of toxicity of compound benziethiazolinone and dimethomorph on cucumber downy mildew

Table 2 Analysis of results of test of toxicity of benziethiazolinone, dimethomorph and compound benziethiazolinone and dimethomorph on cucumber downy mildew

Names of reagents	EC ₅₀ (μg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziethiazolinone	4.08	100.0	/	/
Dimethomorph	6.36	63.9	/	/
Benziethiazolinone:dimethomorph ratio=50:1	2.99	136.5	99.29	137.48
Benziethiazolinone:dimethomorph ratio=30:1	2.40	170.0	98.835	172.00
Benziethiazolinone:dimethomorph ratio=10:1	2.12	192.4	96.718	198.93
Benziethiazolinone:dimethomorph ratio=1:1	2.01	203.0	81.95	247.71
Benziethiazolinone:dimethomorph ratio=1:10	2.91	140.2	67.18	208.69
Benziethiazolinone:dimethomorph ratio=1:30	3.33	122.5	65.17	187.97
Benziethiazolinone:dimethomorph ratio=1:50	4.87	83.8	64.6	129.72

The results (Table 2) show that, the compound benziethiazolinone and dimethomorph has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber

downy mildew pathogenic fungi. Especially when the ratio of benziothiazolinone and dimethomorph is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziothiazolinone and dithianon is 170 and more, and the synergistic effect is significant.

3. Test of toxicity of compound benziothiazolinone and iprodione on cucumber downy mildew

Table 3 Analysis of results of test of toxicity of benziothiazolinone, iprodione and compound benziothiazolinone and iprodione on cucumber downy mildew

Names of reagents	EC ₅₀ (μg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziothiazolinone	4.21	100.00	/	/
Iprodione	5.82	72.34	/	/
Benziothiazolinone:dimethomorph ratio=50:1	3.32	126.81	99.458	127.50
Benziothiazolinone:iprodione ratio=30:1	3.05	138.03	99.108	139.27
Benziothiazolinone:iprodione ratio=10:1	2.29	183.84	97.485	188.58
Benziothiazolinone:iprodione ratio=1:1	2.07	203.38	86.170	236.02
Benziothiazolinone:iprodione ratio=1:10	2.54	165.75	74.855	221.43
Benziothiazolinone:iprodione ratio=1:30	4.18	100.72	73.232	137.54
Benziothiazolinone:iprodione ratio=1:50	4.62	91.13	72.882	125.04

The results (Table 3) show that, the compound benziothiazolinone and iprodione has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziothiazolinone and iprodione is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziothiazolinone and iprodione is 135 and more, and the synergistic effect is significant.

4. Test of toxicity of compound benziothiazolinone and epoxiconazol on cucumber downy mildew

Table 4 Analysis of results of test of toxicity of benziythiazolinone, epoxiconazol and compound benziythiazolinone and epoxiconazol on cucumber downy mildew

Names of reagents	EC ₅₀ (μg/ml)	ATI	TTI	Co-toxicity coefficient (CTC)
Benziythiazolinone	3.81	100.00	/	/
Epoxiconazol	4.25	89.65	/	/
Benziythiazolinone:Epoxiconazol ratio=50:1	2.90	131.343	99.797	131.61
Benziythiazolinone:epoxiconazol ratio=30:1	2.56	148.722	99.666	149.22
Benziythiazolinone:epoxiconazol ratio=10:1	1.97	193.680	99.059	195.52
Benziythiazolinone:epoxiconazol ratio=1:1	1.59	240.106	94.825	253.21
Benziythiazolinone:epoxiconazol ratio=1:10	1.94	196.383	90.591	216.78
Benziythiazolinone:epoxiconazol ratio=1:30	3.02	126.274	89.645	140.86
Benziythiazolinone:epoxiconazol ratio=1:50	3.51	108.403	89.353	121.32

The results (Table 4) show that, the compound benziythiazolinone and epoxiconazol has significantly improved prevention and treatment effect on cucumber downy mildew, indicating that the compound of the two has a significant synergistic effect on cucumber downy mildew pathogenic fungi. Especially when the ratio of benziythiazolinone and epoxiconazol is in the range of 1:30 to 30:1, the co-toxicity coefficient of benziythiazolinone and epoxiconazol is 140 and more, and the synergistic effect is significant.

10 (II) Field efficacy verification test

Test method: In the early period, the reagent was immediately sprayed for the first time, and 7 days later, the reagent was applied for the second time, each treatment had 4 sections, and each section had a size of 20 m². The incidence was investigated before application of the reagent and 10 days after the second application of the reagent, each section was randomly sampled at 5 points, 5 crops were investigated at each point, the percentage of the

lesion area in the leaf area of each leave on the whole crop was investigated, the leaves were graded, and the disease index and the prevention and treatment effect were calculated.

$$\text{Disease index} = \frac{\Sigma(\text{Incidence of leaves of various levels} \times \text{Representative value of this level})}{\text{The total number of leaves} \times \text{Representative value of the highest level}} \times 100$$

$$\text{Prevention and treatment effect (\%)} = \left(1 - \frac{\text{Pre-reagent control disease index} \times \text{Post-reagent treatment disease index}}{\text{Post-reagent control disease index} \times \text{Pre-reagent treatment disease index}}\right) \times 100$$

- 5 Expected control efficiency (%) = $X+Y-XY/100$ (where X and Y are control efficiency of single reagent)

Grading standard:

0 grade: Having no lesion;

1 grade: having less than 5 leaf lesions, and the length of lesions being less than 1 cm;

- 10 3 grade: having 6 to 10 leaf lesions, and the length of some lesions being greater than 1 cm;

5 grade: having 11 to 25 leaf lesions, some lesions being contiguous, and the area of the lesions being 10% to 25% of the leaf area;

- 15 7 grade: having 26 and more leaf lesions, lesions being contiguous, and the area of the lesions being 26% to 50% of the leaf area;

9 grade: lesions being contiguous, and the area of the lesions being 50% and more of the leaf area or the entire leave withering up.

(1) Field efficacy verification test of compound benziothiazolinone and dithianon on grape downy mildew

- 20 Table 5 Prevention and treatment effect of compound benziothiazolinone and dithianon mixture on grape downy mildew

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency (%)

Embodiment 1	15% benziethiazolinone emulsion in water	125.8	2.79	6.46	85.8
	50% dithianon suspension	4.2	3.21	50.51	3.5
	Expected control efficiency after mixing the two components	-	-	-	86.3
	62% benziethiazolinone·dithianon water dispersible granule (benziethiazolinone:dithianon=60:2)	130.0	3.02	3.05	93.8
Embodiment 2	15% benziethiazolinone emulsion in water	4	2.81	40.00	12.7
	50% dithianon suspension	126	2.9	11.25	76.2
	Expected control efficiency after mixing the two components	-	-	-	79.2
	65% benziethiazolinone·dithianon water dispersible granule (benziethiazolinone:dithianon=2:63)	130.0	2.88	4.60	90.2
Embodiment 9	15% benziethiazolinone emulsion in water	92.8	2.69	10.75	75.5
	50% dithianon suspension	37.2	2.79	39.26	13.7
	Expected control efficiency after mixing the two components	-	-	-	78.9
	35% benziethiazolinone·dithianon suspension (benziethiazolinone:dithianon=25:10)	130.0	2.72	2.35	94.7
Embodiment 10	15% benziethiazolinone emulsion in water	43.4	2.85	23.56	49.3
	50% dithianon suspension	86.6	2.98	30.37	37.5
	Expected control efficiency after mixing the two components	-	-	-	68.3
	36% benziethiazolinone·dithianon suspension (benziethiazolinone:dithianon=12:24)	130.0	2.83	2.17	95.3
Embodiment 17	15% benziethiazolinone emulsion in water	2.9	2.76	40.87	9.2
	50% dithianon suspension	127.1	3.04	11.15	77.5
	Expected control efficiency after mixing the two components	-	-	-	79.6
	90% benziethiazolinone·dithianon wettable powder (benziethiazolinone:dithianon=2:88)	130.0	2.93	5.83	87.8

Embodiment 18	15% benziethiazolinone emulsion in water	127	3	6.75	86.2
	50% dithianon suspension	3	2.87	45.35	3.1
	Expected control efficiency after mixing the two components	-	-	-	86.6
	88% benziethiazolinone·dithianon wettable powder (benziethiazolinone:dithianon=86:2)	130.0	2.91	4.65	90.2
Embodiment 19	15% benziethiazolinone emulsion in water	59	2.79	20.15	55.7
	50% dithianon suspension	71	2.85	31.46	32.3
	Expected control efficiency after mixing the two components	-	-	-	70.0
	55% benziethiazolinone·dithianon wettable powder (benziethiazolinone:dithianon=25:30)	130.0	3.02	4.19	91.5
Embodiment 29	15% benziethiazolinone emulsion in water	21.6	2.68	28.63	34.5
	50% dithianon suspension	108.4	2.89	22.01	53.3
	Expected control efficiency after mixing the two components	-	-	-	69.4
	18% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=3:15)	130.0	2.75	3.36	92.5
Embodiment 30	15% benziethiazolinone emulsion in water	108.4	2.87	10.06	78.5
	50% dithianon suspension	21.6	2.93	43.62	8.7
	Expected control efficiency after mixing the two components	-	-	-	80.37
	30% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=25:5)	130.0	2.85	3.63	92.2
Embodiment 37	15% benziethiazolinone emulsion in water	123.8	2.68	6.86	84.3
	50% dithianon suspension	6.2	2.89	45.15	4.2
	Expected control efficiency after mixing the two components	-	-	-	84.96
	42% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=40:2)	130.0	2.75	3.86	91.4

Embodiment 38	15% benziethiazolinone emulsion in water	11.8	2.76	34.34	23.7
	50% dithianon suspension	118.2	2.85	16.03	65.5
	Expected control efficiency after mixing the two components	-	-	-	73.7
	44% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=4:40)	130.0	3.11	3.14	93.8
Embodiment 45	15% benziethiazolinone emulsion in water	6.2	2.9	39.11	17.3
	50% dithianon suspension	123.8	2.85	14.36	69.1
	Expected control efficiency after mixing the two components	-	-	-	74.4
	42% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=2:40)	130	2.79	4.32	90.5
Embodiment 46	15% benziethiazolinone emulsion in water	118.2	3.05	9.05	81.8
	50% dithianon suspension	11.8	3.25	49.23	7.1
	Expected control efficiency after mixing the two components	-	-	-	83.1
	55% benziethiazolinone·dithianon microemulsion (benziethiazolinone:dithianon=50:5)	130	2.99	3.17	93.5
Water control (CK)	-	-	2.93	46.93	-

Test results (Table 5) show that, the compound benziethiazolinone and dithianon has significantly improved control efficiency on grape downy mildew, indicating that the compound of the two has a significant synergistic effect on grape downy mildew.

5 (2) Field efficacy verification test of compound benziethiazolinone and dimethomorph on litchi blight

Table 6 Prevention and treatment effect of compound benziethiazolinone and dimethomorph on litchi blight

Serial	Chemicals for treatment	Application amount	Disease index	11 days after second application of
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number		(a.i.g/ha)	before application of reagents	chemicals	
				Disease index	Control efficiency (%)
Embodiment 3	15% benziothiazolinone emulsion in water	145.4	2.51	5.95	81.2
	50% dimethomorph wettable powder	19.6	2.63	30.89	6.8
	Expected control efficiency after mixing the two components	-	-	-	82.5
	65% benziothiazolinone·dimethomorph water dispersible granule (benziothiazolinone:dimethomorph=63:2)	150.0	2.52	3.52	88.9
Embodiment 4	15% benziothiazolinone emulsion in water	3.5	2.32	28.50	2.5
	50% dimethomorph wettable powder	146.5	2.29	6.95	75.9
	Expected control efficiency after mixing the two components	-	-	-	76.5
	85% benziothiazolinone·dimethomorph water dispersible granule (benziothiazolinone:dimethomorph=2:83)	150	2.52	4.51	85.8
Embodiment 11	15% benziothiazolinone emulsion in water	142.9	2.45	6.14	80.1
	50% dimethomorph wettable powder	7.1	2.38	28.40	5.3
	Expected control efficiency after mixing the two components	-	-	-	81.2
	42% benziothiazolinone·dimethomorph suspension (benziothiazolinone:dimethomorph=40:2)	150.0	2.53	4.50	85.9
Embodiment 12	15% benziothiazolinone emulsion in water	23.4	2.26	21.47	24.6
	50% dimethomorph wettable powder	126.6	2.64	12.81	61.5
	Expected control efficiency after mixing the two components	-	-	-	71.0
	32% benziothiazolinone·dimethomorph suspension (benziothiazolinone:dimethomorph=5:27)	150	2.65	4.37	86.9
Embodiment 20	15% benziothiazolinone emulsion in water	146.6	2.54	5.60	82.5
	50% dimethomorph wettable powder	3.4	2.52	30.90	2.7
	Expected control efficiency after mixing the two components	-	-	-	83.0
	88% benziothiazolinone·dimethomorph wetable powder (benziothiazolinone:dimethomorph=86:2)	150.0	2.51	4.36	86.2

Embodiment 21	15% benziotiazolinone emulsion in water	75.0	2.72	14.29	58.3
	50% dimethomorph wettable powder	75.0	2.81	23.79	32.8
	Expected control efficiency after mixing the two components	-	-	-	72.0
	benziotiazolinone·dimethomorph wettable powder (benziotiazolinone:dimethomorph=25:25)	150.0	2.41	3.49	88.5
Embodiment 22	15% benziotiazolinone emulsion in water	4.8	2.36	28.58	3.9
	50% dimethomorph wettable powder	145.2	2.32	7.54	74.2
	Expected control efficiency after mixing the two components	-	-	-	75.2
	50% benziotiazolinone·dimethomorph wettable powder (benziotiazolinone:dimethomorph=2:60)	150.0	2.55	4.88	84.8
Embodiment 31:	15% benziotiazolinone emulsion in water	50.0	2.82	21.07	40.7
	50% dimethomorph wettable powder	100.0	2.53	16.74	47.5
	Expected control efficiency after mixing the two components	-	-	-	68.9
	15% benziotiazolinone·dimethomorph microemulsion	150.0	2.63	3.48	89.5
	(benziotiazolinone:dimethomorph=5:10)				
Embodiment 32	15% benziotiazolinone emulsion in water	100.0	2.66	10.66	68.2
	50% dimethomorph wettable powder	50.0	2.39	22.86	24.1
	Expected control efficiency after mixing the two components	-	-	-	75.9
	15% benziotiazolinone·dimethomorph microemulsion (benziotiazolinone:dimethomorph==10:5)	150.0	2.35	3.58	87.9
Embodiment 39	15% benziotiazolinone emulsion in water	136.4	2.56	6.90	78.6
	50% dimethomorph wettable powder	13.6	2.25	26.91	5.1
	Expected control efficiency after mixing the two components	-	-	-	79.7
	22% benziotiazolinone·dimethomorph emulsion in water (benziotiazolinone:dimethomorph=20:2)	150.0	3.01	5.20	86.3
Embodiment 40	15% benziotiazolinone emulsion in water	13.6	2.51	27.14	14.2
	50% dimethomorph wettable powder	136.4	2.62	10.63	67.8

	Expected control efficiency after mixing the two components	-	-	-	72.4
	22% benziothiazolinone-dimethomorph emulsion in water (benziothiazolinone:dimethomorph=2:20)	150.0	2.51	3.83	87.9
Embodiment 47	15% benziothiazolinone emulsion in water	125.0	2.52	8.35	73.7
	50% dimethomorph wettable powder	25.0	2.35	26.77	9.6
	Expected control efficiency after mixing the two components	-	-	-	76.2
	30% benziothiazolinone-dimethomorph oil suspension (benziothiazolinone:dimethomorph=25:5)	150.0	2.69	4.91	85.5
Embodiment 48	15% benziothiazolinone emulsion in water	7.1	2.55	29.95	6.8
	50% dimethomorph wettable powder	142.9	2.21	8.02	71.2
	Expected control efficiency after mixing the two components	-	-	-	73.2
	42% benziothiazolinone-dimethomorph oil suspension (benziothiazolinone:dimethomorph=2:40)	150.0	2.36	4.10	86.2
Water control(CK)	-	-	2.58	32.51	-

Test results (Table 6) show that, the compound benziothiazolinone and dimethomorph has significantly improved control efficiency on litchi blight, indicating that the compound of the two has a significant synergistic effect on litchi blight.

(3) Field efficacy verification test of compound benziothiazolinone and iprodione on pepper cinerea

Table 7 Prevention and treatment effect of compound benziothiazolinone and iprodione on pepper cinerea

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency (%)
Embodiment 5	15% benziothiazolinone emulsion in water	174.2	3.32	9.60	75.8

	50% iprodione suspension	5.8	3.11	35.98	3.2
	Expected control efficiency after mixing the two components	-	-	-	76.6
	62% benziotiazolinone·iprodione water dispersible granule (benziotiazolinone:iprodione=60:2)	180.0	3.52	6.77	83.9
Embodiment 6	15% benziotiazolinone emulsion in water	4.8	3.32	35.91	9.5
	50% iprodione suspension	175.2	3.89	14.09	69.7
	Expected control efficiency after mixing the two components	-	-	-	72.6
	75% benziotiazolinone·iprodione water dispersible granule (benziotiazolinone:iprodione=2:73)	180.0	3.51	7.26	82.7
Embodiment 13	15% benziotiazolinone emulsion in water	163.6	2.85	10.01	70.6
	50% iprodione suspension	16.4	2.98	32.30	9.3
	Expected control efficiency after mixing the two components	-	-	-	73.3
	55% benziotiazolinone·iprodione suspension (benziotiazolinone:iprodione=50:5)	180.0	3.11	5.91	84.1
Embodiment 14	15% benziotiazolinone emulsion in water	8.6	3.21	32.30	15.8
	50% iprodione suspension	171.4	3.14	13.81	63.2
	Expected control efficiency after mixing the two components	-	-	-	69.0
	42% benziotiazolinone·iprodione suspension (benziotiazolinone:iprodione=2:40)	180.0	3.15	6.55	82.6
Embodiment 23	15% benziotiazolinone emulsion in water	175.8	2.84	8.11	76.1
	50% iprodione suspension	4.2	2.92	33.88	2.9
	Expected control efficiency after mixing the two components	-	-	-	76.8
	85% benziotiazolinone·iprodione wettable powder (benziotiazolinone:iprodione=83:2)	180.0	2.82	5.59	83.4
Embodiment 24	15% benziotiazolinone emulsion in water	90.0	3.76	23.68	47.3

	50% iprodione suspension	90.0	3.24	26.60	31.3
	Expected control efficiency after mixing the two components	-	-	-	63.8
	50% benziotiazolinone·iprodione wettable powder (benziotiazolinone:iprodione=25:25)	180.0	3.35	4.88	87.8
Embodiment 25	15% benziotiazolinone emulsion in water	4.2	3.31	35.68	9.8
	50% iprodione suspension	175.8	3.22	13.70	64.4
	Expected control efficiency after mixing the two components	-	-	-	67.9
	85% benziotiazolinone·iprodione wettable powder (benziotiazolinone:iprodione=2:83)	180.0	3.45	7.38	82.1
Embodiment 33	15% benziotiazolinone emulsion in water	60.0	3.72	30.90	30.5
	50% iprodione suspension	120.0	3.13	18.25	51.2
	Expected control efficiency after mixing the two components	-	-	-	66.1
	18% benziotiazolinone·iprodione microemulsion (benziotiazolinone:iprodione=6:12)	180.0	3.42	4.82	88.2
Embodiment 34	15% benziotiazolinone emulsion in water	171.4	3.26	10.05	74.2
	50% iprodione suspension	8.6	3.11	35.20	5.3
	Expected control efficiency after mixing the two components	-	-	-	75.6
	21% benziotiazolinone·iprodione microemulsion (benziotiazolinone:iprodione=20:1)	180.0	3.32	6.55	83.5
Embodiment 41	15% benziotiazolinone emulsion in water	150.0	3.56	15.91	62.6
	50% iprodione suspension	30.0	3.25	31.19	19.7
	Expected control efficiency after mixing the two components	-	-	-	70.0
	30% benziotiazolinone·iprodione emulsion in water (benziotiazolinone:iprodione=25:5)	180.0	3.41	5.34	86.9
Embodiment 42	15% benziotiazolinone emulsion in water	8.6	3.51	35.44	15.5

	50% iprodione suspension	171.4	3.12	14.43	61.3
	Expected control efficiency after mixing the two components	-	-	-	67.3
	42% benziothiazolinone-iprodione emulsion in water (benziothiazolinone:iprodione=2:40)	180.0	3.11	6.28	83.1
Embodiment 49	15% benziothiazolinone emulsion in water	30.0	3.22	30.48	20.8
	50% iprodione suspension	150.0	2.96	13.69	61.3
	Expected control efficiency after mixing the two components	-	-	-	69.3
	18% benziothiazolinone-iprodione oil suspension (benziothiazolinone:iprodione=3:15)	180.0	2.90	3.99	88.5
Embodiment 50	15% benziothiazolinone emulsion in water	163.6	2.86	10.36	69.7
	50% iprodione suspension	16.4	2.91	31.44	9.6
	Expected control efficiency after mixing the two components	-	-	-	72.6
	22% benziothiazolinone-iprodione oil suspension (benziothiazolinone:iprodione=20:2)	180.0	3.19	6.33	83.4
Water control (CK)	-	-	3.21	38.36	-

Test results (Table 7) show that, the compound benziothiazolinone and iprodione has significantly improved control efficiency on pepper cinerea, indicating that the compound of the two has a significant synergistic effect on pepper cinerea.

5 (4) Field efficacy verification test of compound benziothiazolinone and epoxiconazol mixture on sigatoka

Table 8 Prevention and treatment effect of compound benziothiazolinone and epoxiconazol on sigatoka

Serial number	Chemicals for treatment	Application amount (a.i.g/ha)	Disease index before application of reagents	11 days after second application of chemicals	
				Disease index	Control efficiency

					(%)
Embodiment 7	15% benziotiazolinone emulsion in water	96.8	3.11	9.90	76.2
	50% epoxiconazol suspension	3.2	3.23	41.45	4.1
	Expected control efficiency after mixing the two components	-	-	-	77.2
	62% benziotiazolinone·epoxiconazol water dispersible granule (benziotiazolinone:epoxiconazol ratio=60:2)	100.0	3.52	7.49	84.1
Embodiment 8	15% benziotiazolinone emulsion in water	3.2	3.81	47.26	7.3
	50% epoxiconazol suspension	96.8	3.92	17.41	66.8
	Expected control efficiency after mixing the two components	-	-	-	69.2
	62% benziotiazolinone·epoxiconazol water dispersible granule (benziotiazolinone:epoxiconazol ratio=2:60)	100.0	3.28	7.55	82.8
Embodiment 15	15% benziotiazolinone emulsion in water	90.9	3.69	13.77	72.1
	50% epoxiconazol suspension	9.1	3.72	46.44	6.7
	Expected control efficiency after mixing the two components	-	-	-	74.0
	55% benziotiazolinone·epoxiconazol suspension (benziotiazolinone:epoxiconazol ratio=50:5)	100.0	3.71	7.10	85.7
Embodiment 16	15% benziotiazolinone emulsion in water	9.1	3.55	38.52	18.9
	50% epoxiconazol suspension	90.9	3.88	20.40	60.7
	Expected control efficiency after mixing the two components	-	-	-	68.1
	55% benziotiazolinone·epoxiconazol suspension (benziotiazolinone:epoxiconazol ratio=5:50)	100.0	3.83	7.28	85.8
Embodiment 26	15% benziotiazolinone emulsion in water	2.3	3.56	44.82	5.9
	50% epoxiconazol suspension	97.7	3.34	14.39	67.8
	Expected control efficiency after mixing the two components	-	-	-	69.7
	88% benziotiazolinone·epoxiconazol wettable	100.0	3.63	8.21	83.1

	powder (benzothiazolinone:epoxiconazol ratio=2:86)				
Embodiment 27	15% benzothiazolinone emulsion in water	97.3	3.55	11.16	76.5
	50% epoxiconazol suspension	2.3	3.87	49.76	3.9
	Expected control efficiency after mixing the two components	-	-	-	77.4
	86% benzothiazolinone·epoxiconazol wetable powder (benzothiazolinone:epoxiconazol ratio=84:2)	100.0	3.93	9.04	82.8
Embodiment 28	15% benzothiazolinone emulsion in water	50.0	3.59	25.22	47.5
	50% epoxiconazol suspension	50.0	3.55	30.97	34.8
	Expected control efficiency after mixing the two components	-	-	-	65.8
	50% benzothiazolinone·epoxiconazol wetable powder (benzothiazolinone:epoxiconazol ratio=25:25)	100.0	3.42	6.96	84.8
Embodiment 35	15% benzothiazolinone emulsion in water	16.7	3.83	37.00	27.8
	50% epoxiconazol suspension	83.3	3.89	24.72	52.5
	Expected control efficiency after mixing the two components	-	-	-	65.7
	12% benzothiazolinone·epoxiconazol microemulsion (benzothiazolinone:epoxiconazol ratio=2:10)	100.0	3.65	6.40	86.9
Embodiment 36	15% benzothiazolinone emulsion in water	66.7	3.87	25.73	50.3
	50% epoxiconazol suspension	33.3	3.93	41.28	21.5
	Expected control efficiency after mixing the two components	-	-	-	61.0
	15% benzothiazolinone·epoxiconazol microemulsion (benzothiazolinone:epoxiconazol ratio=10:5)	100.0	3.65	800.92	83.6
Embodiment 43	15% benzothiazolinone emulsion in water	95.2	3.68	12.41	74.8
	50% epoxiconazol suspension	4.8	3.89	49.34	5.2
	Expected control efficiency after mixing the two components	-	-	-	76.1

	21% benziotiazolinone·epoxiconazol emulsion in water (benziotiazolinone:epoxiconazol ratio=20:1)	100.0	2.75	5.78	84.3
Embodiment 44	15% benziotiazolinone emulsion in water	4.8	3.76	45.38	9.8
	50% epoxiconazol suspension	95.2	3.55	15.86	66.6
	Expected control efficiency after mixing the two components	-	-	-	69.9
	42% benziotiazolinone·epoxiconazol emulsion in water (benziotiazolinone:epoxiconazol ratio=2:40)	100.0	3.31	6.60	85.1
Embodiment 51	15% benziotiazolinone emulsion in water	83.3	3.69	18.51	62.5
	50% epoxiconazol suspension	16.7	3.82	43.29	15.3
	Expected control efficiency after mixing the two components	-	-	-	68.2
	30% benziotiazolinone·epoxiconazol oil suspension (benziotiazolinone:epoxiconazol ratio=25:5)	100.0	3.79	7.51	85.2
Embodiment 52	15% benziotiazolinone emulsion in water	33.3	3.55	31.78	33.1
	50% epoxiconazol suspension	66.7	3.65	29.20	40.2
	Expected control efficiency after mixing the two components	-	-	-	60.0
	45% benziotiazolinone·epoxiconazol oil suspension (benziotiazolinone:epoxiconazol ratio=15:30)	100.0	3.49	6.44	86.2
Water control (CK)	-	-	3.58	47.9	-

Test results (Table 8) show that, the compound benziotiazolinone and epoxiconazol has significantly improved control efficiency on sigatoka, indicating that the compound of the two has a significant synergistic effect on sigatoka.

53643-6D2

CLAIMS:

1. A synergistic fungicide composition, comprising two active components A and B, wherein the active component A is benzisothiazolinone, the active component B is iprodione, and the weight ratio of the two components is 1:50 to 50:1.
- 5 2. The composition according to claim 1, wherein the composition is composed of 6 wt% to 92 wt% of the active components and 94 wt% to 8 wt% of fungicide adjuvants.
3. The composition according to claim 1 or 2, wherein the weight ratio of the active component benzisothiazolinone and the active component iprodione is 1:30 to 30:1.
4. The composition according to any one of claims 1 to 3, wherein the
10 composition is formulated into any formulation allowable in agriculture.
5. The composition according to any one of claims 1 to 4, wherein the composition is formulated into wettable powder, a suspension, an oil suspension, a water dispersible granule, an emulsion in water or a microemulsion.
6. A use of the composition as defined in any one of claims 1 to 5 in preventing
15 and treating food crop diseases in the agricultural field.
7. The use of the composition according to claim 6, wherein the food crop diseases are selected from cucumber downy mildew, cucumber gray mold, sigatoka, grape downy mildew and litchi blight.