

METHOD OF TREATING A PLANT DISEASE

THIS INVENTION relates to the treatment of plant diseases. It relates in particular to a method of treating a plant disease, to a method of making a substance or composition for treating a plant disease, to a substance or composition for treating a plant disease, to the use of a substance or composition
5 for treating a plant disease, to the use of a substance or composition for preparing a treatment agent for treating a plant disease, to a prophylactic method of preventing plant diseases, to a method of fertilizing a plant, to a method of making a substance or composition for fertilizing a plant, to a substance or composition for fertilizing a plant, to the use of a substance or composition for fertilizing a plant
10 and to the use of a substance or composition for preparing a fertilizer for fertilizing a plant.

According to a first aspect of the invention, there is provided a method of treating a plant disease, the method including the step of applying to a plant which has a plant disease, an effective amount of a substance or composition which
15 comprises, as an active treatment agent, oxi-fulvic acid.

Oxi-fulvic acid is a mixture of substances which include organic acids and is obtainable from Enerkom (Proprietary) Limited. Its method of preparation is described in US Patent 4,912,256 in which it is referred to as "fulvic acids". It is generally provided as an approximately 24 - 25% concentrate. In the remainder
5 of this specification, the concentrate is referred to simply as "oxi-fulvic acid". Thus, a 3% solution of oxi-fulvic acid refers for example to a solution containing 3ml or 3g of the concentrate per 100g.

The plant disease may be selected from leaf diseases and root diseases. The plant disease may for example be a root disease of a grain plant such as wheat,
10 barley, oats, rye or maize, a root disease of a grass such as rye grass or fescue, or a root disease of plants such as potatoes, beans, peanuts, tomatoes, lucerne or alfalfa. Such root diseases include Phytophthora, Pythium, Panama disease and Malelaan disease. The disease may, instead, be a disease such as Brown Scab (Streptomyces Scabies), Resetonia Solani, Late Blight, Bacterial Cancer, Early
15 Blight, Bacterial Wilt, Erwinia, Brown rust on beans, powdery mildew or downy mildew. Erwinia is a pathogen which causes dry rot in potatoes, ie it is a potato tuber disease. The invention should not however be construed as being limited to these diseases and extends to a method of treating other plant diseases, for example diseases of the leaves or roots of plants, which are caused by fungi,
20 bacteria, viruses and other pathogens.

Thus, the plant may be selected from wheat, barley, oats, rye, maize, rye grass, fescue, potatoes, beans, peanuts, tomatoes, lucerne and alfalfa and the disease may be selected from Phytophthora, Pythium, Panama disease, Malelaan disease, root diseases of trees, Brown Scab (*Streptomyces scabies*), Resetonia solani, Late Blight, Bacterial cancer, Early Blight, Bacterial Wilt, Erwinia, Brown Rust, powdery mildew and downy mildew.

The substance or composition may include a carrier. The carrier may be an aqueous carrier. Instead, the carrier may be a liquid fertilizer. In particular, the liquid fertilizer may be selected from liquid fertilizing materials and liquid fertilizer blends of the type described in the Applicant's co-pending South African Patent Application No. 96/5477 which is incorporated herein by reference. Thus the substance or composition may be an aqueous solution of oxi-fulvic acid (optionally including other components) or a liquid fertilizer solution of oxi-fulvic acid (optionally including other components). Thus, in the context of this specification, "liquid fertilizer solution" refers to a solution or mixture (optionally including other components) of oxi-fulvic acid with a liquid fertilizing material or liquid fertilizer blend as described in South African Patent Application No. 96/5477.

The concentration of the oxi-fulvic in the substance or composition may be between about 0,2% and about 8,0% (m/v).

Thus, the aqueous solution or the liquid fertilizer solution may have a concentration of oxi-fulvic acid of about 0,2 - 8,0% (m/v) preferably about 0,5 - 6,0% (m/v) and more preferably about 1,5 - 5,0% (m/v).

5 The method may include the step of dissolving the oxi-fulvic acid in water, eg irrigation water, to form the aqueous solution. The method may include the further step of admixing the aqueous solution of oxi-fulvic acid with the liquid fertilizer to form the liquid fertilizer solution. Naturally, the oxi-fulvic acid need not be pre-dissolved in water before being admixed with the liquid fertilizer and may be added to the liquid fertilizer in an undissolved state or incorporated in the liquid
10 fertilizer during one of the steps of its manufacture. The method may further include the step of applying the aqueous solution or the liquid fertilizer solution to the ground around the plant or spraying it onto the plant eg by means of a knapsack or similar spray.

Thus applying the substance or composition to the plant may include a step
15 selected from applying the substance or composition to the ground around the plant and spraying the substance or composition onto the plant.

The Applicant has found that the presence of oxi-fulvic acid in the liquid fertilizer solution destroys or substantially reduces the amount of bacteria, viruses, fungi and other pathogens in the liquid fertilizer solution. In particular, the oxi-
20 fulvic acid destroys or reduces the amount of plant disease causing bacteria,

viruses, fungi and other pathogens in the liquid fertilizer solution. The oxi-fulvic acid also destroys or reduces the amount of bacteria, viruses, fungi and other pathogens in the soil and on the plant when the soil and plant are fertilized with the liquid fertilizer solution. The liquid fertilizer solution thus, in addition to fertilizing a plant, acts as a prophylactic and/or curative agent in respect of plant diseases.

The following examples exemplify the use of aqueous oxi-fulvic acid in the treatment of plant diseases.

For example, in the case of Phytophthora or similar root diseases in citrus trees, the method may include dissolving oxi-fulvic acid in sufficient water so that the aqueous solution has a concentration of about 0,5 - 6% (m/v) and applying the solution to the drip area of the citrus tree in an amount of about 5 l per running metre. The solution may then be washed into the soil with irrigation water. The soil in the drip area is preferably pre-wetted and the infected trees are treated monthly.

By "drip area" is meant the ground area beneath the body of the tree. By "running metre" is meant a circumferentially extending 1m wide strip around the tree.

In the case of Phytophthora or similar root diseases in avocado pear trees, the method may include dissolving the oxi-fulvic acid in sufficient water so that the aqueous solution has a concentration of about 4% (m/v) and applying the solution to the drip area of the avocado pear tree in an amount of 10ℓ per running metre at field capacity. The solution may then be washed into the ground with irrigation water immediately after application to the drip area. The soil in the drip area is preferably pre-wetted by applying 15mm of water. The treatment is generally carried out weekly or monthly depending on the method of irrigation used.

In the case of Panama disease or similar root diseases in banana trees, the method may include dissolving the oxi-fulvic acid in sufficient water so that the aqueous solution has a concentration of about 0,5 - 6% (m/v), depending on the amount of clay in the soil, and applying the solution to the mat of the banana tree in an amount of 5ℓ per mat. The solution may then be washed in with irrigation water as described above. The soil is generally pre-wetted with 30mm of water and the frequency of application will depend upon the method of irrigation used.

By mat is meant the area under the banana tree and corresponds to the drip area of, for example, a citrus tree or an avocado pear tree.

In the case of Malelaan disease in guava trees, the method may include dissolving the oxi-fulvic acid in water so that the aqueous solution has a concentration of about 0,5 - 6,0% (m/v) and applying the solution to the drip area

of the guava tree in an amount of about 5 ℓ per running metre. The solution may then be washed into the ground with irrigation water as described for avocado pear trees above.

5 In the case of Late Blight or Phytophthora infestance on potatoes or tomatoes, the method may include applying an aqueous solution of oxi-fulvic acid with a concentration of 6% (m/v) as a preventative spray every 4 weeks in an amount of 0,5 - 2,0 ℓ per Ha either by means of an aerial spray or by means of a tractor spray.

10 In the case of brown rust on bean plants, the method may include applying an aqueous solution of oxi-fulvic acid having a concentration of 0,5% (m/v) to the bean plants at a rate of 2 ℓ per Ha. Generally 2 - 4 applications per growing season are sufficient.

The following examples exemplify the use of the liquid fertilizer solution both as a fertilizer and as a treatment agent for plant diseases.

15 Where young citrus or avocado pear trees are being established, and in order to prevent root diseases, the method may include admixing the liquid fertilizer solution as described above with the soil in which the tree is to be planted before it is planted, for example about 500g (in the case of citrus trees) or about 200g (in the case of avocado pear trees).

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In the case of fruit-bearing avocado pear trees, a fertilizer containing 0,5 - 6,0% oxi-fulvic acid is applied. The fertilizer is applied in an amount and at a frequency as recommended by the supplier.

5 The method may include instead, or in addition, the step of treating the soil around the tree while it is being established with the liquid fertilizer solution in an amount of about 500g per running meter every four months for a period of about two years.

The liquid fertilizer solution may be used for the control of diseases in cash crops such as potatoes, tomatoes, peanuts, beans and other vegetable crops.

10 For example, for the control in potatoes of *Streptomyces Scabies* (Brown Potato Scab), the liquid fertilizer solution may be applied to the ridge at planting in an amount of about 800 - 2000 kg per Ha depending upon the plant population.

15 In the case of dry land potatoes, the method may include applying the liquid fertilizer solution in an amount of about 800 kg per Ha and thereafter applying an aqueous solution of oxi-fulvic acid having an oxi-fulvic acid concentration of about 6% (m/v) every 4 - 6 weeks by means of a tractor boom spray at a rate of about 100ℓ per Ha. The application may, instead, be via the irrigation water used to irrigate the potatoes.

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According to another aspect of the invention, there is provided a method of making a substance or composition for treating a plant disease, the method including the step of combining oxi-fulvic acid with a suitable carrier.

The carrier may be an aqueous carrier. Instead, the carrier may be a liquid fertilizer. The liquid fertilizer may be selected from liquid fertilizing materials and liquid fertilizer blends of the type described in South African Patent Application No. 96/5977.

Thus, the method may include dissolving the oxi-fulvic acid in water to form an aqueous solution or combining a fertilizing material with oxi-fulvic acid. The fertilizing material may be a liquid fertilizer as hereinbefore described. Naturally the oxi-fulvic acid may be combined with any liquid fertilizer, whether a chemical (ie inorganic) fertilizer or an organic fertilizer or a fertilizer blend or any plant nutrient used to improve plant growth.

The invention extends to a substance or composition for treating a plant disease whenever made by a method as hereinbefore described.

According to another aspect of the invention, there is provided a substance or composition for treating a plant disease, the substance or composition including, as an active treatment agent, oxi-fulvic acid.

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The substance or composition may be as hereinbefore described.

According to another aspect of the invention, there is provided the use of a substance or composition for treating a plant disease, the substance or composition including, as an active treatment agent, oxi-fulvic acid.

5 The substance or composition may be as hereinbefore described.

According to another aspect of the invention, there is provided the use of a substance or composition for preparing a treatment agent for treating a plant disease, the substance or composition including, as an active treatment agent, oxi-fulvic acid.

10 The invention extends to a prophylactic method of treating plant diseases, the method including a step selected from applying directly to a plant and applying to the soil around a plant, a substance or composition which includes as an active treatment agent, oxi-fulvic acid.

The substance or composition may be as hereinbefore described.

15 According to another aspect of the invention, there is provided a method of fertilizing a plant, the method including the step of applying to a plant a fertilizer which includes oxi-fulvic acid.

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The fertilizer may be a liquid fertilizer as hereinbefore described.

According to another aspect of the invention, there is provided a method of making a substance or composition for fertilizing plants, the method including the step of combining oxi-fulvic acid and a fertilizer.

5 The fertilizer may be a liquid fertilizer as hereinbefore described.

According to another aspect of the invention, there is provided a substance or composition for fertilizing a plant, the substance or composition including a fertilizer and oxi-fulvic acid.

10 According to another aspect of the invention, there is provided the use of a substance or composition for fertilizing a plant, the substance or composition including a fertilizer and oxi-fulvic acid.

The fertilizer may be a liquid fertilizer as hereinbefore described.

15 According to another aspect of the invention, there is provided the use of a substance or composition for preparing a fertilizer for fertilizing plants, the substance or composition including a fertilizing material and oxi-fulvic acid.

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The invention is now described, by way of example, with reference to the accompanying Examples and Figures in which

Figure 1 shows a graph of the log of the number of colony forming units vs time for *Erwinia* treated with oxi-fulvic acid;

5 Figure 2 shows a graph of the number of colony forming units vs time for *Streptomyces scabies* treated with oxi-fulvic acid;

Figure 3 shows a graph of the log of the number of colony forming units vs time for Bacterial Wilt Biovar 3 treated with oxi-fulvic acid; and

10 Figure 4 shows a graph of the log of the number of colony forming units vs time for Bacterial Wilt Biovar 2 treated with oxi-fulvic acid.

In the Examples below "oxi-fulvic acid" refers to the approximately 24 - 25% concentrate described above unless the context clearly indicates otherwise.

EXAMPLE 1

TREATMENT OF PHYTOPHTHORA IN CITRUS TREES

15 In order to treat Phytophthora in citrus trees, oxi-fulvic acid was dissolved in water to produce an aqueous solution having a concentration of 5 - 6% (m/v). The drip area of the tree was pre-wetted and the aqueous solution was supplied to the drip area in an amount of 5ℓ per running metre. The solution was then washed into the soil with irrigation water. The treatment was carried out weekly.

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EXAMPLE 2TREATMENT OF PHYTOPHTHORA IN AVOCADO PEAR TREES

In order to treat Phytophthora in avocado pear trees, oxi-fulvic acid was dissolved in water to produce an aqueous solution having a concentration of 4% (m/v). The soil in the drip area of the avocado pear tree was pre-wetted with 15mm water and the solution was applied to the drip area of the avocado pear tree in an amount of 10ℓ per running metre at field capacity. The solution was then washed into the ground with irrigation water immediately after application to the drip area. The treatment was carried out weekly.

EXAMPLE 3TREATMENT OF PANAMA DISEASE IN BANANA TREES

In order to treat Panama disease in banana trees, oxi-fulvic acid was dissolved in water to produce an aqueous solution having a concentration of 0,5 - 6,0% (m/v) depending upon the amount of clay in the soil. The mat was pre-wetted with 30mm water and the solution was applied to the mat of the banana tree in an amount of 5ℓ per mat. The solution was then washed into the soil with irrigation water.

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EXAMPLE 4TREATMENT OF MALELAAN DISEASE IN GUAVA TREES

In order to treat Malelaan disease in guava trees, oxi-fulvic acid was dissolved in water to produce an aqueous solution having a concentration of 0,5 - 6,0% (m/v). The drip area was pre-wetted with 15mm water and the solution was applied to the drip area of the guava tree in an amount of 5ℓ per running metre and was then washed into the ground with irrigation water. The treatment was carried out weekly.

EXAMPLE 5

5.1 The citrus leaf piece baiting technique was used to assess the effect of oxi-fulvic acid on Phytophthora and Pythium zoospores in irrigation water. Soils known to be infected with *P. nicotianae* were placed in ice trays.

Ten grams of soils were placed in each cubicle. Distilled water containing 0; 0,1; 0,5; 1,2 and 4% of oxi-fulvic acid respectively were added to the soil. Citrus leaf pieces were floated on the water for 48 hours after which they were placed on two selective mediums, viz. PARP and PARPH. The leaf pieces were then incubated for 48 - 96 hours during which time the number of leaf pieces from which Phytophthora and Pythium grew was

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monitored.

The results of the test are set out in Table 1.

TABLE 1

Treatment	% Citrus Leaves Positive	
	Phytophthora	Pythium
Control	39	100
0,1%	25	80
0,5%	0	2
1.0%	0	0
2%	0	0
4%	0	0

5.2 The above test was repeated using the same procedures. The results are set out in Table 2.

TABLE 2

Treatment (ml/ℓ)	% Citrus Leaves Positive	
	Phytophthora	Pythium
Control	100	100
1%	25	100
5%	0	0
10%	0	0
20%	0	0
40%	0	0

As can be seen from Table 2, Phytophthora was eliminated at a concentration of 5ml/ℓ.

5.3 In a further test, oxi-fulvic acid was added to a sand-bark growth media commonly used by the citrus nursery industry. This media was inoculated with Phytophthora using Phytophthora infested irrigation water for four weeks. Thereafter, oxi-fulvic acid was added at either 40 or 80 ml/ℓ as a soil drench. Another four weeks of Phytophthora infested irrigation was then added. Ridomil was used as the chemical standard and was used at 2g/pot. An additional treatment, an extract as described in Example 7 below containing 3% of oxi-fulvic acid was also included. However, in this case the trees were irrigated with Phytophthora-free water for the first few weeks followed by Phytophthora-infested water for the next four weeks.

The media was tested for the presence of Phytophthora eight weeks after the trial started using the citrus leaf piece baiting technique. The results are set out in Table 3. In the Table, Organo cure refers to oxi-fulvic acid and Organoflo refers to the extract with oxi-fulvic acid.

TABLE 3

TREATMENT AND DOSE	% LEAF SAMPLES INFECTED WITH PHYTOPHTHORA
Untreated control (no Phytophthora)	0
Treated control (+ Phytophthora)	33,7
Ridonil 2g/5 l bag	1
Organo cure 1 (40ml/l)	10,2
Organo cure 1 (80ml/l)	7
Organo cure 2 (40ml/l)	10,2
Organo flo 1x/week (64ml/l)	1

As can be seen from Table 3, in the case of Organo cure the incidence of Phytophthora decreased by 80% compared with 97% for Ridomil, and in the case of Organoflo by the same amount as for Ridomil.

EXAMPLE 6

In vitro tests were conducted to determine the efficacy of oxi-fulvic acid against *Erwinia*, *Streptomyces scabies*, Bacterial Wilt Biovar 3 of *Ralstonia*

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solanaceanum and Bacterial Wilt Biovar 2 of *Ralstonia solanaceanum*. Aliquots each containing $\pm 10^6$ bacteria/ml were pipetted into test tubes and treated, respectively, with solutions of oxi-fulvic acid having concentrations of 0,5%, 1,0%, 2,0% and 4,0% and compared with an untreated control containing $\pm 10^6$ bacteria/ml. Samples were plated out on different growth media at intervals of 0,5; 2,5; 10; 15; 30 and 60 minutes. The log of the number of colony forming units (CFUs) was determined and plotted as a function of time. The results are set out in Figures 1, 3 and 4. The number of colony forming units $\times 10^5$ (CFUs $\times 10^5$) was determined for the *Streptomyces scabies* and plotted as a function of time. The results are set out in Figure 2.

In the graphs "Organo cure" refers to the aqueous solution of oxi-fulvic acid. The solution had a concentration of about 24% as described above and was diluted as indicated in the Figures. From Figure 1 it can be seen that at all concentrations down to 0,5%, oxi-fulvic acid destroyed *Erwinia* bacteria within 30 seconds. From Figure 2 it can be seen that the number of colony forming units ($\times 10^5$) of *Streptomyces scabies* was reduced from a value of 23×10^5 to a value of $6,1 \times 10^5$ after 60 minutes. From Figures 3 and 4 it can be seen that, as for Figure 1, Bacterial Wilt Biovar 3 and Bacterial Wilt Biovar 2 bacteria were destroyed at all concentrations down to 0,5% within 30 seconds.

In the Figures, CVP refers to crystal violet pectate; NA refers to nutrient agar; and TZC refers to tetrazolium chloride (a semi-selective medium for bacterial

wilt pathogens).

EXAMPLE 7

In order to prepare an extract, chicken manure (1kg) was added to water (1,5ℓ) and the mixture was heated to 80°C, with stirring, for 30 minutes. The resulting mixture, comprising an aqueous phase and insoluble material, was passed through a cyclone to separate insoluble material from the mixture. The aqueous phase was then passed through a filter-press to remove remaining suspended solid material.

The extract was produced by concentrating the filtered aqueous phase to a volume of about 1ℓ. The extract had a carbon:nitrogen ratio of 24:1 and contained about 35%(m/m) dissolved solids.

In a separate run, potassium hydroxide (50g) was added to the mixture. The addition of the potassium hydroxide resulted in an initial temperature increase to about 40°C.

EXAMPLE 8

A liquid fertilizing material containing the fertilizing substance calcium nitrate was made as follows. A solution of calcium nitrate was prepared by dissolving

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calcium nitrate (53g) in water (100 ml) to produce a solution having a concentration of 53 % (m/v). The solution (100 ml) was then admixed with the extract of Example 7 (400 ml) (the ratio between the extract and the calcium nitrate solution thus being 1:4). Oxi-fulvic acid (3ml) was added to the mixture, the resulting mixture was heated to 60°C and left to stand for 24 hours to produce the liquid fertilizing material containing the fertilizing substance calcium nitrate.

The process of Example 8 was repeated using the fertilizing substance calcium acetate (53 g) and the same quantities of water, extract and oxi-fulvic acid to produce a liquid fertilizing material containing the fertilizing substance calcium acetate.

The calcium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials (prepared as described below), or with other nutrients, to form a fertilizer blend or fertilizer which is suited to the requirements of a particular crop. The calcium-containing liquid fertilizing material can, instead, be used directly, as a calcium source, through an irrigation system or as a foliar feed to overcome specific calcium deficiencies (detected for example by leaf analysis) that may occur during the growing season of a plant.

EXAMPLE 9

A liquid fertilizing material containing the fertilizing substance magnesium

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nitrate was prepared as follows. A solution of magnesium nitrate was prepared by dissolving magnesium nitrate (35 g) in water (100 ml) to produce a solution having a concentration of 35% (m/v). The solution (100 ml) was then admixed with the extract of Example 7 (400 ml) (the ratio between the extract and the calcium nitrate solution thus being 1:4). Oxi-fulvic acid (3 ml) was added to the mixture and the resulting mixture was left to stand for 48 hours to produce the liquid fertilizing material containing the fertilizing substance magnesium nitrate.

The magnesium-containing liquid fertilizing material can be used in blends, as described above, directly through irrigation systems or as a foliar feed in the case of magnesium deficiencies in a plant (for example as detected by tissue analysis).

EXAMPLE 10

A liquid fertilizing material containing the fertilizing substance potassium nitrate was prepared as follows. A solution of potassium nitrate was prepared by dissolving potassium nitrate 1kg in water 600ml at 70 - 90°C with mechanical stirring for 5 - 10 minutes to produce a solution having a concentration of 62,5% (m/m). The resulting solution (100 ml) was admixed with the extract of Example 7 (400 ml) (the ratio between the extract and the potassium nitrate solution thus being 1:4). Oxi-fulvic acid (3ml) was added to the mixture to produce the liquid fertilizing material containing the fertilizing substance potassium nitrate.

The process of Example 10 was repeated twice more using, respectively, the fertilizing substances potassium chloride and potassium sulphate in the same quantities to produce liquid fertilizing materials containing the fertilizing substances potassium chloride and potassium sulphate respectively.

- 5 The potassium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients, as described above, or used on its own and applied through irrigation systems or as a foliar feed.

EXAMPLE 11

- 10 A liquid fertilizing material containing the fertilizing substance ammonium nitrate was prepared as follows. A 21% (m/m) solution of ammonium nitrate (100 ml) was admixed with the extract of Example 7 (400 ml) (the ratio between the extract and the ammonium nitrate solution thus being 1:4). Oxi-fulvic acid (3ml) was added to the mixture and the resulting mixture was left to stand for 24 hours to produce the liquid fertilizing material containing the fertilizing substance
- 15 ammonium nitrate.

The process of Example 11 was repeated twice more using, respectively, the fertilizing substances ammonium sulphate as an 80% (m/m) solution and urea ammonium nitrate as an 80% (m/m) solution in the same quantities to produce

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liquid fertilizing materials containing the fertilizing substances ammonium sulphate and urea ammonium nitrate respectively.

5 The ammonium-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients, as described above, or used on its own through an irrigation system or as a foliar feed in prescribed quantities.

EXAMPLE 12

10 A liquid fertilizing material containing the fertilizing substance monoammonium phosphate was prepared as follows. A 30% (m/m) solution of monoammonium phosphate (100 ml) was admixed with the extract of Example 6 (400 ml) (the ratio between the extract and the monoammonium phosphate solution thus being 1:4). Oxi-fulvic acid (3 ml) was added to the mixture and the resulting mixture was mechanically stirred for 5 minutes and left to stand for 48 hours to produce the liquid fertilizing material containing the fertilizing substance monoammonium phosphate.

15 The process of Example 12 was repeated three times using, respectively, the fertilizing substances diammonium phosphate, monopotassium phosphate and dipotassium phosphate, each as a 30% (m/m) solution, in the same quantities to produce liquid fertilizing materials containing the fertilizing substances diammonium phosphate, monopotassium phosphate and di-potassium phosphate.

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The phosphate-containing liquid fertilizing material(s) can be blended with other liquid fertilizing materials or nutrients as described above to suit the requirements of a specific crop or area or used on its own through irrigation systems or as a foliar feed to overcome phosphate deficiencies (for example as detected by tissue analysis).

EXAMPLE 13

A liquid fertilizer blend was prepared by admixing the potassium-containing liquid fertilizing material of Example 10 (20kg) with the ammonium-containing liquid fertilizing material of Example 11 (40kg) and the phosphate-containing liquid fertilizing material of Example 12 (33kg). Oxi-fulvic acid (6kg) [PLEASE CONFIRM] and BMX micro-nutrient blend (0,2kg), supplied by Chemserve Colloids (Pty) Limited, were added to the mixture to produce the liquid fertilizer blend.

EXAMPLE 14

A liquid fertilizer blend was prepared by admixing the potassium-containing liquid fertilizing material of Example 10 (20kg), the ammonium-containing liquid fertilizing material of Example 11 (61kg), the calcium-containing liquid fertilizing material of Example 8 (7,3kg) and the magnesium-containing liquid fertilizing material of Example 9 (2,5kg). Oxi-fulvic acid (6kg) and BMX micro-nutrient blend (0,2kg), were added to the mixture to produce the liquid fertilizer blend.

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EXAMPLE 15

During the planting of potatoes, in a series of runs the liquid fertilizing materials of Examples 8 - 12 and the liquid fertilizer blends of Examples 13 and 14 were applied to the ridge in an amount of 2000kg per Ha. All of these blends were effective in controlling brown potato scab.

EXAMPLE 16

Before planting citrus trees, the soil in which the tree was to be planted was admixed with 500g of a fertilizer material of Examples 8 - 12 or a liquid fertilizer blends of Examples 13 and 14. The fertilizer or the blend was then applied to the soil around the tree in an amount of 1 - 2 kg per m² every four months for 2 years.

No root diseases were subsequently detected.

EXAMPLE 17

Before planting avocado pear trees, the soil in which the tree was to be planted was admixed with 200g of a fertilizing material or liquid fertilizer blend as described in Examples 16 or 17. The fertilizing material or the blend was then applied to the soil around the tree in an amount of 1 - 2kg/m² every four months for 2 years.

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No root diseases were subsequently detected.

Liquid fertilizers, ie fertilizers containing dissolved fertilizing components in an aqueous medium, generally cannot be produced by combining calcium-containing fertilizing materials with many other fertilizing materials because of the tendency of calcium salts to precipitate from the aqueous medium. For example, calcium salts cannot be combined, in liquid fertilizers, with phosphates, sulphates (such as ammonium sulphate or magnesium sulphate) or carbonates because of precipitation of calcium phosphate (for example as tricalcium phosphate) calcium sulphate or calcium carbonate. Even when a soluble calcium salt is applied to the soil, for example as a component of a top-dressing, the soluble calcium salt can be converted, in the soil, into insoluble calcium carbonate or calcium hydroxide. This limits the availability of the calcium of the soluble calcium salt to plants growing in the soil. Magnesium-containing salts can similarly be converted, in the soil, to partly-soluble magnesium carbonate or magnesium hydroxide so that the availability of the magnesium of the soluble magnesium salt to plants growing in the soil is also limited.

It is an advantage of the invention described that it provides a liquid fertilizing material which contains fertilizing substances which normally would produce precipitates if merely dissolved in water. Without being bound by theory, the Applicant believes that a chelation process takes place in which at least the cations of the fertilizing substances are collated by substances extracted from the

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natural organic material. This chelation process is believed to be responsible for preventing precipitation from taking place. The Applicant further believes that the chelation process also prevents the fertilizing substances from being leached from the soil.

5 It is a further advantage of the invention described that the addition of oxi-fulvic acid destroys or substantially reduces pathogens such as viruses and bacteria which cause plant diseases. The Applicant has found that the presence of oxi-fulvic acid in the liquid fertilizing material results in an increased root mass of plants treated with the liquid fertilizing material. This enables the plants to utilize
10 nutrients in the soil more efficiently. The Applicant has also found that the addition of oxi-fulvic acid appears to enhance the chelation effect described above.

 It is a further advantage of the invention described that predetermined amounts of different liquid fertilizing materials may be blended to provide a blend having predetermined amounts of different fertilizing materials present. This
15 permits the preparation of liquid fertilizer blends which are suited to the requirements of different plants or to the requirements of a specific plant during different periods of its growth cycle. For example, some plants require certain nutrients during their growth stage and other nutrients during their reproduction stage. The invention thus provides blends which can be applied to the ground in
20 the vicinity of the plant during these stages. Furthermore, prior art organic fertilizers of which the Applicant is aware do not contain large amounts of micro-

nutrients. It has thus generally been necessary to use relatively large amounts of such prior art organic fertilizers in order to provide sufficient micro-nutrients to meet the requirements of a particular type of plant. It is an advantage of the invention described that it provides a liquid fertilizing material which includes
5 relatively large amounts of micro-nutrients so that it is not necessary to use large quantities of the liquid fertilizing material in order to provide adequate micro-nutrients to a plant.

**CLAIMS**

THIS SHEET HAS BEEN REPLACED

1. A method of treating a plant disease, characterised in that the method includes the step of applying to a plant which has a plant disease, an effective amount of a substance or composition which comprises, as an active treatment agent, oxi-fulvic acid.
2. A method as claimed in Claim 1, characterised in that the plant disease is selected from leaf diseases and root diseases.
3. A method as claimed in Claim 2, characterised in that the plant is selected from wheat, barley, oats, rye, maize, rye grass, fescue, potatoes, beans, peanuts, tomatoes, lucerne and alfalfa.
4. A method as claimed in Claim 2 or Claim 3, characterised in that the disease is selected from Phytopthera, Pythium, Panama disease, Malelaan disease, root diseases of trees, Brown Scab (*Streptomyces scabbies*), *Resetonia solani*, Late Blight, Bacterial Cancer, Early Blight, Bacterial Wilt, *Erwinia*, Brown Rust, powdery mildew and downy mildew.
5. A method as claimed in any one of the preceding Claims, characterised in that the substance or composition includes a carrier.
6. A method as claimed in Claim 5, characterised in that the carrier is an aqueous carrier.
7. A method as claimed in Claim 5, characterised in that the carrier is a liquid fertilizer.
8. A method as claimed in Claim 7, characterised in that the liquid fertilizer is selected from liquid fertilizing materials and liquid fertilizer blends of the type described in South African Patent Application No. 96/5477.

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9. A method as claimed in any one of the preceding Claims, characterised in that the concentration of the oxi-fulvic acid in the substance or composition is between 0,2 - 8,0% (m/v).
10. A method as claimed in any one of the preceding Claims, characterised in that applying the substance or composition to the plant includes a step selected from applying the substance or composition to the ground around the plant and spraying the substance or composition onto the plant.
11. A method of making a substance or composition for treating a plant disease, characterised in that the method includes the step of combining oxi-fulvic acid with a suitable carrier.
12. A method as claimed in Claim 11, characterised in that the carrier is an aqueous carrier.
13. A method as claimed in Claim 11, characterised in that the carrier is a liquid fertilizer.
14. A method as claimed in Claim 13, characterised in that the liquid fertilizer is selected from liquid fertilizing materials and liquid fertilizer blends of the type described in South African Patent Application No. 96/5477.
15. A substance or composition for treating a plant disease prepared by a method as claimed in any one of Claims 11 to 14 inclusive.
16. A substance or composition for treating a plant disease, characterised in that the substance or composition includes, as an active treatment agent, oxi-fulvic acid.
17. The use of a substance or composition for treating a plant disease, characterised in that the substance or composition comprises, as an active treatment agent, oxi-fulvic acid.

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18. The use of a substance or composition for preparing a treatment agent for treating a plant disease, characterised in that the substance or composition comprises, as an active treatment agent, oxi-fulvic acid.
19. A prophylactic method of treating plant diseases, characterised in that the method includes a step selected from applying directly to a plant and applying to the soil around a plant a substance or composition which includes, as an active treatment agent, oxi-fulvic acid.
20. A method of fertilizing a plant, characterised in that the method includes the step of applying to a plant a fertilizer which includes oxi-fulvic acid.
21. A method of making a substance or composition for fertilizing a plant, characterised in that the method includes the step of combining oxi-fulvic acid and a fertilizer.
22. A substance or composition for fertilizing a plant, characterised in that the substance or composition includes a fertilizer and oxi-fulvic acid.
23. The use of a substance or composition for fertilizing a plant, characterised in that the substance or composition includes a fertilizer and oxi-fulvic acid.
24. The use of a substance or composition for preparing a fertilizer for fertilizing plants, characterised in that the substance or composition includes a fertilizing material and oxi-fulvic acid.

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