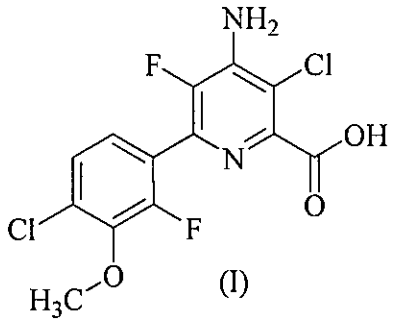
CLAIMS

1. A herbicidal composition comprising a herbicidally effective amount of (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide selected from the group consisting of dithiopyr, oryzalin, pendimethalin, and thiazopyr, wherein (a) and (b) are present in the composition in a ratio such that the composition exhibits herbicidal synergy, and wherein the ratio of (a):(b) is from about 1:3360 to about 9:1.

2. The composition of claim 1, wherein (a) is a C_{1-4} alkyl or benzyl ester of the compound of formula (I).

3. The composition of claim 1, wherein (a) is a C_{1-4} alkyl ester of the compound of formula (I).

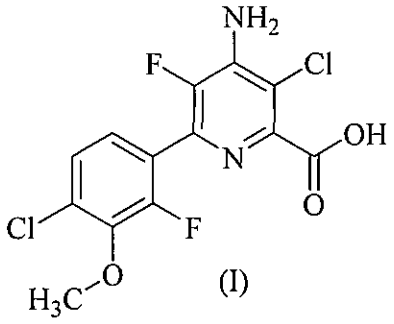
4. The composition of claim 1, wherein (a) is a benzyl ester of the compound of formula (I).

5. The composition of claim 1, wherein (a) is the carboxylic acid of the compound of formula (I).

6. The composition of claim 1, further comprising at least one compound selected from the group consisting of agriculturally acceptable, herbicide safeners, adjuvants, and carriers.

7. A method of controlling undesirable vegetation, comprising the steps of:

contacting a plant, wherein the plant is undesirable vegetation, or the locus thereof, soil or water, wherein the soil or the water supports the growth of the undesirable vegetation, with a herbicidally effective amount of a combination comprising (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide selected from the group consisting of dithiopyr, oryzalin, pendimethalin, and thiazopyr, wherein (a) and (b) are present in the combination in a ratio such that the combination exhibits herbicidal synergy wherein the undesirable vegetation is controlled in direct-seeded, water-seeded and transplanted rice, cereals, wheat, barley, oats, rye, sorghum, maize and canola, and wherein the ratio of (a):(b) is from about 1:3360 to about 9:1.

8. The method of claim 7, wherein the (a) and (b) are applied to water.

9. The method of claim 8, wherein the water is part of a flooded rice paddy.

10. The method of claim 7, wherein the (a) and (b) are applied pre-emergently to the undesirable vegetation in a crop.

11. The method of claim 7, wherein the (a) and (b) are applied post-emergently to the undesirable vegetation in a crop.

12. The method of claim 7, wherein the undesirable vegetation is controlled in glyphosate-, 5-enolpyruvylshikimate-3-phosphate synthase inhibitor-, glufosinate-, glutamine synthetase inhibitor-, dicamba-, phenoxy auxin-, pyridyloxy auxin-, synthetic auxin-, auxin transport inhibitor-, aryloxyphenoxypropionate-, cyclohexanedione-, phenylpyrazoline-, acetyl CoA carboxylase inhibitor-, imidazolinone-, sulfonylurea-, pyrimidinylthiobenzoate-, triazolopyrimidine-, sulfonylaminocarbonyltriazolinone-, acetolactate synthase or acetohydroxy acid synthase inhibitors-, 4-hydroxyphenyl-pyruvate dioxygenase inhibitor-, phytoene desaturase inhibitor-, carotenoid biosynthesis inhibitor-, protoporphyrinogen oxidase inhibitor-, cellulose biosynthesis inhibitor-, mitosis inhibitor-, microtubule inhibitor-, very long chain fatty acid inhibitor-, fatty acid and lipid biosynthesis inhibitor-, photosystem I inhibitor-, photosystem II inhibitor-, triazine-, or bromoxynil-tolerant crops.

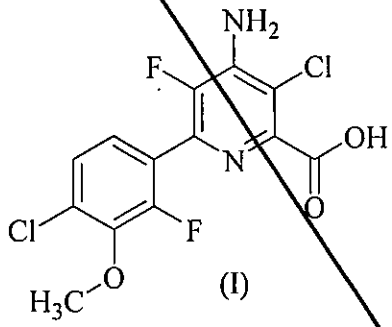
13. The method of claim 12, wherein the tolerant crop possesses multiple or stacked traits conferring tolerance to multiple herbicides.

14. The method of claim 7, wherein the undesirable vegetation comprises a herbicide resistant or tolerant plant.

15. The method of claim 14, wherein the resistant or tolerant plant is resistant or tolerant to multiple herbicides.

16. The method of claim 14, wherein the resistant or tolerant plant is resistant or tolerant to acetolactate synthase or acetohydroxy acid synthase inhibitors, photosystem II inhibitors, acetyl CoA carboxylase inhibitors, synthetic auxins, auxin transport inhibitors, photosystem I inhibitors, 5-enolpyruvylshikimate-3-phosphate synthase inhibitors, microtubule assembly inhibitors, fatty acid and lipid synthesis inhibitors, protoporphyrinogen oxidase inhibitors, carotenoid biosynthesis inhibitors, very long chain fatty acid inhibitors, phytoene desaturase inhibitors, glutamine synthetase inhibitors, 4-hydroxyphenyl-pyruvate-dioxygenase inhibitors, mitosis inhibitors, cellulose biosynthesis inhibitors, herbicides with multiple modes-of-action, quinclorac, arylaminopropionic acids, difenzoquat, endothall, or organoarsenicals.

17. A herbicidal composition comprising a herbicidally effective amount of (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide, wherein the microtubule inhibiting herbicide is selected from the group consisting of dimethenamid, S-dimethenamid, and propyzamide, wherein (a) and (b) are present in the composition in a ratio such that the composition exhibits herbicidal synergy, and wherein the ratio of (a):(b) is from about 1:820 to about 4:1.

18. The composition of claim 17, wherein (a) is a C_{1-4} alkyl or benzyl ester of compound (I).

19. The composition of claim 17, wherein (a) is a C_{1-4} alkyl ester of compound (I).

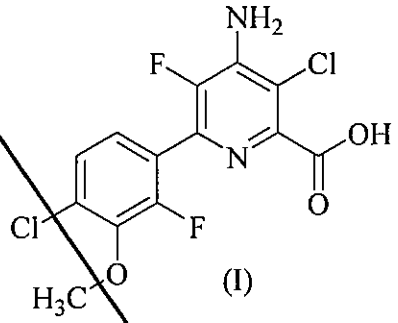
20. The composition of claim 17, wherein (a) is a benzyl ester of compound (I).

21. The composition of claim 17, wherein (a) is the compound of formula (I), which is the carboxylic acid.

22. The composition of claim 17, further comprising at least one compound selected from the group consisting of agriculturally acceptable, herbicide safeners, adjuvants, and carriers.

23. A method of controlling undesirable vegetation, comprising the steps of:

contacting a plant, wherein the plant is undesirable vegetation, or the locus thereof, soil or water, wherein the soil or the water support the growth of the undesirable vegetation a herbicidally effective amount of a combination comprising (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide, wherein the microtubule inhibiting herbicide is selected from the group consisting of dimethenamid, S-dimethenamid, and propyzamide, wherein (a) and (b) are present in the combination in a ratio such that the combination exhibits herbicidal synergy, and wherein the ratio of (a):(b) is from about 1:820 to about 4:1.

24. The method of claim 23, wherein the undesirable vegetation is controlled in direct-seeded, water-seeded and transplanted rice, cereals, wheat, barley, oats, rye, sorghum, corn/maize, sugarcane, sunflower, oilseed rape, canola, sugar beet, soybean, cotton, pineapple, pastures, grasslands, rangelands, fallowland, turf, tree and vine orchards, aquatics, industrial vegetation management or rights of way.

25. The method of claim 23, wherein the (a) and (b) are applied to water.

26. The method of claim 25, wherein the water is part of a flooded rice paddy.

27. The method of claim 23, wherein the (a) and (b) are applied pre-emergently to a weed or a crop.

28. The method of claim 23, wherein the (a) and (b) are applied post-emergently to a weed or a crop.

29. The method of claim 23, wherein the undesirable vegetation is controlled in glyphosate-, 5-enolpyruvylshikimate-3-phosphate synthase inhibitor-, glufosinate-, glutamine synthetase inhibitor-, dicamba-, phenoxy auxin-, pyridyloxy auxin-, synthetic auxin-, auxin transport inhibitor-, aryloxyphenoxypropionate-, cyclohexanedione-, phenylpyrazoline-, acetyl CoA carboxylase inhibitor-, imidazolinone-, sulfonylurea-, pyrimidinylthiobenzoate-, triazolopyrimidine-, sulfonylaminocarbonyltriazolinone-, acetolactate synthase or acetohydroxy acid synthase inhibitors-, 4-hydroxyphenyl-pyruvate dioxygenase inhibitor-, phytoene desaturase inhibitor-, carotenoid biosynthesis inhibitor-, protoporphyrinogen oxidase inhibitor-, cellulose biosynthesis inhibitor-, mitosis inhibitor-, microtubule inhibitor-, very long chain fatty acid inhibitor-, fatty acid and lipid biosynthesis inhibitor-, photosystem I inhibitor-, photosystem II inhibitor-, triazine-, or bromoxynil- tolerant crops.

30. The method of claim 29, wherein the tolerant crop possesses multiple or stacked traits conferring tolerance to multiple herbicides or multiple modes of action.

31. The method of claim 23, wherein the undesirable vegetation comprises a herbicide resistant or tolerant plant.

32. The method of claim 31, wherein the resistant or tolerant plant is a biotype with resistance or tolerance to multiple herbicides.

33. The method of claim 31, wherein the resistant or tolerant plant is a biotype resistant or tolerant to acetolactate synthase or acetohydroxy acid synthase inhibitors, photosystem II inhibitors, acetyl CoA carboxylase inhibitors, synthetic auxins, auxin transport inhibitors, photosystem I inhibitors, 5-enolpyruvylshikimate-3-phosphate synthase inhibitors, microtubule assembly inhibitors, fatty acid and lipid synthesis inhibitors, protoporphyrinogen oxidase inhibitors, carotenoid biosynthesis inhibitors, very long chain fatty acid inhibitors, phytoene desaturase inhibitors, glutamine synthetase inhibitors, 4-hydroxyphenyl-pyruvate-dioxygenase inhibitors, mitosis inhibitors, cellulose biosynthesis inhibitors, herbicides with multiple modes-of-action, quinclorac, arylaminopropionic acids, difenzoquat, endothall, or organoarsenicals.

34. The composition of claim 17, wherein the microtubule inhibiting herbicide is propyzamide.

35. The method of claim 23, wherein the microtubule inhibiting herbicide is propyzamide.

36. The composition according to claim 1, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:1120 to about 9:1 when (b) is dithiopyr; from about 1:3360 to about 1:1 when (b) is oryzalin; from about 1:1120 to about 1:2 when (b) is pendimethalin; and from about 1:1120 to about 6:1 when (b) is thiazopyr.

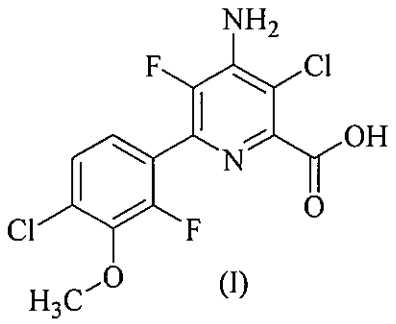
37. The method according to claim 7, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:1120 to about 9:1 when (b) is dithiopyr; from about 1:3360 to about 1:1 when (b) is oryzalin; from about 1:1120 to about 1:2 when (b) is pendimethalin; and from about 1:1120 to about 6:1 when (b) is thiazopyr.

38. The composition according to claim 17, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:820 to about 3:1 when (b) is dimethenamid; from about 1:820 to about 3:1 when (b) is S-dimethenamid; from about 1:600 to about 4:1 when (b) is propyzamide.

39. The method according to claim 23, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:820 to about 3:1 when (b) is dimethenamid; from about 1:820 to about 3:1 when (b) is S-dimethenamid; from about 1:600 to about 4:1 when (b) is propyzamide.

CLAIMS

1. A herbicidal composition comprising a herbicidally effective amount of (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide selected from the group consisting of: dithiopyr, oryzalin, pendimethalin, propyzamide, and thiazopyr, wherein (a) and (b) are present in the composition in a ratio such that the composition exhibits herbicidal synergy, and wherein the ratio of (a):(b) is from about 1:2 to about 1:255.7.

2. The composition of claim 1, wherein (a) is a C_{1-4} alkyl or benzyl ester of the compound of formula (I).

3. The composition of claim 1, wherein (a) is a C_{1-4} alkyl ester of the compound of formula (I).

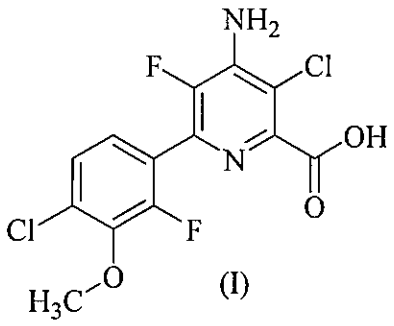
4. The composition of claim 1, wherein (a) is a benzyl ester of the compound of formula (I).

5. The composition of claim 1, wherein (a) is the carboxylic acid of the compound of formula (I).

6. The composition of claim 1, further comprising at least one compound selected from the group consisting of agriculturally acceptable, herbicide safeners, adjuvants, and carriers.

7. A method of controlling undesirable vegetation, comprising the steps of:

contacting a plant, wherein the plant is undesirable vegetation, or the locus thereof, soil or water, wherein the soil or the water supports the growth of the undesirable vegetation, with a herbicidally effective amount of a combination comprising (a) a compound of the formula (I):



(I)

or an alkyl or benzyl ester, or an agriculturally acceptable salt of formula (I) and (b) a microtubule inhibiting herbicide selected from the group consisting of: dithiopyr, oryzalin, pendimethalin, propyzamide, and thiazopyr, wherein (a) and (b) are present in the combination in a ratio such that the combination exhibits herbicidal synergy, and wherein the ratio of (a):(b) is from about 1:2 to about 1:255.7.

8. The method of claim 7, wherein the (a) and (b) are applied to water.

9. The method of claim 8, wherein the water is part of a flooded rice paddy.

10. The method of claim 7, wherein the (a) and (b) are applied pre-emergently to the undesirable vegetation in a crop.

11. The method of claim 7, wherein the (a) and (b) are applied post-emergently to the undesirable vegetation in a crop.

12. The method of claim 7, wherein the undesirable vegetation is controlled in glyphosate-, 5-enolpyruvylshikimate-3-phosphate synthase inhibitor-, glufosinate-, glutamine synthetase inhibitor-, dicamba-, phenoxy auxin-, pyridyloxy auxin-, synthetic auxin-, auxin transport inhibitor-, aryloxyphenoxypropionate-, cyclohexanedione-, phenylpyrazoline-, acetyl CoA carboxylase inhibitor-, imidazolinone-, sulfonylurea-, pyrimidinylthiobenzoate-, triazolopyrimidine-, sulfonylaminocarbonyltriazolinone-, acetolactate synthase or acetohydroxy acid synthase inhibitors-, 4-hydroxyphenyl-pyruvate dioxygenase inhibitor-, phytoene desaturase inhibitor-, carotenoid biosynthesis inhibitor-, protoporphyrinogen oxidase inhibitor-, cellulose biosynthesis inhibitor-, mitosis inhibitor-, microtubule inhibitor-, very long chain fatty acid inhibitor-, fatty acid and lipid biosynthesis inhibitor-, photosystem I inhibitor-, photosystem II inhibitor-, triazine-, or bromoxynil-tolerant crops.

13. The method of claim 12, wherein the tolerant crop possesses multiple or stacked traits conferring tolerance to multiple herbicides.

14. The method of claim 7, wherein the undesirable vegetation comprises a herbicide resistant or tolerant plant.

15. The method of claim 14, wherein the resistant or tolerant plant is resistant or tolerant to multiple herbicides.

16. The method of claim 14, wherein the resistant or tolerant plant is resistant or tolerant to acetolactate synthase or acetohydroxy acid synthase inhibitors, photosystem II inhibitors, acetyl CoA carboxylase inhibitors, synthetic auxins, auxin transport inhibitors, photosystem I inhibitors, 5-enolpyruvylshikimate-3-phosphate synthase inhibitors, microtubule assembly inhibitors, fatty acid and lipid synthesis inhibitors, protoporphyrinogen oxidase inhibitors, carotenoid biosynthesis inhibitors, very long chain fatty acid inhibitors, phytoene desaturase inhibitors, glutamine synthetase inhibitors, 4-hydroxyphenyl-pyruvate-dioxygenase inhibitors, mitosis inhibitors, cellulose biosynthesis inhibitors, herbicides with multiple modes-of-action, quinclorac, arylaminopropionic acids, difenzoquat, endothall, or organoarsenicals.

17. The method of claim 7, wherein the undesirable vegetation is controlled in direct-seeded, water-seeded and transplanted rice, cereals, wheat, barley, oats, rye, sorghum, corn/maize, sugarcane, sunflower, oilseed rape, canola, sugar beet, soybean, cotton, pineapple, pastures, grasslands, rangelands, fallowland, turf, tree and vine orchards, aquatics, industrial vegetation management or rights of way.

18. The method of claim 7, wherein the (a) and (b) are applied pre-emergently to a weed or a crop.

19. The method of claim 7, wherein the (a) and (b) are applied post-emergently to a weed or a crop.

20. The method of claim 14, wherein the resistant or tolerant plant is a biotype with resistance or tolerance to multiple herbicides.

21. The method of claim 14, wherein the resistant or tolerant plant is a biotype resistant or tolerant to acetolactate synthase or acetohydroxy acid synthase inhibitors, photosystem II

inhibitors, acetyl CoA carboxylase inhibitors, synthetic auxins, auxin transport inhibitors, photosystem I inhibitors, 5-enolpyruvylshikimate-3-phosphate synthase inhibitors, microtubule assembly inhibitors, fatty acid and lipid synthesis inhibitors, protoporphyrinogen oxidase inhibitors, carotenoid biosynthesis inhibitors, very long chain fatty acid inhibitors, phytoene desaturase inhibitors, glutamine synthetase inhibitors, 4-hydroxyphenyl-pyruvate-dioxygenase inhibitors, mitosis inhibitors, cellulose biosynthesis inhibitors, herbicides with multiple modes-of-action, quinclorac, arylaminopropionic acids, difenzoquat, endothall, or organoarsenicals.

22. The composition according to claim 1, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:2 to about 1:32 when (b) is dithiopyr; from about 1:32 to about 1:255.7 when (b) is oryzalin; from about 1:8 to about 1:127.9 when (b) is pendimethalin; from about 1:2.2 to about 1:70 when (b) is propyzamide; and from about 1:17.5 to about 1:70 when (b) is thiazopyr.

23. The method according to claim 7, wherein the ratio of (a):(b) is selected from the group consisting of: from about 1:2 to about 1:32 when (b) is dithiopyr; from about 1:32 to about 1:255.7 when (b) is oryzalin; from about 1:8 to about 1:127.9 when (b) is pendimethalin; from about 1:2.2 to about 1:70 when (b) is propyzamide; and from about 1:17.5 to about 1:70 when (b) is thiazopyr.

24. The composition according to claim 1, wherein (b) is pendimethalin, wherein the ratio of (a):(b) is from 1:8 to 1:127.9.

25. The composition according to claim 1, wherein (b) is dithiopyr, wherein the ratio of (a):(b) is from 1:2 to 1:32.

26. The composition according to claim 1, wherein (b) is thiazopyr, wherein the ratio of (a):(b) is from 1:17.5 to 1:70.

27. The composition according to claim 1, wherein (b) is oryzalin, wherein the ratio (a):(b) is from 1:32 to 1:255.7.

28. The composition according to claim 1, wherein (b) is propyzamide, wherein the ratio of (a):(b) is from 1:2.2 to 1:70.

29. The method according to claim 7, wherein (b) is pendimethalin, wherein the ratio of (a):(b) is from 1:8 to 1:127.9.

30. The method according to claim 7, wherein (b) is dithiopyr, wherein the ratio of (a):(b) is from 1:2 to 1:32.

31. The method according to claim 7, wherein (b) is thiazopyr, wherein the ratio of (a):(b) is from 1:17.5 to 1:70.

32. The method according to claim 7, wherein (b) is oryzalin, wherein the ratio (a):(b) is from 1:32 to 1:255.7.

33. The method according to claim 7, wherein (b) is propyzamide, wherein the ratio of (a):(b) is from 1:2.2 to 1:70.