

and a micro-organism associated with the fungus and a partner plant", IFO Research Communications, Vol. 26, 87-100 (2012), Institute for Fermentation.

Non-patent Document 3: MIWA, Yuka, and two co-authors, "Use of bahiagrass in hydroponic cultivation of salad lettuce", Horticultural Research, Vol. 7 (Suppl. 1), 345 (2008), the Japanese Society for Horticultural Science.

Disclosure of the Invention

Problem to Be Solved by the Invention

[0006] However, absolutely no report has been made to date about a systematic hydroponic cultivation technology that uses AMF and their (AMF are *pl.*) partner bacteria along with a partner plant which assists proliferation of these beneficial micro-organisms. There is no research report either on a study about the effects of use of AMF and their partner bacteria along with their partner plant under hydroponic cultivation on crop production and crop quality, for example, such as fruit quality.

[0007] An object of the present invention is, therefore, to provide a hydroponic cultivation method that uses AMF and their partner bacteria along with their partner plant to give favorable effects on the yield and quality of a crop.

Means for Solving the Problem

[0008] To achieve this object, the present invention

according to claim 1 provides a method for the hydroponic cultivation of a crop by using arbuscular mycorrhizal fungi and their partner bacteria as beneficial micro-organisms, said method comprising inoculating the mycorrhizal fungus and the partner bacteria, which is compatible and coexists with the mycorrhizal fungus, to infect the mycorrhizal fungus to a partner plant, which enables easy growth of the mycorrhizal fungus and partner bacteria, or the crop, and allowing the partner plant to grow between rows of the crop.

[0009] Claim 2 is characterized in that in the method of claim 1, the mycorrhizal fungus is arbuscular mycorrhizal fungi, with which the crop or partner plant is infected in advance before commencement of the hydroponic cultivation of the crop.

[0010] Claim 3 is characterized in that in the method of claim 1 or 2, the partner bacteria grows in and around spores of the mycorrhizal fungus, promotes hyphal growth of the mycorrhizal fungus, and has phosphate solubilizing ability, nitrogen fixing ability, and antagonistic action against plant pathogens.

[0011] Claim 4 is characterized in that in the method of any one of claims 1-3, the partner plant promotes development of hyphal networks of the mycorrhizal fungus, enables easy growth of the partner bacteria around roots of the partner plant to assist .

proliferation of the partner bacteria, and does not give
an adverse effect on growth of the crop.

[0012] Claim 5 is characterized in that in the method of

environmental stress resistance.

[0030] On the other hand, the partner bacteria - which promotes the hyphal growth of the mycorrhizal fungus, has phosphate solubilizing ability, nitrogen fixing ability and antagonistic action against plant pathogens, and is compatible - grows abundantly on and around the surfaces of roots of the crop and partner plant, and therefore, can assist the nutrient uptake of the crop and can impart soundness or the like to its roots.

[0031] Further, the use of the hydroponic cultivation apparatus, which is filled with zeolite, charcoal or the like capable of removing plant growth inhibiting substances leached from roots, is of the nutrient liquid recycling system and enables to control the temperature of water, and can create an environment that can make easier the proliferation of the mycorrhizal fungus and its partner bacteria and does not give an adverse effect on the growth or the like of the crop and partner plant.

[0032] Furthermore, the use of organic matter biodegraded beforehand with the partner bacteria or the like, for example, an organic liquid fertilizer (OLF) from green manure instead of chemical fertilizers enables completely organic cultivation under hydroponic cultivation, and therefore can increase the production of safe and secure crops.

Example 1

CLAIMS

- [1] (Amended) A method for the hydroponic cultivation of crops by using mycorrhizal fungi and their partner bacteria as beneficial micro-organisms, said method comprising:

Inoculating the mycorrhizal fungus and the partner bacteria, which is compatible and coexists with the mycorrhizal fungus, to infect the mycorrhizal fungus to a partner plant, which enables easy growth of the mycorrhizal fungus and partner bacteria, or the crop, and allowing the partner plant to grow between rows of the crop.

- [2] The method according to claim 1, wherein:

the mycorrhizal fungus is arbuscular mycorrhizal fungi, with which the crop or partner plant is infected in advance before commencement of the hydroponic cultivation of the crop.

- [3] The method according to claim 1 or 2, wherein:

the partner bacteria grows in and around spores of the mycorrhizal fungus, promotes hyphal growth of the mycorrhizal fungus, and has phosphate solubilizing ability, nitrogen fixing ability, and antagonistic action against plant pathogens.

- [4] The method according to any one of claims 1-3, wherein:

the partner plant promotes the development of hyphal networks of the mycorrhizal fungus, enables easy

growth of the partner bacteria around roots of the partner plant to assist proliferation of the partner bacteria, and does not give an adverse effect on growth of the crop.

- [5] The method according to any one of claims 1-4, further comprising:

using a hydroponic cultivation apparatus that is of the nutrient liquid recycling system, which enables easy proliferation of the mycorrhizal fungus and partner bacteria and can remove plant growth inhibiting substances leached from roots of the crop, and that enables to control a temperature of water.

- [6] The method according to any one of claims 1-5, further comprising:

using an organic liquid fertilizer of organic matter allowed to biodegrade beforehand with the partner bacteria.

- [7] The method according to any one of claims 1-6, wherein:

the partner bacteria is a *Bacillus* strain, *Paenibacillus* strain or a *Pseudomonas* strain.

- [8] The method according to any one of claims 1-7, wherein:

the partner plant is a mycorrhizal plant.

- [9] The method according to claim 5, wherein:

the hydroponic cultivation apparatus is filled with zeolite or charcoal.

[10] The method according to claim 6, wherein:
the organic matter is an organic liquid fertilizer
such as green manure.

[11] The method according to claim 10, wherein:
the organic liquid fertilizer is one obtained by
adding stems and leaves of a leguminous plant, stems
and leaves of a gramineous plant, or the like and
allowing the same to biodegrade.

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[0008] To achieve this object, the present invention

according to claim 1 provides a method for the hydroponic cultivation of a crop by using arbuscular mycorrhizal fungi and their partner bacteria as beneficial micro-organisms, said method comprising inoculating the mycorrhizal fungus and the partner bacteria, which is compatible and coexists with the mycorrhizal fungus, to infect the mycorrhizal fungus to a partner plant, which enables easy growth of the mycorrhizal fungus and partner bacteria, or the crop, and allowing the partner plant to grow between rows of the crop.

[0009] Claim 2 is characterized in that in the method of claim 1, the mycorrhizal fungus is arbuscular mycorrhizal fungi, with which the crop or partner plant is infected in advance before commencement of the hydroponic cultivation of the crop.

[0010] Claim 3 is characterized in that in the method of claim 1 or 2, the partner bacteria grows in and around spores of the mycorrhizal fungus, promotes hyphal growth of the mycorrhizal fungus, and has phosphate solubilizing ability, nitrogen fixing ability, and antagonistic action against plant pathogens.

[0011] Claim 4 is characterized in that in the method of any one of claims 1-3, the partner plant promotes development of hyphal networks of the mycorrhizal fungus, enables easy growth of the partner bacteria around roots of the partner plant to assist

proliferation of the partner bacteria, and does not give an adverse effect on growth of the crop.

[0012] Claim 5 is characterized in that in the method of

environmental stress resistance.

[0030] On the other hand, the partner bacteria - which promotes the hyphal growth of the mycorrhizal fungus, has phosphate solubilizing ability, nitrogen fixing ability and antagonistic action against plant pathogens, and is compatible - grows abundantly on and around the surfaces of roots of the crop and partner plant, and therefore, can assist the nutrient uptake of the crop and can impart soundness or the like to its roots.

[0031] Further, the use of the hydroponic cultivation apparatus, which is filled with zeolite, charcoal or the like capable of removing plant growth inhibiting substances leached from roots, is of the nutrient liquid recycling system and enables to control the temperature of water, and can create an environment that can make easier the proliferation of the mycorrhizal fungus and its partner bacteria and does not give an adverse effect on the growth or the like of the crop and partner plant.

[0032] Furthermore, the use of organic matter biodegraded beforehand with the partner bacteria or the like, for example, an organic liquid fertilizer (OLF) from green manure instead of chemical fertilizers enables completely organic cultivation under hydroponic cultivation, and therefore can increase the production of safe and secure crops.

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- [2] The method according to claim 1, wherein:

the mycorrhizal fungus is arbuscular mycorrhizal fungi, with which the crop or partner plant is infected in advance before commencement of the hydroponic cultivation of the crop.

- [3] The method according to claim 1 or 2, wherein:

the partner bacteria grows in and around spores of the mycorrhizal fungus, promotes hyphal growth of the mycorrhizal fungus, and has phosphate solubilizing ability, nitrogen fixing ability, and antagonistic action against plant pathogens.

- [4] The method according to any one of claims 1-3, wherein:

the partner plant promotes the development of hyphal networks of the mycorrhizal fungus, enables easy

growth of the partner bacteria around roots of the partner plant to assist proliferation of the partner bacteria, and does not give an adverse effect on growth of the crop.

- [5] The method according to any one of claims 1-4, further comprising:

 using a hydroponic cultivation apparatus that is of the nutrient liquid recycling system, which enables easy proliferation of the mycorrhizal fungus and partner bacteria and can remove plant growth inhibiting substances leached from roots of the crop, and that enables to control a temperature of water.

- [6] The method according to any one of claims 1-5, further comprising:

 using an organic liquid fertilizer of organic matter allowed to biodegrade beforehand with the partner bacteria.

- [7] The method according to any one of claims 1-6, wherein:

 the partner bacteria is a *Bacillus* strain, *Paenibacillus* strain or a *Pseudomonas* strain.

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