stress tolerance, increase photosynthetic rate, and increase disease tolerance. Although the precise mechanism by which plant biostimulants exert their effect on plants, one hypothesis is that they operate by up-regulating or down-regulating plant hormones.

Despite advances in agricultural compositions and methods, there remains a need for compositions and methods that can perform plant biostimulation, i.e., improving plant growth responses and development, while reducing the use of chemical fertilizers. Methods and compositions disclosed herein may address these needs and others.

SUMMARY

In accordance with the disclosure herein, as embodied and broadly described herein, the disclosurerelates to compositions and methods for plant biostimulation. Also disclosed herein are compositions comprising a cell-free supernatant of a microbial culture comprising a mixture of microorganisms, which may comprise one or more of bacteria, fungi, algae, and/or microorganisms. Methods of the present disclosure comprise using compositions disclosed herein to enhance the growth of plants.

In a first aspect of the present disclosure, there is provided a composition comprising:
(1) a cell-free supernatant of a microbial culture, wherein the microbial culture is obtained by inoculating an isolated mixed microbial composition comprising isolated microorganisms of either IN-M1, ATCC Patent Deposit Designation No. PTA- 12383, or IN-M2, ATCC Patent Deposit Designation No. PTA-121556, and
(2) water,
wherein the ratio between the cell-free supernatant and water in the composition is between 1/25 and 1/1000 .

In a second aspect of the present disclosure, there is provided a composition comprising an agronomically acceptable carrier and an effective amount of the cell-free supernatant composition of the first aspect.

In a third aspect of the present disclosure, there is provided a method of enhancing plant growth comprising providing a cell-free supernatant composition of the first aspect or a composition of the second aspect to a seed, to a plant, or to a

plant at a particular growth stage, or combinations thereof, thereby enhancing plant growth, wherein the plant is a herbaceous plant.

In a fourth aspect of the present disclosure, there is provided a method for preparing a cell-free supernatant composition comprising the steps of:

(a) inoculating a fermentation broth an isolated mixed microbial composition comprising isolated microorganisms of either IN-M1, ATCC Patent Deposit Designation No. PTA-12383, or IN-M2, ATCC Patent Deposit Designation No. PTA-121556;

(b) incubating the inoculated fermentation broth;

(c) removing microbes from the inoculated fermentation broth; thereby providing the cell-free supernatant; and

(d) diluting the cell-free supernatant in water at a rate between 1/25 and 1/1000.

In a fifth aspect of the present disclosure, there is provided a cell-free supernatant composition prepared by the method of the fourth aspect.

Disclosed are compositions comprising a cell-free supernatant of a microbial culture inoculated with an isolated microorganism, wherein the microorganism comprises one or more of *Aspergillus* spp., *Bacillus* spp., *Rhodopseudomonas* spp., *Candida* spp., *Lactobacillus* spp., *Lactococcus* spp., *Pseudomonas* spp., *Saccharomyces* spp., or *Streptococcus* spp.; or combinations thereof.

Also disclosed are methods of enhancing plant growth comprising providing the disclosed cell-free supernatant composition to a seed, to a plant, or to a plant at a particular growth stage, or combinations thereof, thereby enhancing plant growth. Growth is enhanced when a plant treated with a composition disclosed herein has

CLAIMS

What is claimed is:

1. A composition comprising:
   (1) a cell-free supernatant of a microbial culture, wherein the microbial culture is obtained by inoculating an isolated mixed microbial composition comprising isolated microorganisms of either IN-Ml, ATCC Patent Deposit Designation No. PTA-12383, or IN-M2, ATCC Patent Deposit Designation No. PTA-121556, and
   (2) water,
   wherein the ratio between the cell-free supernatant and water in the composition is between 1/25 and 1/1000.

2. The composition of claim 1, wherein the cell-free supernatant is filter-sterilized.

3. The composition of claim 1, further comprising a herbicide.

4. The composition of claim 1, further comprising a pesticide.

5. The composition of claim 1, further comprising a fungicide.

6. The composition of claim 1, further comprising a liquid nutrient solution.

7. The composition of claim 1, wherein the microbial culture is obtained by further inoculating at least one isolated micorrhyzal fungus.

8. A composition comprising an agronomically acceptable carrier and an effective amount of the cell-free supernatant composition of any of claims 1-7.

9. A method of enhancing plant growth comprising providing a cell-free supernatant composition of any of claims 1-7 or the composition of claim 8 to a seed, to a plant, or to a plant at a particular growth stage, or combinations thereof, thereby enhancing plant growth, wherein the plant is a herbaceous plant.

10. The method of claim 9, wherein providing the cell-free supernatant composition comprises applying the cell-free supernatant to the seeds of plants.

11. The method of claim 9, wherein providing the cell-free supernatant composition comprises applying the cell-free supernatant to the roots of plants.

12. The method of claim 9, wherein providing the cell-free supernatant composition comprises applying the cell-free supernatant to the leaves or stalks of plants.

13. The method of claim 9, wherein the plant is grown in a greenhouse.

14. The method of claim 9, wherein the plant is grown in a field.

15. The method of claim 9, wherein enhancing plant growth is an increase in leaf area or dry biomass.

16. A method for preparing a cell-free supernatant composition comprising the steps of:
    (a) inoculating a fermentation broth with an isolated mixed microbial composition comprising isolated microorganisms of either IN-Ml, ATCC Patent Deposit Designation No. PTA-12383, or IN-M2, ATCC Patent Deposit Designation No. PTA-121556;
    (b) incubating the inoculated fermentation broth;
    (c) removing microbes from the inoculated fermentation broth; thereby providing the cell-free supernatant; and
    (d) diluting the cell-free supernatant in water at a rate between 1/25 and 1/1000.

17. The method of claim 16, wherein the removing step comprises centrifuging the culture after step (b) for at least 10 minutes at a centrifugal force of at least 14,000 x g.

18. The method of claim 16, further comprising the step (d) of sterilizing the cell-free supernatant.

19. The method of claim 18, wherein sterilizing is filter sterilization.

20. A cell-free supernatant composition prepared by the method of claim 16.