Microorganisms Recognized As Plant Biostimulants

This list is intended to specifically identify microorganisms considered to be 'plant biostimulants' and to provide accurate identification and permissible labeling claims. This is a communication tool and is not an exhaustive list of all microorganisms allowed as beneficial substances within fertilizing materials. Omission of a microbe from this list may result in the submission of efficacy data to support labeling claims for CDFA review.

The presence of a "pesticidal property" of a microorganism does not indicate that it must be regulated as a pesticide in the absence of pesticidal claims; products should be evaluated on a case-by-case basis according to their claims, intended use, and supporting data. Similarly, low-risk (Risk Group 1) potential pathogens that pose little to no risk for healthy individuals should also be evaluated on a similar case-by-case basis. While these microorganisms may not be considered plant biostimulants, they may prove to be acceptable as general beneficial substances.

Genus / species	**Synonym(s) (or Also Known As)**	**Accepted Claim(s)**
Acaulospora colombiana	*Entrophospora columbiana, Kuklospora columbiana*	Improve crop yields and productivity.
Acidovorax delafieldii		Beneficial to plants and/or soils.
Acidovorax facilis	*Pseudomonas facilis, Hydrogenomonas facilis*	Beneficial to plants and/or soils.
Acinetobacter calcoaceticus		Beneficial to plants and/or soils.
Anabaena cylidrica		Nitrogen fixing.
Anacystis montana	*Lightfootiella montana, Ulva montana, Palmella montana, Sorospora montana*	Beneficial to plants and/or soils.
Aneurinibacillus aneurinilyticus		Beneficial to plants and/or soils.
Artherobacter agilis	*Micrococcus agilis*	Beneficial to plants and/or soils.
Arthrobacter citreus		Beneficial to plants and/or soils.
Arthrobacter globiformis		Beneficial to plants and/or soils.
Arthrobacter luteus	*Cellulosimicrobium cellulans*	Beneficial to plants and/or soils.
Arthrobacter simplex	*Pimelobacter simplex, Corynebacterium simplex*	Beneficial to plants and/or soils.
Arthrobacter terregens	*Microbacterium terregens, Aureobacterium terregens*	General yield benefit. *Compost aid is not yet approvable.*
Aspergillus terreus		Beneficial to plants and/or soils.
Aterococcus scherffel		Beneficial to plants and/or soils.

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Azoarcus indigens		Nitrogen fixing.
Azorhizobium caulinodans		1. Nitrogen-fixing. It can establish typical rhizobial associations but has limited host associations, primarily limited to Sesbania. 2. Under certain conditions it has been associated with increases in wheat yield.
Azospirillum amazonense	*Nitrospirillum amazonense*	Beneficial to plants and/or soils.
Azospirillum lipoferum		1. Nitrogen fixing. Does not always fix nitrogen for plant and depends on environmental factors. Does not always provide sufficient nitrogen to enhance plant. Has shown crop yield increases though. Evaluate on a claim-by-claim basis as some claims might be supported and other may not be.
Azotobacter paspali	*Azorhizophilus paspali*	1. Nitrogen fixing. 2. Molybdenum or vanadium is required for N fixation; aerobic.
Azotobacter vinelandii		Nitrogen fixing.
Bacillus atrophaeus	*Bacillus globigii, Bacillus subtilis var. niger*	Nitrogen fixing.
Bacillus azotofixans	*Paenibacillus azotofixans; Paenibacillus durum*	Nitrogen fixing.
Bacillus azotoformans	*Schinkia azotoformans, Calidifontibacillus azotoformans*	Nitrogen fixing.
Bacillus brevis	*Brevibacillus brevis*	Beneficial to plants and/or soils.
Bacillus coagulans	*Heyndrickxia coagulans, Weizmannia goagulans, Lactobacillus sporogenes*	Beneficial to plants and/or soils.
Bacillus composti	*Siminiovitchia composti, Lysinibacillus composti*	Beneficial to plants and/or soils.
Bacillus laevolacticus	*Sporolactobacillus laevolacticus*	Beneficial to plants and/or soils.
Bacillus laterosporus	*Brevibacillus laterosporus*	May increase yield. Increased lettuce yield.
Bacillus macerans	*Paenibacillus macerans*	Nitrogen fixing; nif gene was identified.
Bacillus marinus	*Jeotgalibacillus marinus, Marinibacillus marinus*	Beneficial to plants and/or soils.

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Bacillus methylotrophicus	*Bacillus velezensis*	May increase germination, root and shoot length,and root and shoot dry weight. *If strains are evaluated, it is important to verify they are not pesticides*.
Bacillus mojavensis	*Bacillus axarquiensis, Bacillus malacitensis*	May increase growth. Increases growth of lettuce, radish.
Bacillus mucilaginosus	*Paenibacillus mucilaginosus*	1. Plant growth increase, but K of soil & plant not increased. 2. K solubilizing.
Bacillus oleronius	*Heyndrickxia oleronia*	Beneficial to plants and/or soils.
Bacillus pasteurii	*Sporosarcina pasteurii*	Beneficial to plants and/or soils.
Bacillus polymyxa	*Paenibacillus polymyxa*	1. Nitrogen fixing. nif gene was identified. 2. Promotes phosphorus solubilization. 3. Can survive and reproduce in acidic to neutral pH soil
Bacillus siamensis	*Bacillus vanillea*	*Bacillus siamensis PB12* may increase growth and fruit yield.
Bacillus simplex	*Peribacillus simplex*	1. Promotes phosphorus solubilization. 2. Increases growth and plant nutrient levels. 3. Microbe is a nitrogen scavenger, not a fixer. Use of bacterium increases number and dry wt of roots, some siderophores.
Bacillus sonorensis		Beneficial to plants and/or soils.
Bacillus tequilensis		Promotes phosphorus solubilization.
Bacillus uniflagellatus	*Bacillus subtilis*	Beneficial to plants and/or soils.
Bacteroides lipolyticum		Beneficial to plants and/or soils.
Bacteroides succinogenes	*Bacteroides succinogenes*	Beneficial to plants and/or soils.
Beijerinckia indica	*Azotobacter indicus*	Beneficial to plants and/or soils.
Bradyrhizobium denitrificans		Beneficial to plants and/or soils.
Bradyrhizobium japonicum	*Rhizobium japonicum*	Nitrogen fixing
Bradyrhizobium lupinus	*Rhizobium lupini*	Accepted strains: Lp78, Lp73, Lp53, Lp83. 1. Lp83: greater *Lupinus* biomass. 2. Nitrogen fixing.
Bradyrhizobium vigna		Beneficial to plants and/or soils.
Brevibacillus choshinensis	*Bacillus choshinensis*	Beneficial to plants and/or soils.
Brevibacillus laterosporus	*Bacillus laterosporus*	May improve yield. Increased lettuce yield.

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Brevibacterium lipolyticum		Beneficial to plants and/or soils.
Calothrix castelli		1. May improve yield. Higher yield in lettuce. Cyano bacterium. 2. Nitrogen fixing.
Candida utilis	*Cyberlindnera jadinii, Saccharomyces jadinii*	Beneficial to plants and/or soils.
Cellulomonas fimi	*Bacillus fimi*	Beneficial to plants and/or soils.
Cellulomonas flavigena	*Bacillus flavigenus*	Beneficial to plants and/or soils.
Chlorococcum humicola	*Protococcus humicola*	Beneficial to plants and/or soils.
Claroideoglomus claroideum	*Entrophospora claroidea*	Increased plant growth & nutrient acquisition under saline and non-saline conditions.
Claroideoglomus etunicatum	*Glomus etunicatum, Entrophospora etunicata*	Beneficial to plants and/or soils.
Clonostachys rosea	*Gliocladium roseum, Acrostalagmus roseus*	1. Colonizes plant tissues. 2. May increase root growth. 3. Greater root biomass in cucumber plants inoculated with *Clonostachys rosea*.
Clostridium pasteurianum		Beneficial to plants and/or soils.
Corynebacterium ammoniagenes	*Bacillus ammoniagenes, Brevibacterium ammoniagenes*	Beneficial to plants and/or soils.
Curtobacterium salicis	*Curtobacterium salicaceae*	Nitrogen fixing.
Entrophospora columbiana	*Acaulospora colombiana*	Improve crop yields and productivity.
Euglena ehrenberg		Beneficial to plants and/or soils.
Flavobacterium aquatile	*Bacillus aquatilis*	Beneficial to plants and/or soils.
Frateuria aurantia	*Acetobacter aurantius, Acetobacter aurantium*	Higher yield in corn.
Funneliformis monosporus	*Glomus monosporum*	Beneficial to plants and/or soils.
Funneliformis mosseae	*Glomus mosseae, Endogone mosseae*	Beneficial to plants and/or soils.
Geobacillus thermoglucosidasius	*Parageobacillus thermoglucosidasius, Bacillus thermoglucosidasius, Geobacillus thermoglucosidans*	Direct plant benefit in plant height, weight and chlorophyll content.
Gigaspora albida		Beneficial to plants and/or soils.

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Gigaspora margarita	*Gigaspora ramisporophora*	Beneficial to plants and/or soils.
Glomus brasilianum	*Paraglomus brasilianum*	Beneficial to plants and/or soils.
Glomus claroideum	*Glomus claroideum, Glomus maculosum, Glomus multisubstensum, Glomus fistulosum*	Beneficial to plants and/or soils.
Glomus clarum	*Rhizophagus clarus, Glomus clarum*	Beneficial to plants and/or soils.
Glomus coronatum	*Funneliformis coronatum*	Beneficial to plants and/or soils.
Glomus deserticola	*Septoglomus deserticola*	Beneficial to plants and/or soils.
Glomus dussii	*Funneliformis dussii*	Beneficial to plants and/or soils.
Glomus fasciculatum	*Endogone fasciculata, Rhizophagus fasciculatus, Rhizoglomus fasciculatum*	Beneficial to plants and/or soils.
Glomus iranicum	*Glomus iranicum var. tenuihypharum, Rhizophagus iranicus, Dominikia iranica*	Effective in high saline soils.
Glomus manihotis	*Rhizophagus manihotis*	Improves nutrient acqusition.
Glomus microaggregatum	*Rhizoglomus microaggregatum*	Beneficial to plants and/or soils.
Glomus monosporum	*Funneliformis monosporus*	Beneficial to plants and/or soils.
Gluconacetobacter diazotrophicus	*Saccharobacter nitrocaptans, Acetobacter diazotrophicus*	1. Nitrogen fixing. 2. May allow less nitrogen input to maintain crop yield. 3. May enhance crop yield when applied with full nitrogen fertilizer program.
Kurthia zopfii	*Bacterium zopfii, Helikobacterium zopfii, Bacillus zopfii, Zopfius zopfii*	Beneficial to plants and/or soils.
Laccaria bicolor	*Laccaria laccata var. bicolor Maire, Laccaria proxima var. bicolor*	Beneficial to plants and/or soils.
Laccaria laccata	*Agaricus laccatus, Clitocybe laccata, Omphalia laccata*	Beneficial to plants and/or soils.
Lactobacillus acidophilus	*Bacillus acidophilus*	Beneficial to plants and/or soils.
Lactobacillus buchneri	*Lactobacillus buchneri*	1. Promote plant growth and root development. 2. Increase P availability & yield.

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Lactobacillus casei	*Lacticaseibacillus casei*	1. Helps improve soil structure. 2. Helps improve nutrient availability.
Lactobacillus plantarum	*Lactiplantibacillus plantarum*	May increase plant growth. Increased cucumber seedling growth.
Lactococcus lactis	*Streptococcus lactis*	Beneficial to plants and/or soils.
Leuconostoc pseudomesenteroides		Beneficial to plants and/or soils.
Mesorhizobium ciceri	*Rhizobium ciceri*	Beneficial to plants and/or soils.
Mesorhizobium loti	*Rhizobium loti*	Beneficial to plants and/or soils.
Methylobacterium gregans		Beneficial to plants and/or soils.
Methylobacterium komagatae		Beneficial to plants and/or soils.
Methylobacterium radiotolerans		Beneficial to plants and/or soils.
Micrococcus luteus	*Micrococcus flavus, Bacteridium luteum, Sarcina lutea*	1. Siderophore properties. 2. Detoxify chemicals in soils; complete with unwanted microbes for limiting nutrients.
Mucor hiemalis		Beneficial to plants and/or soils.
Myrothecium verrucaria	*Albifimbria verrucaria*	Beneficial to plants and/or soils.
Ochrobactrum pseudogrignonense	*Brucella pseudogrignonensis*	1. Nitrogen fixing 2. Increases plant growth. Increased growth of oil palm, peas, black gram seedlings.
Oidiodendron maius		Stimulates growth, vigor, as well as promoting the development of strong roots with a greater capacity to absorb water and nutrients.
Paenibacillus azotofixans	*Bacillus azotofixans*	Nitrogen fixing.
Paenibacillus azotoformans		Beneficial to plants and/or soils.
Paenibacillus durus	*Clostridium durum*	Beneficial to plants and/or soils.
Paenibacillus gordonae	*Bacillus gordonae, Paenbacillus validus*	Aids VA mycorrhizae survive in absence of hosts.
Paenibacillus macerans	*Bacillus macerans*	Nitrogen fixing. nif gene was identified.
Paenibacillus mucilaginosus	*Bacillus mucilaginosus*	Plant growth increase, but K of soil & within plant not increased.

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Paenibacillus polymyxa	*Bacillus polymyxa*	1. Nitrogen fixing. Nif gene was identified. 2. Promotes phosphorous solubilization. 3. Can survive and reproduce in acidic to neutral pH soil.
Pantoea dispersa		Beneficial for plants growing in soil.
Paraglomus brasilianum	*Glomus brasilanum*	Beneficial to plants and/or soils.
Pezoloma ericae	*Rhizoscyphus ericae, Pezizella ericae, Hymenoscyphus ericae*	1. Stimulates growth, vigor, as well as promoting the development of strong roots with a greater capacity to absorb water and nutrients. 2. Ericoid mycorrhizal fungi on Ericaceae family plants.
Phacus dujardin		Beneficial to plants and/or soils.
Phanerochaete chrysosporium		Beneficial to plants and/or soils.
Piriformospora indica	*Serendipita indica*	1. Colonizes roots and promotes root growth and thus promotes increased nutrient uptake. 2. As a result, it improves vigor and yield of crops. 3. Promotes root growth, shoot growth, grain yield of rice, barley, and increases drought tolerance.
Pisolithus arhizus	*Lycoperdon arhizon*	Increased biomass (dwt.) of *Shorea pinanga* (tropical tree).
Pisolithus tinctorius		Beneficial to plants and/or soils.
Propionibacterium freudenreichii	*Propionicibacterium freudenreichii*	Beneficial to plants and/or soils.
Pseudomonas calcis		Beneficial to plants and/or soils.
Pseudomonas denitrificans	*Bacillus denitrijcans jluorescens*	Beneficial to plants and/or soils.
Pseudomonas glathei	*Caballeronia glathei, Burkholderia glathei, Paraburkholderia glathei*	Beneficial to plants and/or soils.
Pseudomonas monteilii		1. Solubilizes inorganic phosphorous. 2. Nitrogen fixing. 3. Greater root length, shoot and root dry weight.
Pseudomonas palmensis		Beneficial to plants and/or soils.
Pseudomonas pseudoalcaligenes	*Ectopseudomonas pseudoalcaligenes*	Beneficial to plants and/or soils.
Pseudomonas siliginis		Beneficial to plants and/or soils.
Pseudomonas striata		1. Promotes phosphorous solubilization. 2. Increases the benefit of Nitrogen fixing microbes.

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Rhizobium japonicum	*Bradyrhizobium japonicum, Rhizobacterium japonicum*	Nitrogen fixing.
Rhizobium leguminosarum	*Schinzia leguminosarum, Phytomyxa leguminosarum, Rhizobacterium leguminosarum*	Nitrogen fixing.
Rhizobium loti	*Mesorhizobium loti*	Nitrogen fixing.
Rhizobium meliloti	*Sinorhizonium melioti , Ensufer meliloti*	Nitrogen fixing.
Rhizobium phaseoli		1. Nitrogen fixing . 2. Increase in yield, growth of beans.
Rhizobium tropici		1. May increase yield, chlorophyll. 2. *Rhizobium tropici bv populus* is a Nitrogen fixing endophyte.
Rhizophagus aggregatus	*Glomus aggregatum; Rhizoglomus aggregatum*	Beneficial to plants and/or soils.
Rhizophagus clarus	*Glomus clarum, Rhizoglomus clarum*	Beneficial to plants and/or soils.
Rhizophagus diaphanus	*Glomus diaphanum, Oehila diaphana*	Increased leaf P under well-watered and drought conditions.
Rhizophagus intraradices	*Rhizophagus irregularis, Glomus intaradices, Glomus irregulare*	1. Increase nutrient uptake. 2. Root enhancer. A beneficial soil fungi that creates a sponge-like mass which collects and stores nutrients and water, increasing the uptake of both. 3. More efficient use of water and nutrients. 4. Help plants resist drought. 5. Reduce transplant shock. 6. More vigorous plant growth. 7. Can increase yield. 8. Will not burn when used as directed.

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Rhizophagus irregularis	*Rhizophagus intraradices, Glomus intaradices, Glomus irregulare*	1. Mycorrhizae helps to strengthen the root system. 2. Aids in nutrient uptake. 3. Helps the plant throughtout abiotic stress periods. 4. It forms beneficial associations with the crop's root system. 5. It stimulates root growth and macro and micro nutrients absorption by the crop (especially those less accessible). 6. Better crop development. 7. Acts by increasing yield and crop quality, enabling it to overcome stressful conditions.
Rhizopogon amylopogon		Beneficial to plants and/or soils.
Rhizopogon fulvigleba		Beneficial to plants and/or soils.
Rhizopogon luteolus	*Rhizopogon induratus*	Beneficial to plants and/or soils.
Rhizopogon rhodochrous		Beneficial to plants and/or soils.
Rhizopogon roseolus	*Rhizopogon luteorubescens*	Beneficial to plants and/or soils.
Rhizopogon rubescens	*Hysterangium rubescens*	Beneficial to plants and/or soils.
Rhizopogon subcaerulescens		Beneficial to plants and/or soils.
Rhizopogon villosulus	*Rhizopogon rogersii*	Beneficial to plants and/or soils.
Rhizopogon vulgaris	*Hysteromyces vulgaris, Rhizopogon rubescens var. vittadinil, Rhizopogon vittadinii*	Alone-as a benefit to pine species.
Rhizopus oryzae	*Rhizopus arrhizus*	Beneficial to plants and/or soils.
Rhodococcus rhodochrous	*Staphylococcus rhodochrous, Rhodococcus roseus*	Beneficial to plants and/or soils.
Rhodopseudomonas palustris	*Rhodopseudomonas rutila*	1. K solubilization activity. 2. Nitrogen fixing. 3. Photosynthetic to itself.
Rhodopseudomonas putida		Beneficial to plants and/or soils.
Rhodopseudomonas sphaeroides	*Rhodobacter sphaeroides, Luteovulum sphaeroides, Cereibacter sphaeroides*	Beneficial to plants and/or soils.
Rhodospirillum rubrum	*Spirillum rubrum*	Beneficial to plants and/or soils.
Scleroderma cepa	*Scleroderma citrina*	Beneficial to plants and/or soils.
Scleroderma citrinum		Beneficial to plants and/or soils.

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Scleroderma geaster	*Dentiscutata heterogama, Gigaspora geterogama*	Beneficial to plants and/or soils.
Scutellospora heterogama		Beneficial to plants and/or soils.
Septoglomus deserticola	*Glomus deserticola*	Beneficial to plants and/or soils.
Sinorhizobium meliloti	*Rhizobium melitoti, Ensifer meliloti*	Nitrogen fixing.
Sporosarcina pasteurii	*Bacillus pasteurii*	Beneficial to plants and/or soils.
Streptococcus lactis	*Lactococcus lactis*	Beneficial to plants and/or soils.
Streptomyces albus		Beneficial to plants and/or soils.
Streptomyces cellulosae	*Streptomyces cellulosi*	Beneficial to plants and/or soils.
Streptomyces coelicor		Beneficial to plants and/or soils.
Streptomyces fradiae		Beneficial to plants and/or soils.
Streptomyces griseoflavus	*Streptomyces griseiflavus*	Beneficial to plants and/or soils.
Streptomyces griseus		Beneficial to plants and/or soils.
Suillus granulatus	*Boletus granulatus*	Beneficial to plants and/or soils.
Suillus punctatipes	*Boletinus punctatipes*	Beneficial to plants and/or soils.
Suillus punctipes	*Boletus punctipes*	Tree-specific. Label must include application for use on trees.
Trichoderma reesei		Beneficial to plants and/or soils.
Trichoderma viride		Beneficial to plants and/or soils.
Xanthobacter autotrophicus	*Corynebacterium autrophicum*	1. Nitrogen fixing. 2. May increase soil fertilty.
Yarrowia lipolytica	*Endomycopsis lipolytica, Mycotorula lipolytica*	1. Beneficial yeast microorganism. Yeast solubilizes phosphate. 2. Together with mycorrhizae increases P uptake and growth.

Note 1: "Accepted Claim(s)" are not intended to be verbatim. Label claims can vary as long as it adheres to the general intent of the acceptable claim(s).

Note 2: "Benefical to plants and/or soils" is the default generally acceptable claim, if no additional supported claims have been identified.