

Biosensor to Detect Isothiocyanates in Plants, Soils, and Seed Meals

Isothiocyanates (ITCs) are bioactive compounds of cruciferous plants that have anti-cancerous properties in humans and are commonly used to control plant pathogens in agriculture by cover cropping, seed meal amendment, or green manuring. Current methods to detect ITCs are time consuming and require specialized training. A novel biosensor detection method for ITCs can be used to analyze soils, plant extracts and solutions to determine the presence and relative level of a variety of different forms of ITCs. In agriculture, assessment of ITCs can inform the efficacy of cruciferous-based practices such as green manuring, validate safe replant dates, and identify cultivars with potentially high ITC production levels.

Docket No: 95.20

Contact: David.Nicholson@usda.gov



Benefits

- Simple easy-to-use method with short hands-on time for analysis
- Adaptable to on-farm use
- Amenable to a variety of media including soil, plant tissue, seed meal, and solutions
- Reduces risk of plant-back damage from Brassicas

Applications

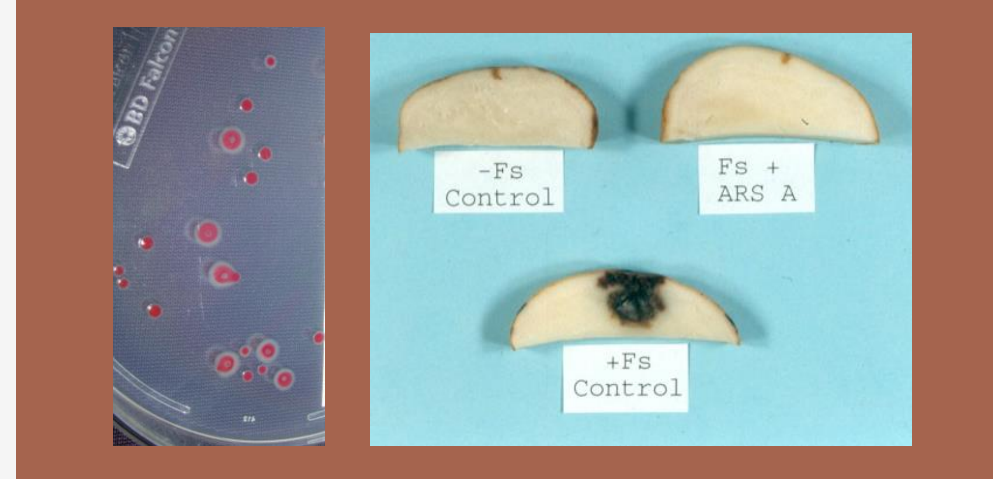
- Determine safe plant-back dates after ITC soil biofumigation
- Assess cultivar potentials for ITC production levels
- Confirm ITC production in soil biofumigation, green manuring or cover-cropping

Desiccation Resistant *Pseudomonas*

Novel *Pseudomonas* strains were generated using adaptive laboratory mutagenesis to repetitively challenge the parent population during exposure to stressed conditions of growth, drying, long term dry storage and rehydration. Resistant variants were isolated and ranked based on high viable cell yield, recovery after dry storage, suppression of potato disease, and rapid growth on low cost medium, including hydrolyzates of renewable lignocellulosic biomass. The desiccation resistant bacterial strains and method of mutagenesis are included in the invention.

Docket No: 137.17

Contact: Renee.Wagner@usda.gov



Benefits

- Is a dry storable agent that provides broad protection against a variety of potato maladies, including fungal diseases (Fusarium dry rot, late blight, pink rot, and others) and sprouting
- Will reduce the use ofazole chemistries in agriculture that have lost efficacy due to widespread resistance of target pathogens
- May lessen efficacy loss of medically important azoles used to control fungal infections in humans

Applications

- Is a biological agent to be applied to potatoes (and potentially other crops) to control fungal infections and reduce sprouting.

Antisense Oligo Targets Bacterial pathogens in Plants and Insects

This invention relates to bactericidal molecules to suppress bacterial pathogens inside of plants (Citrus trees or Potato) and insects (Hemiptera: Psyllids and Leafhoppers).

Specifically, *Liberibacter* pathogens, but also gram-negative or gram-positive bacteria.

Suppression of *Liberibacter* bacteria in potatoes reduced symptoms, and suppression of bacteria in citrus trees is associated with increased retention of fruits.

Docket No: 40.17

Contact: Tanaga.Boozer@usda.gov



Untreated infected

Treated infected

Benefits

- Provides protection against Bacteria, including *Candidatus Liberibacter* (Citrus pathogen) and *Candidatus Liberibacter solanacearum* (potato pathogen)

Applications

- Prevent and reduce spread of citrus huanglongbing, HLB, and Zebra Chip in potato
- Suppression of other bacterial plant pathogens
- Suppression of insects by targeting endosymbionts

RNAi Strategies for Control of Whitefly

A double stranded RNA that targets genes important for the viability of the whitefly. By suppressing expression of key genes, the whitefly dies quickly, reducing whitefly populations on plants treated with these RNA constructs or on modified plants producing the RNAs. Reduced incidence of whitefly numbers and whitefly feeding on plants has the potential to greatly reduce transmission of whitefly-transmitted plant viruses that infect a wide array of crops.

Docket No: 105.17 + 75.21

Contact: David.Nicholson@usda.gov



Benefits

- Provides broad plant protection against whitefly, *Bemisia tabaci*, *B. argentifolii*, and biotypes, by reducing populations
- Could result in a reduction in the use of insecticides in crop production
- Can be applied as topical product or incorporated into plant expressed systems

Applications

- Efficacious whitefly suppression to combat pest and the viral pathogens they transmit
- Increase yields by reducing losses to whitefly

Sweetly Control Fly Pests

Insect dipteran pests damage a wide range of agricultural crops and livestock and transmit a variety of vector-borne diseases to humans. Current control methods heavily depend on non-specific chemical insecticides which negatively impact the environment and human health and can lead to chemical resistance. There is a need to replace current control methods with environmentally friendly alternatives. ARS has developed an insecticidal formulation based on non-nutritive sugars to control spotted-wing drosophila adults, and it has potential to control other fly pests and mosquitoes.

Docket No: 47.19

Contact: David.Nicholson@usda.gov



Benefits

- The artificial sweetener formulation is a biologically-based insecticide
- Could be an organic control alternative to chemical insecticides
- Provides a safe and simple method

Applications

- The sugar formulation can be sprayed directly on berry crops including blueberry plants
- This formulation can be used as a delivery agent or feeding attractant combined with conventional or biological insecticides to enhance insecticidal efficacy
- The method can be expanded to other Dipteran pests

Cadherin Receptor Peptide for Potentiating Bt Biopesticides

A cadherin peptide that enhances the toxicity of Cry proteins. The approach uses a peptide fragment derived from an insect cadherin protein combined with *Bacillus thuringiensis* Cry protein toxin to work as an insecticide against coleopterans and lepidopteran species.

Docket No: 44.07

Contact: Dennis.Goodes@usda.gov

Benefits

- An increase in synergistic potency that would not be achieved via administration of the partial cadherin fragment or Cry protein individually

Applications

- Control of coleopteran and lepidopteran pests

A Hexaploid Schedonorus Arundinaceus Plant That Possesses a Lolium Multiflorum Cytoplasm Useful for Producing Rhizomatous Hybrids

A tall fescue DH66OP possessing a *L. multiflorum* cytoplasm that can enhance or induce rhizome formation across various genotypes. DH66OP may allow for the transfer the *L. multiflorum* cytoplasm to additional tall fescue genotypes for the recovery of genotypes expressing rhizomes.

Docket No: 99.18

Contact: Dennis.Goodes@usda.gov

Benefits

- Rhizomatous forms of any grass turf or forage are highly desirable since the rhizomes represent rapidly spreading tillers that can fill voids in turf or pastures without the need for reseeding

Applications

- DH66OP may be used as the maternal parent in a hybridization with another plant, such as a *Fescue sp.* or *Lolium sp.* Plant to produce rhizomatous plant materials or hybrids

Methods of Attracting *Drosophila Suzukii*

A Method of attracting *Drosophila suzukii*, involving treating an object or area with a chemical attractant composition based on apple juice volatiles that attract *Drosophila suzukii*.

Docket No: 148.18

Contact: Jim.Poulos@usda.gov



Benefits

- The compound *is* a synthetic natural attractant based on fruits
- The method provides a means of early detection and population monitoring of *Drosophila suzukii*

Applications

- Infestation detection and monitoring
- Could potentially enable future development of mass trapping and mating disruption technologies for managing this pest

A Nematicide Having Low Toxicity Made from Corn Starch and a Vegetable Oil Derivative

When water-insoluble corn starch is combined with a water-insoluble fatty amine salt (from vegetable oil) at elevated temperature using a common industrial technique, an amylose inclusion complex is formed which acts as a nematicide.

Docket No: 128.18

Contact: Renee.Wagner@usda.gov



Damage caused by plant-parasitic nematodes to raspberry (left) and wheat (right). Smaller plants

Benefits

- Order of magnitude safer than current nematicides
- Ease of application
- ~100% Biobased and biodegradable
- Ingredient costs less than \$1/lb

Applications

- Ease of use and safety makes this ideal for controlling nematodes in the home garden
- Cost makes this an ideal addition to a multi-faceted approach to controlling nematodes in agricultural settings

DEEPER ROOTING 1 Gene

The shape of a plant's root system impacts the resources it can access. The DEEPER ROOTING 1 (DRO1) gene assists in modulating the angle at which the roots grow. Knot-out mutations in the DRO1 gene lead to horizontal root growth, while plants that over-expressed DRO1 have more downward root growth.

Docket No: 106.15

Contact: Jim.Poulos@usda.gov



Benefits

- More downward root growth may lead to increased access to water at deeper soil layers
- Potential for improving plant stability in soil

Applications

- Trees and other plants with altered root system shape to better access soil resources such as water and nutrients, as well as potentially improved anchorage

Double Stranded RNA for Asian Citrus Psyllid Control

Novel double stranded RNA constructs that target trehalase enzyme, gene expression in psyllids. Trehalose is the major blood sugar in insects with a crucial role as an instant source of energy and in dealing with abiotic stresses.

The hydrolysis of trehalose is under the enzymatic control of trehalase. The use of constructs suitable as topical applied or incorporation for plant expression.

Docket No: 137.14

Contact: Tanaga.Boozer@usda.gov



Benefits

- Provides focused pest suppression, psyllids, Asian citrus psyllid by reducing populations
- Could result in a reduction in the use of insecticides in citrus production
- Can be applied as topical product or incorporated into citrus trees in expression systems

Applications

- Safe and efficacious psyllid population suppression to aid reduction of transmission and spread of *Liberibacter asiaticus*, pathogenic bacteria in citrus.

Two-line Breeding System in Sorghum

A novel, two-line breeding system based on a stable nuclear male sterile mutant *ms8* and its gene. The breeding system is efficient because it doesn't require breeding for A/B pair or R lines.

Docket No: 68.17

Contact: Dennis.Goodes@usda.gov



Benefits

- Sorghum hybrids can be created by pollinating the bridge plants with any elite line or natural collection
- Simplified breeding process and more hybrid vigor
- Avoid devastating diseases that attack sorghum hybrids made with A1 cytoplasm

Applications

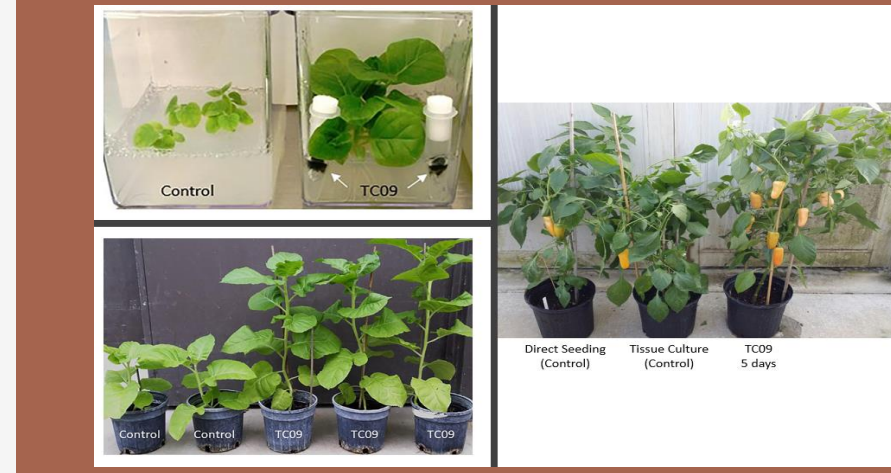
- Efficiently create hybrids for any type of sorghum, especially for biomass or special use sorghums, for which the traditional three breeding system has not been well-established.

Fungal Volatiles to Promote Plant Growth and Increase Crop Productivity

This technology involves the use of non-phytopathogenic isolates of the fungal species *Cladosporium sphaerospermum* to rapidly promote plant growth, early flowering and increased crop productivity. All of these can be achieved by a short duration exposure of seedlings to the volatiles emitted by the fungus.

Docket No: 57.17

Contact: Jim.Poulos@usda.gov



Benefits

- Speeds up the development of both shoots and roots within days of exposure
- Dramatically increases biomass
- Provides higher growth rates throughout the entire plant life cycle
- Achieves up to 20-day earlier flowering
- 100% increase in fruit yield
- Provides higher
- Improve root growth under both *in vitro* and *ex vitro* conditions
- Effective on many crop species in diverse plant families

Applications

- May be incorporated in seedling preparation for field crops with transplant system, greenhouse crops and vertical agriculture operations
- The technology can be used to enhance root growth in tissue culture systems to overcome poor rooting-associated problems as well as to accelerate plant transformation systems

Plant-mediated Silencing of a Fatty Acid – and Retinol-binding Protein in *Pratylenchus Penetrans*

Fatty acid- and retinol-binding (FAR) proteins are a family of proteins unique to *Pratylenchus Penetrans*, a species of nematodes. This invention consists of a region of the FAR-1 gene from the root lesion nematode that has been made into a dsDNA construct (ds-FAR-1) that is designed to silence the FAR-1 gene of root lesion nematodes. The reproduction of root lesion nematodes feeding on soybean roots engineered to contain this construct was significantly reduced.

Docket No: 199.16

Contact: Jim.Poulos@usda.gov



A root infected with
many nematodes

Benefits

- ds-FAR-1 can be used to engineer plants, or apply directly to plants, for resistance to root lesion nematodes
- Plants with resistance to root lesion nematodes decreases the use of fumigants and pesticides from nematode control
- Because the FAR-1 protein is found on in nematodes, application of this technology should not affect non-target organisms such as humans, plants, insects (e.g. bees), etc.

Applications

- The ds-FAR-1 construct may be a useful technology for genetic improvement of plants that are susceptible to root lesion nematodes such as potatoes, soybeans, corn, fruits (apples, raspberries, and cherries), and lilies

A Tool for Managing the Quality of Plant Products

This system provides a novel approach to quality management in plant-based products. Plants do not always do what we want. Sometimes stress is needed to get the human-desired outcome. This system consists of a combination of physiological information, plant temperature and water status, and an irrigation controller. The system allows a user to continuously monitor and manage the progress of the plant toward a desired quality outcome.

Docket No: 99.09

Contact: Dennis.Goodes@usda.gov



Benefits

- Allows for the precise imposition and management of plant thermal and water stress
- Allows for management of quality-related plant outcomes in a highly reliable manner
- Useful in greenhouse and field settings
- Automated

Applications

- Quality-related factors such as aromatics and taste parameters can be associated with plant status and modified over a season
- Provides water at minimum amounts to achieve desired outcome (product)

Use of Phyllosphere Associated Lactic Acid Bacteria as Biocontrol Agents to Reduce Bacterial Growth on Fresh Produce

The use of phyllosphere-associated lactic acid bacteria that demonstrate inhibitory effects on the growth and maintenance of human pathogens, such as *Salmonella enterica*, on the surface of food products, particularly fresh fruits and vegetables.

Docket No: 76.14

Contact: David.Nicholson@usda.gov

Benefits

- Bacteria are applied in liquid or freeze-dried powder forms onto food surfaces or agricultural environments that are already contaminated with pathogenic bacteria
- Treatment of produce can take place either pre- or post-harvest
- Easily implemented, low cost solution

Applications

- Could be used to eliminate prevalent food-borne pathogens
- Bacteria could also be used to decontaminate food processing environments and machinery as part of a normal sanitization process

Chromobacterium Species with Insecticidal Activity

A novel species of *Chromobacterium* that selectively kills lepidopteran insect larvae (such as, gypsy moth, diamondback moth, tobacco hornworm larvae, and cabbage looper larvae). Compositions containing *Chromobacterium spagni* sp. strains and the use of these compositions to kill insect larvae are covered by the U.S. and PCT patent applications. These compositions kill the indicated larvae at least as well as or better than some *C. subtsugae* biocontrol agents.

Docket Nos: 58.19

Contact: Jim.Poulos@usda.gov

Benefits

- Biocontrol agent
- Some species of lepidoptera have become resistant to currently used pesticides. Thus a need exists for new biocontrol agents

Applications

- This invention covers an insecticidal bacterium that can be used to kill lepidopteran insect larvae without harming non-target insect larvae

In-Row Rotary Cultivator

A hydraulically-driven rotary weeder for in-row cultivation of vineyards and other crops grown on a berm. This cultivator is especially useful for the removal of weeds in and around grapevines without major disruption of vine trunks and berms. It is also useful in wine grape production where certain herbicides such as glyphosate are prohibited. ARS researchers have developed a prototype that is about 90% complete.

Docket No: 17.09

Contact: David.Nicholson@usda.gov



Benefits

- Eliminates the use of herbicides while maintaining weed-free berm
- Provides weed control on berms where organic crops are grown
- May be used on a variety of bermed crops where weed-free zones are desired

Applications

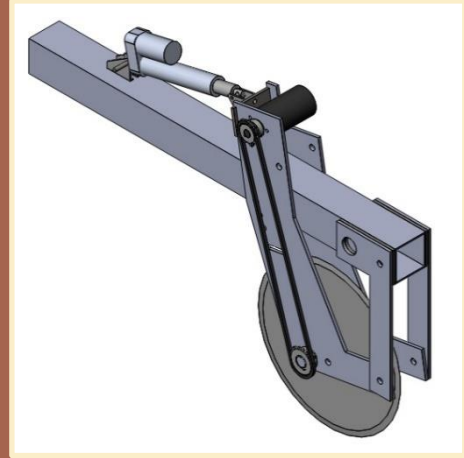
- May be used in and around a variety of crops grown on berms where a weed-free zone in between and around plants is desired. Rotary cultivator can be used with an existing tractor hydraulic system, or a remote oil tank can be used

Modular Cutting Device for Cover Crop Residue

A modular cutting device for cover crop residue can improve planting quality in both row crop and vegetable no-till farming systems. Eliminates interference with planting unit by cleanly cutting through heavy surface residue utilizing higher RPM of the cutting disk compared to RPM obtained through free rotation (friction with soil) for traditional coulters. This versatile and compact modular design allows retrofitting of current commercially-available planting equipment for different planting configurations.

Docket No: 131.18

Contact: Tanaga.Boozer@usda.gov



Benefits

- Provides effective and clean cutting of heavy cover crop residue for better quality planting cash crops directly into cover crop residue
- Modular design to allow different mounting configurations and available power sources such as mechanical, hydraulic and electric
- Vastly improved cutting effectiveness of cover crop residue over traditional cutting coulters especially in weight-limited small farm applications

Applications

- For use in heavy cover cropping systems where tradition cutting coulters are less effective. This device can be adapted to any no-till planting system and equipment size

Subsurface Applicator for Dry Manure

A novel, tractor-drawn implement that can apply dry poultry litter in shallow parallel bands beneath the soil surface. It can also be used for subsurface application of other dry bulky soil amendments such as manure, compost, or biochar. This technology utilizes an innovative auger system to crush and distribute dry, untreated poultry litter to soil openers, and no-till technology that minimizes damage to soil structure and perennial crops. It provides uniform litter distribution and precise control of litter application rates, including very low rates that are not feasible with litter spreaders.

Docket No: 64.07

Contact: Tanaga.Boozer@usda.gov



Benefits

- Maximizes nutrient-use efficiency by preventing ammonia-N loss to the atmosphere, even during extended periods of adverse weather
- Improves water quality by preventing more than 90% of litter nutrient losses in storm runoff
- Increases crop yield and/or quality by retaining more nutrients and water in the soil
- Controls nuisance odor problems from litter

Applications

- This technology can help farmers utilize organic nutrients more efficiently to increase production while improving air and water quality, especially in perennial pastures and other no-till systems

Sorghum Derived Transcription Regulatory Elements Predominantly Active in Root Hair Cells

Transcription regulatory elements, namely promoter and terminator sequences, obtained from *Sorghum bicolor* that drive RNA transcription predominately in root hair cells, as well as cassettes, expression vectors, and genetically modified plants containing these transcription regulatory elements. The genetically modified plants can be gymnosperms, dicots, or monocots. Methods of directing transcription of a heterologous polynucleotide under control of these transcription regulatory elements in a genetically modified plant's root hair cells are also provided.

(Life Sciences)

Docket Nos: 77.18 + 183.07

Contact: Tanaga.Boozer@usda.gov



Benefits

- The transcription regulatory elements selectively direct gene expression in root hair cells of a plant

Applications

- Overexpress transporters in root hairs to increase a plant's ability to extract nutrients from the soil or alternatively as a means of removing soil contaminants
- Highly express secretory signal proteins in root hairs which would then be secreted into soil for collection
- Use of root hair promoters to express gene products capable of synthesizing pesticidal compounds, which when secreted in soil would reduce the need for synthetic pesticide treatments

Chromobacterium phragmitis for Insect Control

Chromobacterium phragmitis is a newly discovered species of bacteria that has insecticidal activity against immature stages of both fly and moth pests. These bacteria are not insect pathogens, but produce compounds in culture that are toxic to the insects. This means that it is not necessary to maintain the viability of the bacteria in a product, and that the toxic compounds can be concentrated in post-fermentation processing.

Docket No: 109.15

Contact: Jim.Poulos@usda.gov

Benefits

- Cultures of *C. phragmitis* are more toxic to moth species than *C. subtsugae*
- An alternative to *Bacillus thuringiensis* with a broader activity spectrum

Applications

- Cultured *C. phragmitis* can be used as an organic insecticide with activity against lepidopteran and dipteran insect pests such as cabbage looper, diamondback moth, and seedcorn maggot

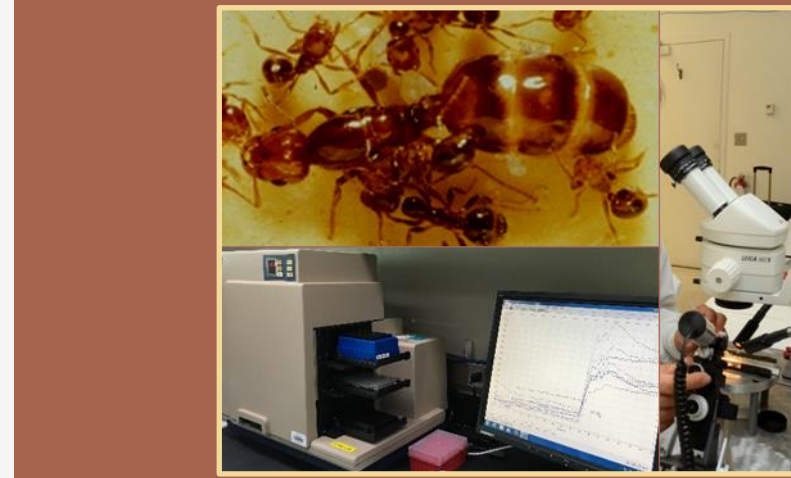
Bioactive Peptides Having Insecticide Activity

Novel bioactive peptides were discovered using a receptor screening process. The peptides are structurally very different from the natural ligand(s) for this receptor. Injection of the novel peptides into fire ants (our model system) resulted in mortality. Interestingly, several peptides displayed similar mortality effects when fed to ants in a sucrose solution, thus, a bait-station system could be used as a novel control method to add to the fire ant integrated management toolbox. Fire ants are an annual 6-billion-dollar problem in the U.S. The screening method can be applied to a wide variety of receptors and insect pests, providing versatility and likely target specificity.

(Life Sciences, Medical-Health)

Docket Nos: 135.17 + 244.12

Contact: Tanaga.Boozer@usda.gov



Benefits

- The novel peptide ligands show mortality effects when fed to fire ants – a bait formulations and fire ant control
- Peptide selection method is readily adapted to other target receptors and insect pests
- The control method is targeted rather than general.
- The peptides are expected to be an environmentally-friendly pest management tool

Applications

- Bioactive peptides discovered can be used directly and/or formulated to control the fire ant and other insect pests.
- The technology for fire ant model, but the invention can be applied to any insect pest species.

Novel *Nylanderia fulva* Virus

At least one novel virus capable of infecting crazy ants (*Nylanderia fulva*), along with polynucleotide sequences and amino acid sequences of the virus. The virus is capable of be used as a biopesticide to control populations of crazy ants.

(Life Sciences, Medical-Health)

Docket Nos: 47.16 + 36.14

Contact: Tanaga.Boozer@usda.gov

Benefits

- This *Nylanderia fulva* virus is the first virus to be discovered from the invasive ant species *N. fulva*

Applications

- Potentially the virus could be utilized as a biopesticide or biological control agent to eliminate or at least reduce the spread of *Nylanderia fulva* and their colonies
- The virus could serve as a gene delivery system to study functional genomics in the ant

Novel Cytochrome P450 Enzymes from Sorghum Bicolor

Two novel cytochrome P450 genes isolated from sorghum, each gene encoding a protein having pentadecatrienyl resorcinol hydroxylase activity. Expression vectors containing these sequences are made and used to elevate levels of pentadecatrienyl resorcinol hydroxylase in transgenic cells and organisms. Divisional patent application. Parent U.S. patent No. is 9,284,537.

(Life Sciences)

Docket No: 41.16 + 145.12

Contact: Tanaga.Boozer@usda.gov



Benefits

- Modification and expression of the sorghum cytochrome P450 enzymes in plant cells could increase sorgoleone levels, or alternatively, introduce its biosynthesis into species lacking the endogenous sorgoleone biosynthetic enzymes

Applications

- Potential use for engineering the production of sorgoleone and related phenolic lipids in crops for enhanced resistance to disease and for the ability to resist weed infestations

Novel PPETAC1 Gene and Method to Manipulate Tree Architecture

A gene (PpeTAC1) identified from peach can be manipulated to influence branching angle and thus, overall tree architecture. Silencing or overexpressing the gene controls the branch angles (either upright or spreading).

(Life Sciences)

Docket No: 180.11

Contact: Jim.Poulos@usda.gov

Benefits

- Increased planting density
- Improved plant water use efficiency
- Reduced chemical sprays

Applications

- Development of plant or tree varieties with erect growth habit for agriculture or ornamental uses

The Effect of PPEGID1A on Vegetative Growth of Fruit Trees

A novel gene for a recessive dwarf trait in peach and its role in controlling tree size. Silencing the gene results in *Prunus* trees having a dwarf appearance while still retaining normal flower and fruit development. The degree of silencing corresponds to the degree of overall tree size.

(Life Sciences)

Docket No: 169.13

Contact: Jim.Poulos@usda.gov

Benefits

- Developing crop trees with different degrees of dwarfing could lead to high density production, reduce manual labor costs, and reduce the volume of chemical inputs needed
- Environmental benefit given that less agricultural land and chemical inputs are needed

Applications

- *Prunus* tree industry
- Ornamental tree industry

Potato Fertility Restoration

Transgenic Bintje potato plants have been developed that restore fertility and seed ball formation in sterile potato plants. The gene used in transgenic development is a family 1 cellulose-binding-domain encoding gene from *Phytophthora infestans*. Bintje control plants are male and female sterile while the transgenic plants are male sterile and female fertile thus enabling crosses to be made into transgenic Bintje to obtain Bintje potatoes with favorable traits. The *P. infestans* RB gene for resistance to late blight, and genes responsible for color and tuber shape have been transferred into Bintje germplasm. Selection for the absence of the CBD1 transgene provides null-segregants that are considered non-transgenic, *i.e.*, a non-transgenic potato having the desirable trait of resistance to late blight for example.

(Life Sciences)

Docket No: 162.13

Contact: Jim.Poulos@usda.gov

Benefits

- Use of the CBD1 gene in transgenic Bintje will allow for the introduction of new traits into previously infertile cultivar

Applications

- The cultivar Bintje is one of the most widely used potatoes in Europe. Bintje has the advantage of having outstanding flavor, but some disadvantages are that it lacks disease resistance and the tubers are short and unsuitable for use commercially in the U.S., for example, where longer French fries are sold by fast food franchises. Thus, the possibility now exists for non-transgenic potatoes resulting from crosses with the transgenic Bintje potato to have the desirable traits of disease resistance and longer length while still maintaining the outstanding flavor of Bintje

A Transgene Construct to Improve Fusarium Head Blight Resistance in Wheat and Barley

A gene encoding a wheat ethylene-responsive transcription factor was cloned into a plant gene expression vector. This vector when transformed into wheat and barley results in increased resistance to Fusarium head blight and other Fusarium-related diseases. The fungus responsible for this disease produces a mycotoxin that poses a significant threat to the human and animal health.

(Life Sciences)

Docket No: 168.11

Contact: Renee.Wagner@usda.gov



Benefits

- To date, no sources of wheat completely resistance to this disease have been found; therefore, fungicides are required for control. The problem is that the currently available registered fungicides only provide partial control (50-60%). Transgenic plants expressing this gene have significant resistance to this disease.

Applications

- Fusarium head blight disease results in close to \$500 million in damage to the US wheat and barley crop. Transgenic plants expressing this gene results in significant resistance to this disease.

Barley Mutant Lines Having Grain with Ultra-High Beta Glucan Content

A barley plant having grain with ultra-high beta-glucan content and total fiber.

(Life Sciences, Medical-Health)

Docket No: 53.12

Contact: David.Nicholson@usda.gov

Benefits

- A lower starch, but not empty endosperm line like other high beta-glucan lines
- Could provide high beta-glucan flour that is used in various food products
- Plants have normal looking morphology

Applications

- Use as an critical parental line to significantly boost beta-glucan content in food barley cultivars
- Use as parental line to significantly boost total dietary fiber in food barley development
- Directly use it as dietary fiber extraction source

Insecticidal Strain of *Serratia* for Control of Insects Such as Brown Marmorated Stink Bug (BMSB) *Halyomorpha Halys*

A strain of the *Serratia* bacteria that has insecticidal properties was identified. This strain can be used as a novel biocontrol agent and strategy for controlling brown marmorated stink bugs.

(Environmental, Life Sciences)

Docket No: 92.14

Contact: Jim.Poulos@usda.gov



Benefits

- This bacteria strain was isolated in Maryland so they are native pathogens. In addition, the bacteria strain can be grown on standard laboratory media

Applications

- This bacteria strain may be able to be used in a bait to control brown marmorated stink bugs

Pseudomonas Fluorescens 2-79 with Genes for Biosynthesis of Pyrrolnitrin Improves Biocontrol Activity

Pseudomonas fluorescens 2-79 bacterial strains with pyrrolnitrin biosynthetic genes have enhanced biocontrol activity against the soil-borne pathogen *Rhizoctonia*.

(Environmental, Life Sciences)

Docket No: 128.11

Contact: David.Nicholson@usda.gov

Benefits

- There is no resistance in wheat or barley to *Rhizoctonia*, no fungicides are available, and all crops grow in rotation with wheat and barley are susceptible to *Rhizoctonia*

Applications

- Could be used as a seed treatment to enhance biocontrol activity against *Rhizoctonia* root rot of wheat
- *Rhizoctonia solani* AG-8 is a disease of direct-seeded wheat and a barrier to wider adoption of conservation tillage, which is needed to control soil erosion

Pseudomonas Fluorescens Inhibit Annual Bluegrass and Rough Bluegrass Root Growth and Germination

A biocontrol agent effective for controlling annual bluegrass and rough bluegrass root growth and seed germination comprising of one or more *Pseudomonas fluorescens* strains. Also provided are methods for use of these biocontrol agents to control the growth of annual bluegrass and rough bluegrass.
(*Environmental, Life Sciences*)

Docket No: 129.11

Contact: David.Nicholson@usda.gov

Benefits

- The biocontrol agent does not inhibit the growth of desired grasses, such as turfgrasses, cereal crops and native plants
- May be applied to the soil and/or seeds in the fall with inhibition occurring in subsequent years
- Can also be used in combination with herbicides and/or fertilizer

Applications

- Inhibits the growth of annual bluegrass and/or rough bluegrass when they are most actively growing and out-competing desired plants (e.g., turfgrass, crops, and native plants)

Transplanter for a Walk-Behind Tractor

The transplanter is a self-propelled walk-behind tractor for no-till and/or organic vegetable small scale market farms and gardens. The transplanter is designed to help small farmers transplant vegetables and other seedling vegetables and to ensure good root system-to-soil contact.

(Environmental, Electronics & Hardware)

Docket No: 187.16

Contact: Tanaga.Boozer@usda.gov

Benefits

- Adapted to small scale tractors
- The transplanter is operated by one person who simultaneously operates the transplanter and drives the walk-behind tractor
- Auxiliary racks of transplant vegetables can be attached to the tractor to enable the operator to reload the transplanter and thereby continuously transplant multiple plants
- The transplanter can be configured to plant more than one row simultaneously
- A no till system that mechanically transplants vegetables into cover crop residue

Applications

- A walk-behind tractor to help small farmers transplant seedling vegetables

Computer Vision Qualified Infrared Temperature Sensor

An integrated set of sensors, microprocessor, and devices with software that remotely measures surface temperature and simultaneously acquires an image for the purposes of qualifying the sensed temperature. The system can be used to aide in precision irrigation management of center pivot or lateral move irrigation systems by providing surface temperature data for use in irrigation scheduling algorithms and automatic irrigation. The system can also be used in greenhouse environments and in drip irrigated fields to help monitor plant abiotic (drought, chemical) and biotic stresses (disease, insect infestation).

(Environmental, Electronics & Hardware)

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Benefits

- Can detect whether sensor sees plant or soil thus improving data quality immensely
- Greatly improved irrigation scheduling
- Much cheaper acquisition of data critical for real-time crop management
- Improved accuracy in crop yield forecasting
- Water conservation

Applications

- Crop irrigation scheduling and automation
- Detection of crop nutrient deficiencies, pests, weeds, and diseases
- Crop yield forecasting