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(54) **Title**: METHOD FOR IMPROVING PLANT QUALITY

(57) **Abstract**: The present invention relates to a method for improving plant quality, which method comprises treating the crop plant and/or the locus where the crop plant is growing or is intended to grow and/or the plant propagules with a plant quality improving amount of a micronutrient containing active ingredient.

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Method for improving plant quality

The present invention relates to the novel method for improving plant quality, which method comprises treating the crop plant and/or the locus where the crop plant is growing or is intended to grow and/or the plant propagules with a plant quality improving amount of a micronutrient containing active ingredient.

Zinc is an essential micronutrient for the normal growth, development and health of plants and human beings. Currently, large areas of agricultural land are now known to be zinc deficient, causing severe reductions in crop productivity and nutritional quality of the food crops. Still in many countries, zinc deficiency is unrecognized or underestimated and untreated. There is, therefore, an urgent need to understand and address zinc deficiency in these countries in order to contribute to both crop production and human health. Zinc is also particularly important for better tolerance of crop plants under various stress factors such as drought, heat and salinity.

Applying zinc fertilizers to soil and/or onto plant leaves offers a simple and highly effective solution to zinc deficiency problems in crop plants and to increasing zinc concentrations of foods. This strategy greatly prevents unnecessary loss of food production and helps improve public health. For example, enrichment of rice and wheat grain with zinc may save the lives of up to 48,000 children in India annually.

For millions of people around the world, a few extra milligrams of zinc each day can make the difference between illness or death and a healthy, productive life. By ensuring that crops have an adequate supply of zinc, we can help address this global problem by providing significant health, social and economic benefits (Zinc Fertilizer Brochure 2009, published by the International Zinc Association IFA; see also Comparative Quantification/Global and Regional Burden of Diseases Attributable to Selected Major Risk Factors of Health Risks, Ezzati, Lopez, Rodgers, Murray (eds.), Chapter 5 – Zinc Deficiency, WHO, 2004).

Zinc is essential for the normal healthy growth and reproduction of plants, animals and humans. When the supply of plant-available zinc is inadequate, crop yields and quality of crop products are impaired. In plants, zinc plays a key role as a structural constituent or regulatory co-factor of a wide range of different enzymes and proteins in many important biochemical pathways. When the supply of zinc to the plant is inadequate, the physiological functions of zinc cannot operate correctly and thus plant growth is adversely affected. This can result within the plant in visible symptoms of stress, which symptoms vary with species and which might include: stunting (reduced height), interveinal chlorosis (yellowing of the leaves between the veins), bronzing of chlorotic leaves, small and abnormally shaped leaves and/or stunting and rosetting of leaves (where the leaves form a whorl on shortened stems). So-called hidden deficiencies without obvious visible symptoms might lead to a 20 % loss of plant yield. Zinc-deficient soils causing hidden deficiency may cause a significant financial loss to the farmer. Thus, it is necessary to identify zinc-deficient soils as early as possible by soil testing or crop plant analysis. Once identified, zinc-deficient soils can be easily treated with zinc fertilizers to provide an adequate supply of zinc to the crops, where zinc sulphate is by far the most widely used fertilizer (cf. Zinc in Soils and Crop Nutrition by B.J. Alloway, 2nd Ed. Brussels, Paris, 2008).

Furthermore, it is known that vines treated with zinc sulfate or Zineb fungicide showed significantly greater yield and growth compared to untreated vines (cf. ISHS *Acta Horticulturae* **1987**, *199*, 157-161). In barley it has been shown that prevention of zinc deficiency was not the cause of yield response (cf. *EPPO Bull.* **1981**, *11*, 277-285). It is also known that micronutrients like copper, manganese and zinc can be applied to plants via fungicides containing such micronutrients. However, it depends on the type of complex the metal forms with the rest molecule whether uptake of the micronutrient is more or less efficient. It has thus been found that zinc in certain formulations of Ziram is not as readily absorbed compared to zinc from Zineb (cf. University of Florida, IFAS Extension, HS1159, 2009).

Furthermore, compositions for delivering zinc oxide in combination with a pesticide to plants and, more particularly, to potatoes are known (cf. WO 95/20874).

Herewith a method for improving the plant quality is provided, characterized in that a crop plant and/or the locus where the crop plant is growing or is intended to grow and/or the plant propagules are treated with a plant quality improving amount of a micronutrient containing active ingredient, which active ingredient preferably is also fungicidally active.

The micronutrient containing active ingredient is preferably selected from the group consisting of active ingredients containing at least one metal ion selected from the group consisting of zinc, manganese, molybdenum, iron and copper or the micronutrient boron.

More preferably these active ingredients are selected from the group consisting of zinc containing compounds like Propineb, Polyoxin Z (zinc salt), Zineb, Ziram, zinc thiodazole, zinc naphthenate and Mancozeb (also containing manganese), or from manganese containing compounds like Maneb, Metiram and Mancopper (also containing copper), or from iron containing compounds like Ferbam, or from copper containing compounds like Bordeaux mixture, copper oxychloride, tribasic copper sulphate, copper oxide, copper octanoate, copper hydroxide, oxine copper and copper naphthenate.

More preferably the active ingredients are selected from the group consisting of Propineb and Mancozeb. More preferably the active ingredient is Propineb.

All of the above mentioned micronutrient containing active ingredients are known to have fungicidal properties and can be used for controlling various plant diseases (cf. The Pesticide Manual, 15th Edition 2009).

The term “plant quality” (quality of a plant) is defined as a condition of the crop plant and/or its products which is determined by several aspects alone or in combination with each other such as yield (for example increased biomass, increased content of valuable ingredients and/or improved content or composition of certain ingredients) and plant vigor (for example improved plant growth and/or greener leaves).

One indicator for the quality of a plant, in particular for the condition of the plant is its yield. “Yield” is to be understood as any plant part or product of economic value that is produced by the plant such as grains, leaves, roots, fruits in the proper sense, vegetables, nuts, seeds, wood (e.g. in the case of forestry) or even flowers (e.g. in the case of horticulture and ornamentals). The plant products may in addition be further utilized and/or processed after harvesting.

According to the present invention “increased yield” of a crop plant means that the yield of a product of the respective crop plant is increased by a measurable amount over the yield of the same product of the plant produced under the same conditions, but without the application of the micronutrient containing active ingredient. Increased yield can be characterized inter alia by following improved properties of the crop plant:

- increased plant weight,
- increased plant height,
- increased zinc content,
- increased iron content,
- increased calcium content,
- increased biomass such as higher fresh weight (FW) and/or dry weight (DW),
- higher grain yield,
- higher acidity,
- higher anthocyanin content,
- more tillers,
- larger leaves,
- increased shoot growth,
- increased (e.g. of soluble proteins),
- increased oil content,
- increased starch content,
- increased pigment content,
- increased nutrient content,
- increased protein content,
- increased vitamin content (e.g. of Vitamin B_1, B_2, C and E),
- increased content of fatty acids,
- increased metabolite content,
- increased carotenoid content (e.g. of Vitamin A),
- increased amount of essential amino acids,
- improved nutrient composition,
- improved protein composition,
- improved composition of fatty acids,

- improved metabolite composition,
- improved carotenoid composition,
- improved sugar composition,
- improved amino acids composition,
- improved or optimal fruit color,
- improved leaf color,
- higher storage capacity,
- higher processability of the harvested products.

According to one embodiment of the present invention, depending on the type of improved property the yield is increased by at least 5 %, 10 %, 25 %, 50 % or even more compared to the respective untreated control plant.

Another indicator for the quality of a plant, in particular for the condition of the crop plant is the "plant vigor". The plant vigor becomes manifest in several aspects such as the general visual appearance and growth. Improved plant vigor can be characterized inter alia by following improved properties of the plant:

- improved vitality of the plant,
- improved plant growth,
- improved plant development,
- improved visual appearance,
- improved plant stand (less plant verse/lodging),
- improved emergence,
- enhanced root growth and/or more developed root system,
- enhanced nodulation, in particular rhizobial nodulation,
- bigger leaf blade,
- bigger size,
- increased plant weight,
- increased fresh weight (FW),
- increased dry weight (DW),
- increased plant height,
- increased tiller number,
- increased shoot growth,
- increased root growth (extensive root system), increased yield when grown on poor soils or unfavorable climate,
- enhanced photosynthetic activity,
- enhanced pigment content (e.g. Chlorophyll content),
- earlier flowering,
- earlier fruiting,

- earlier and improved germination,
- earlier grain maturity,
- better size distribution
- higher grain hardness
- improved self-defence mechanisms,
- improved stress tolerance and resistance of the plants against biotic and abiotic stress factors such as fungi, bacteria, viruses, insects, heat stress, cold stress, drought stress, UV stress and/or salt stress,
- less non-productive tillers,
- less dead basal leaves,
- less input needed (such as fertilizers or water),
- greener leaves,
- complete maturation under shortened vegetation periods,
- less fertilizers needed,
- less seeds needed,
- easier harvesting,
- faster and more uniform ripening,
- longer shelf-life
- longer panicles,
- delay of senescence,
- stronger and/or more productive tillers,
- better extractability of ingredients,
- improved quality of seeds (for being seeded in the following seasons for seed production),
- reduced production of ethylene and/or the inhibition of its reception by the plant.

According to one embodiment of the present invention, depending on the type of improved property the plant vigor is increased by at least 5 %, 10 %, 25 %, 50 % or even more compared to the respective untreated control plant.

Depending on the treated plant, different quality parameters are more preferably increased than others. In the following some quality parameters are mentioned depending on the treated crop plant.

According to one embodiment of the invention the preferred quality parameters for potatoes are

- increased protein content (e.g. of soluble proteins),
- increased starch content,
- increased biomass such as higher fresh weight (FW) and/or dry weight (DW),
- increased zinc content.
- better size distribution

According to one embodiment of the invention the preferred quality parameters for rice are

- increased carotenoid content (e.g. of Vitamin A),
- increased zinc content,
- increased iron content,
- increased protein content (e.g. of soluble proteins).

According to one embodiment of the invention the preferred quality parameters for corn/maize are

- increased carotenoid content (e.g. of Vitamin A),
- increased zinc content,
- increased iron content,
- increased protein content (e.g. of soluble proteins),
- increased oil content,
- increased starch content.

According to one embodiment of the invention the preferred quality parameters for apples are

- increased calcium content,
- higher acidity.

According to one embodiment of the invention the preferred quality parameter for citrus plants is

- increased Vitamin C content.

According to one embodiment of the invention the preferred quality parameter for tomatoes and cucumbers is

- increased calcium content.

According to one embodiment of the invention the preferred quality parameters for grapes/vine are

- higher anthocyanin content,
- higher acidity.

The micronutrient containing active ingredients which can be used according to the invention can be employed as such or in the form of customary formulations, such as solutions, emulsions, suspensions, powders, pastes, etc. Application is then carried out by customary methods. Thus, for example, it is possible to dress seeds with preparations comprising the micronutrient containing active ingredients, if appropriate in a mixture with other agrochemically active compounds and customary additives. A further type of application comprises mixing substances which can be used according to the invention either as such or in formulated form with other agrochemically active compounds and with customary formulation auxiliaries and preparing solid plant treatment agents, such as granules or baits, from these preparations.

When employing the micronutrient containing active ingredients which can be used according to the invention, the application rates can be varied within a certain range, depending on the type of application. In the treatment of seed, the application rates of micronutrient containing active ingredients are generally between 10 and 10000 mg per kilogram of seed, preferably between 10 and 300 mg per kilogram of seed. When used in solid formulations, the application rates of micronutrient containing active ingredients are generally between 20 and 800 mg per kilogram of formulation, preferably between 30 and 700 mg per kilogram of formulation.

The micronutrient containing active ingredients used according to the invention are generally applied in form of a composition comprising at least one micronutrient containing active ingredient as mentioned above. Preferably the fungicidal composition comprises agriculturally acceptable additives, solvents, carriers, surfactants, or extenders.

According to the invention, carrier is to be understood as meaning a natural or synthetic, organic or inorganic substance which is mixed or combined with the active compounds for better applicability, in particular for application to plants or plant parts or seeds. The carrier, which may be solid or liquid, is generally inert and should be suitable for use in agriculture.

Suitable solid or liquid carriers are: for example ammonium salts and natural ground minerals, such as kaolins, clays, talc, chalk, quartz, attapulgite, montmorillonite or diatomaceous earth, and ground synthetic minerals, such as finely divided silica, alumina and natural or synthetic silicates, resins, waxes, solid fertilizers, water, alcohols, especially butanol, organic solvents, mineral oils and vegetable oils, and also derivatives thereof. It is also possible to use mixtures of such carriers. Solid carriers suitable for granules are: for example crushed and fractionated natural minerals, such as calcite, marble, pumice, sepiolite, dolomite, and also synthetic granules of inorganic and organic meals and also granules of organic material, such as sawdust, coconut shells, maize cobs and tobacco stalks.
Suitable liquefied gaseous extenders or carriers are liquids which are gaseous at ambient temperature and under atmospheric pressure, for example aerosol propellants, such as butane, propane, nitrogen and CO_2.
Tackifiers, such as carboxymethylcellulose and natural and synthetic polymers in the form of powders, granules and latices, such as gum arabic, polyvinyl alcohol, polyvinyl acetate, or else natural phospholipids, such as cephalins and lecithins and synthetic phospholipids can be used in the formulations. Other possible additives are mineral and vegetable oils and waxes, optionally modified.
If the extender used is water, it is also possible for example, to use organic solvents as auxiliary solvents. Suitable liquid solvents are essentially: aromatic compounds, such as xylene, toluene or alkylnaphthalenes, chlorinated aromatic compounds or chlorinated aliphatic hydrocarbons, such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons, such as cyclohexane or paraffins, for example mineral oil fractions, mineral and vegetable oils, alcohols, such as butanol or glycol, and also ethers and esters thereof, ketones, such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents, such as dimethylformamide and dimethyl sulphoxide, and also water.
The compositions according to the invention may comprise additional further components, such as, for example, surfactants. Suitable surfactants are emulsifiers, dispersants or wetting agents having ionic or nonionic properties, or mixtures of these surfactants. Examples of these are salts of polyacrylic acid, salts of lignosulphonic acid, salts of phenolsulphonic acid or naphthalenesulphonic acid, polycondensates of ethylene oxide with fatty alcohols or with fatty acids or with fatty amines, substituted phenols (preferably alkylphenols or arylphenols), salts of sulphosuccinic es-

ters, taurine derivatives (preferably alkyl taurates), phosphoric esters of polyethoxylated alcohols or phenols, fatty esters of polyols, and derivatives of the compounds containing sulphates, sulphonates and phosphates. The presence of a surfactant is required if one of the active compounds and/or one of the inert carriers is insoluble in water and when the application takes place in water. The proportion of surfactants is between 5 and 40 per cent by weight of the composition according to the invention.
It is possible to use colorants such as inorganic pigments, for example iron oxide, titanium oxide, Prussian blue, and organic dyes, such as alizarin dyes, azo dyes and metal phthalocyanine dyes, and trace nutrients, such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.
If appropriate, other additional components may also be present, for example protective colloids, binders, adhesives, thickeners, thixotropic substances, penetrants, stabilizers, sequestering agents, complex formers. In general, the active compounds can be combined with any solid or liquid additive customarily used for formulation purposes.

In general, the compositions according to the invention comprise between 0.05 and 99 per cent by weight, 0.01 and 98 per cent by weight, preferable between 0.1 and 95 per cent by weight, particularly preferred between 0.5 and 90 per cent by weight of the active compound combination according to the invention, very particularly preferable between 10 and 70 per cent by weight.

The active compound combinations or compositions according to the invention can be used as such or, depending on their respective physical and/or chemical properties, in the form of their formulations or the use forms prepared therefrom, such as aerosols, capsule suspensions, cold-fogging concentrates, warm-fogging concentrates, encapsulated granules, fine granules, flowable concentrates for the treatment of seed, ready-to-use solutions, dustable powders, emulsifiable concentrates, oil-in-water emulsions, water-in-oil emulsions, macrogranules, microgranules, oil-dispersible powders, oil-miscible flowable concentrates, oil-miscible liquids, foams, pastes, pesticide-coated seed, suspension concentrates, suspoemulsion concentrates, soluble concentrates, suspensions, wettable powders, soluble powders, dusts and granules, water-soluble granules or tablets, water-soluble powders for the treatment of seed, wettable powders, natural products and synthetic substances impregnated with active compound, and also microencapsulations in polymeric substances and in coating materials for seed, and also ULV cold-fogging and warm-fogging formulations.

The formulations mentioned can be prepared in a manner known per se, for example by mixing the active compounds or the active compound combinations with at least one additive. Suitable additives are all customary formulation auxiliaries, such as, for example, organic solvents, extenders, solvents or diluents, solid carriers and fillers, surfactants (such as adjuvants, emulsifiers, dispersants, protective colloids, wetting agents and tackifiers), dispersants and/or binders or fixatives, preservatives, dyes and pigments, defoamers, inorganic and organic thickeners, water repellents, if appropriate siccatives and UV stabilizers, gibberellins and also water and further processing auxiliaries. Depending on the formulation type to be prepared in each case, further processing steps such as, for example, wet grinding, dry grinding or granulation may be required.

The compositions according to the invention do not only comprise ready-to-use compositions which can be applied with suitable apparatus to the plant or the seed, but also commercial concentrates which have to be diluted with water prior to use.

The active compound combinations according to the invention can be present in (commercial) formulations and in the use forms prepared from these formulations as a mixture with other (known) active compounds, such as insecticides, attractants, sterilants, bactericides, acaricides, nematicides, fungicides, growth regulators, herbicides, fertilizers, safeners and Semiochemicals.

The treatment according to the invention of the plants and plant parts with the active compounds or compositions is carried out directly or by action on their surroundings, habitat or storage space using customary treatment methods, for example by dipping, spraying, atomizing, irrigating, evaporating, dusting, fogging, broadcasting, foaming, painting, spreading-on, watering (drenching), drip irrigating and, in the case of propagation material, in particular in the case of seeds, furthermore as a powder for dry seed treatment, a solution for seed treatment, a water-soluble powder for slurry treatment, by incrusting, by coating with one or more layers, etc. It is furthermore possible to apply the active compounds by the ultra-low volume method, or to inject the active compound preparation or the active compound itself into the soil.

The invention furthermore comprises a method for treating seed. The invention furthermore relates to seed treated according to one of the methods described in the preceding paragraph.

The active compounds or compositions according to the invention are especially suitable for treating seed. A large part of the damage to crop plants caused by harmful organisms is triggered by an infection of the seed during storage or after sowing as well as during and after germination of the plant. This phase is particularly critical since the roots and shoots of the growing plant are particularly sensitive, and even small damage may result in the death of the plant. Accordingly, there is great interest in protecting the seed and the germinating plant by using appropriate compositions.

The control of phytopathogenic fungi by treating the seed of plants has been known for a long time and is the subject of continuous improvements. However, the treatment of seed entails a series of problems which cannot always be solved in a satisfactory manner. Thus, it is desirable to develop methods for protecting the seed and the germinating plant which dispense with the additional application of crop protection agents after sowing or after the emergence of the plants or which at least considerably reduce additional application. It is furthermore desirable to optimize the amount of active compound employed in such a way as to provide maximum protection for the seed and the germinating plant from attack by phytopathogenic fungi, but without damaging the plant itself by the active compound employed. In particular, methods for the treatment of seed should also take into consideration the intrinsic fungicidal properties of transgenic plants in order to achieve optimum protection of the seed and the germinating plant with a minimum of crop protection agents being employed.

Accordingly, the present invention also relates in particular to a method for treating seed and germinating plants to improve plant quality.

It is also considered to be advantageous that method according to the invention can be used in particular also on transgenic seed where the plant growing from this seed is capable of expressing a protein which acts against pests. By treating such seed with the active compound combinations or compositions according to the invention, even by the expression of the, for example, insecticidal protein, certain pests may be controlled. Surprisingly, a further synergistic effect may be observed here, which additionally improves the quality of the treated plant.

The compositions according to the invention are suitable for treating seed of any plant variety employed in agriculture, in the greenhouse, in forests or in horticulture or viticulture. In particular, this takes the form of seed of cereals (such as wheat, barley, rye, triticale, millet, oats), maize (corn), cotton, soya bean, rice, potatoes, sunflowers, beans, coffee, beets (e.g. sugar beets and fodder beets), peanuts, oilseed rape, poppies, olives, coconuts, cacao, sugar cane, tobacco, vegetables (such as tomatoes, cucumbers, onions and lettuce), lawn and ornamental plants (also see below). The treatment of seeds of cereals (such as wheat, barley, rye, triticale, and oats), maize (corn) and rice is of particular importance.

As also described further below, the treatment of transgenic seed with the active compound combinations or compositions according to the invention is of particular importance. This refers to the seed of plants containing at least one heterologous gene which allows the expression of a polypeptide or protein having insecticidal properties. The heterologous gene in transgenic seed can originate, for example, from microorganisms of the species Bacillus, Rhizobium, Pseudomonas, Serratia, Trichoderma, Clavibacter, Glomus or Gliocladium. Preferably, this heterologous gene is from Bacillus sp., the gene product having activity against the European corn borer and/or the Western corn rootworm. Particularly preferably, the heterologous gene originates from Bacillus thuringiensis.

In the context of the present invention, the active compound combinations or compositions according to the invention are applied on their own or in a suitable formulation to the seed. Preferably, the seed is treated in a state in which it is sufficiently stable so that the treatment does not cause any damage. In general, treatment of the seed may take place at any point in time between harvesting and sowing. Usually, the seed used is separated from the plant and freed from cobs, shells, stalks, coats, hairs or the flesh of the fruits. Thus, it is possible to use, for example, seed which has been harvested, cleaned and dried to a moisture content of less than 15 % by weight. Alternatively, it is also possible to use seed which, after drying, has been treated, for example, with water and then dried again.

When treating the seed, care must generally be taken that the amount of the composition according to the invention applied to the seed and/or the amount of further additives is chosen in such a way that the germination of the seed is not adversely affected, or that the resulting plant is not damaged. This must be borne in mind in particular in the case of active compounds which may have phytotoxic effects at certain application rates.

The compositions according to the invention can be applied directly, that is to say without comprising further components and without having been diluted. In general, it is preferable to apply the compositions to the seed in the form of a suitable formulation. Suitable formulations and methods for the treatment of seed are known to the person skilled in the art and are described, for example, in the following documents: US 4,272,417, US 4,245,432, US 4,808,430, US 5,876,739, US 2003/0176428 A1, WO 2002/080675, WO 2002/028186.

The active compound combinations which can be used according to the invention can be converted into customary seed dressing formulations, such as solutions, emulsions, suspensions, powders, foams, slurries or other coating materials for seed, and also ULV formulations.
These formulations are prepared in a known manner by mixing the active compounds or active compound combinations with customary additives, such as, for example, customary extenders and also solvents or diluents, colorants, wetting agents, dispersants, emulsifiers, defoamers, preservatives, secondary thickeners, adhesives, gibberellins and water as well.

Suitable colorants that may be present in the seed dressing formulations which can be used according to the invention include all colorants customary for such purposes. Use may be made both of pigments, of sparing solubility in water, and of dyes, which are soluble in water. Examples that may be mentioned include the colorants known under the designations Rhodamine B, C.I. Pigment Red 112, and C.I. Solvent Red 1.
Suitable wetting agents that may be present in the seed dressing formulations which can be used according to the invention include all substances which promote wetting and are customary in the formulation of active agrochemical substances. With preference it is possible to use alkylnaphthalene-sulphonates, such as diisopropyl- or diisobutylnaphthalene-sulphonates.
Suitable dispersants and/or emulsifiers that may be present in the seed dressing formulations which can be used according to the invention include all nonionic, anionic, and cationic dispersants which are customary in the formulation of active agrochemical substances. With preference, it is possible to use nonionic or anionic dispersants or mixtures of nonionic or anionic dispersants. Particularly suitable nonionic dispersants are ethylene oxide-propylene oxide block polymers, alkylphenol polyglycol ethers, and tristyrylphenol polyglycol ethers, and their phosphated or sulphated derivatives. Particularly suitable anionic dispersants are lignosulphonates, polyacrylic salts, and arylsulphonate-formaldehyde condensates.
Defoamers that may be present in the seed dressing formulations to be used according to the invention include all foam-inhibiting compounds which are customary in the formulation of agrochemically active compounds. Preference is given to using silicone defoamers, magnesium stearate, silicone emulsions, long-chain alcohols, fatty acids and their salts and also organofluorine compounds and mixtures thereof.
Preservatives that may be present in the seed dressing formulations to be used according to the invention include all compounds which can be used for such purposes in agrochemical compositions. By way of example, mention may be made of dichlorophen and benzyl alcohol hemiformal.

Secondary thickeners that may be present in the seed dressing formulations to be used according to the invention include all compounds which can be used for such purposes in agrochemical compositions. Preference is given to cellulose derivatives, acrylic acid derivatives, polysaccharides, such as xanthan gum or Veegum, modified clays, phyllosilicates, such as attapulgite and bentonite, and also finely divided silicic acids.

Suitable adhesives that may be present in the seed dressing formulations to be used according to the invention include all customary binders which can be used in seed dressings. Polyvinylpyrrolidone, polyvinyl acetate, polyvinyl alcohol and tylose may be mentioned as being preferred.

Suitable gibberellins that may be present in the seed dressing formulations to be used according to the invention are preferably the gibberellins A1, A3 (= gibberellic acid), A4 and A7; particular preference is given to using gibberellic acid. The gibberellins are known (cf. R. Wegler "Chemie der Pflanzenschutz- and Schädlingsbekämpfungsmittel" [Chemistry of Crop Protection Agents and Pesticides], Vol. 2, Springer Verlag, 1970, pp. 401-412).

The seed dressing formulations which can be used according to the invention may be used directly or after dilution with water beforehand to treat seed of any of a very wide variety of types. The seed dressing formulations which can be used according to the invention or their dilute preparations may also be used to dress seed of transgenic plants. In this context, synergistic effects may also arise in interaction with the substances formed by expression.

Suitable mixing equipment for treating seed with the seed dressing formulations which can be used according to the invention or the preparations prepared from them by adding water includes all mixing equipment which can commonly be used for dressing. The specific procedure adopted when dressing comprises introducing the seed into a mixer, adding the particular desired amount of seed dressing formulation, either as it is or following dilution with water beforehand, and carrying out mixing until the formulation is uniformly distributed on the seed. Optionally, a drying operation follows.

According to the invention all plants and plant parts can be treated. By plants is meant all plants and plant populations such as desirable and undesirable wild plants, cultivars and plant varieties (whether or not protectable by plant variety or plant breeder's rights). Cultivars and plant varieties can be plants obtained by conventional propagation and breeding methods which can be assisted or supplemented by one or more biotechnological methods such as by use of double haploids, protoplast fusion, random and directed mutagenesis, molecular or genetic markers or by bioengineering and genetic engineering methods. By plant parts is meant all above ground and below ground parts and organs of plants such as shoot, leaf, blossom and root, whereby for example leaves, needles, stems, branches, blossoms, fruiting bodies, fruits and seed as well as roots, tubers, corms and rhizomes are listed. Crops and vegetative and generative propagating material, for example cuttings, corms, rhizomes, tubers, runners and seeds also belong to plant parts.

The active compounds of the invention, in combination with good plant tolerance and favourable toxicity to warm-blooded animals and being tolerated well by the environment, are suitable for protecting plants and plant organs, for increasing the harvest yields, for improving the quality of the harvested material. They may be preferably employed as crop protection agents. They are active against normally sensitive and resistant species and against all or some stages of development.

Among the plants that can be treated by the method according to the invention, mention may be made of major field crops like corn, soybean, cotton, *Brassica* oilseeds such as *Brassica napus* (e.g. canola), *Brassica rapa*, *B. juncea* (e.g. mustard) and *Brassica carinata*, rice, wheat, sugarbeet, sugarcane, oats, rye, barley, millet, triticale, flax, vine and various fruits and vegetables of various botanical taxa such as *Rosaceae sp.* (e.g. pip fruit such as apples and pears, but also stone fruit such as apricots, cherries, almonds and peaches, berry fruits such as strawberries), *Ribesioidae sp.*, *Juglandaceae sp.*, *Betulaceae sp.*, *Anacardiaceae sp.*, *Fagaceae sp.*, *Moraceae sp.*, *Oleaceae sp.*, *Actinidaceae sp.*, *Lauraceae sp.*, *Musaceae sp.* (e.g. banana trees and plant-ings), *Rubiaceae sp.* (e.g. coffee), *Theaceae sp.*, *Sterculiceae sp.*, *Rutaceae sp.* (e.g. lemons, oranges and grapefruit) ; *Solanaceae sp.* (e.g. tomatoes, potatoes, peppers, eggplant), *Liliaceae sp.*, Compositiae *sp.* (e.g. lettuce, artichoke and chicory - including root chicory, endive or common chicory), *Umbelliferae sp.* (e.g. car-rot, parsley, celery and celeriac), *Cucurbitaceae sp.* (e.g. cucumber – including pickling cucumber, squash, watermelon, gourds and melons), *Alliaceae* sp. (e.g. onions and leek), Cruciferae *sp.* (e.g. white cabbage, red cabbage, broccoli, cauliflower, brussel sprouts, pak choi, kohlrabi, radish, horseradish, cress, Chinese cab-bage), Leguminosae *sp.* (e.g. peanuts, peas and beans beans - such as climbing beans and broad beans), *Che-nopodiaceae sp.* (e.g. mangold, spinach beet, spinach, beetroots), *Malvaceae* (e.g. okra), *Asparagaceae* (e.g. asparagus); horticultural and forest crops; ornamental plants; as well as genetically modified homologues of these crops. Of particular importance is the treatment of rice, corn/maize, potatoes, cereals and grapes.

As already mentioned above, it is possible to treat all plants and their parts according to the invention. In a preferred embodiment, wild plant species and plant cultivars, or those obtained by conventional biological breeding methods, such as crossing or protoplast fusion, and parts thereof, are treated. In a further preferred embodiment, transgenic plants and plant cultivars obtained by genetic engineering methods, if appropriate in combination with conventional methods (genetically modified organisms), and parts thereof are treated. The terms "parts", "parts of plants" and "plant parts" have been explained above. Particularly preferably, plants of the plant cultivars which are in each case commercially available or in use are treated according to the invention. Plant cultivars are to be understood as mean-ing plants having novel properties (“traits”) which have been obtained by conventional breeding, by mutagenesis or by recombinant DNA techniques. These can be cultivars, bio- or genotypes.

The method of treatment according to the invention can be used in the treatment of genetically modified organisms (GMOs), e.g. plants or seeds. Genetically modified plants (or transgenic plants) are plants of which a heterologous gene has been stably integrated into genome. The expression “heterologous gene” essentially means a gene which is provided or assembled outside the plant and when introduced in the nuclear, chloroplastic or mitochondrial genome gives the transformed plant new or improved agronomic or other properties by expressing a protein or polypeptide of interest or by downregulating or silencing other gene(s) which are present in the plant (using for example, antisense technology, cosuppression technology or RNA interference – RNAi - technology). A heterologous gene that is located in the genome is also called a transgene. A transgene that is defined by its particular location in the plant genome is called a transformation or transgenic event.

Depending on the plant species or plant cultivars, their location and growth conditions (soils, climate, vegetation period, diet), the treatment according to the invention may also result in superadditive ("synergistic") effects. Thus, for example, reduced application rates and/or a widening of the activity spectrum and/or an increase in the activity of the active compounds and compositions which can be used according to the invention, better plant growth, increased tolerance to high or low temperatures, increased tolerance to drought or to water or soil salt content, increased flowering performance, easier harvesting, accelerated maturation, higher harvest yields, bigger fruits, larger plant height, greener leaf color, earlier flowering, higher quality and/or a higher nutritional value of the harvested products, higher sugar concentration within the fruits, better storage stability and/or processability of the harvested products are possible, which exceed the effects which were actually to be expected.

At certain application rates, the active compound combinations according to the invention may also have a strengthening effect in plants. Accordingly, they are also suitable for mobilizing the defense system of the plant against attack by unwanted microorganisms. This may, if appropriate, be one of the reasons of the enhanced activity of the combinations according to the invention, for example against fungi. Plant-strengthening (resistance-inducing) substances are to be understood as meaning, in the present context, those substances or combinations of substances which are capable of stimulating the defense system of plants in such a way that, when subsequently inoculated with unwanted microorganisms, the treated plants display a substantial degree of resistance to these microorganisms. In the present case, unwanted microorganisms are to be understood as meaning phytopathogenic fungi, bacteria and viruses. Thus, the substances according to the invention can be employed for protecting plants against attack by the abovementioned pathogens within a certain period of time after the treatment. The period of time within which protection is effected generally extends from 1 to 10 days, preferably 1 to 7 days, after the treatment of the plants with the active compounds.

Plants and plant cultivars which are preferably to be treated according to the invention include all plants which have genetic material which impart particularly advantageous, useful traits to these plants (whether obtained by breeding and/or biotechnological means).

Plants and plant cultivars which are also preferably to be treated according to the invention are resistant against one or more biotic stresses, i.e. said plants show a better defense against animal and microbial pests, such as against nematodes, insects, mites, phytopathogenic fungi, bacteria, viruses and/or viroids.

Examples of nematode resistant plants are described in e.g. US Patent Application No's 11/765,491, 11/765,494, 10/926,819, 10/782,020, 12/032,479, 10/783,417, 10/782,096, 11/657,964, 12/192,904, 11/396,808, 12/166,253, 12/166,239, 12/166,124, 12/166,209, 11/762,886, 12/364,335, 11/763,947, 12/252,453, 12/209,354, 12/491,396 and 12/497,221.

Plants that may be treated according to the invention are hybrid plants that already express the characteristic of heterosis or hybrid vigor which results in generally higher yield, vigor, health and resistance towards biotic and abiotic stresses). Such plants are typically made by crossing an inbred male-sterile parent line (the female parent) with another inbred male-fertile parent line (the male parent). Hybrid seed is typically harvested from the male sterile plants and sold to growers. Male sterile plants can sometimes (e.g. in corn) be produced by detasseling, i.e. the mechanical removal of the male reproductive organs (or males flowers) but, more typically, male sterility is the result of genetic determinants in the plant genome. In that case, and especially when seed is the desired product to be harvested from the hybrid plants it is typically useful to ensure that male fertility in the hybrid plants is fully restored. This can be accomplished by ensuring that the male parents have appropriate fertility restorer genes which are capable of restoring the male fertility in hybrid plants that contain the genetic determinants responsible for male-sterility. Genetic determinants for male sterility may be located in the cytoplasm. Examples of cytoplasmic male sterility (CMS) were for instance described in Brassica species. However, genetic determinants for male sterility can also be located in the nuclear genome. Male sterile plants can also be obtained by plant biotechnology methods such as genetic engineering. A particularly useful means of obtaining male-sterile plants is described in WO 89/10396 in which, for example, a ribonuclease such as barnase is selectively expressed in the tapetum cells in the stamens. Fertility can then be restored by expression in the tapetum cells of a ribonuclease inhibitor such as barstar.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may be treated according to the invention are herbicide-tolerant plants, i.e. plants made tolerant to one or more given herbicides. Such plants can be obtained either by genetic transformation, or by selection of plants containing a mutation imparting such herbicide tolerance.

Herbicide-resistant plants are for example glyphosate-tolerant plants, i.e. plants made tolerant to the herbicide glyphosate or salts thereof. Plants can be made tolerant to glyphosate through different means. For example, glyphosate-tolerant plants can be obtained by transforming the plant with a gene encoding the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS). Examples of such EPSPS genes are the AroA gene (mutant CT7) of the bacterium S*almonella typhimurium* (Comai et al., 1983, Science 221, 370-371), the CP4 gene of the bacterium *Agrobacterium sp.* (Barry et al., 1992, Curr. Topics Plant Physiol. 7, 139-145), the genes encoding a Petunia EPSPS (Shah et al., 1986, Science 233, 478-481), a Tomato EPSPS (Gasser et al., 1988, J. Biol. Chem. 263, 4280-4289), or an Eleusine EPSPS (WO 01/66704). It can also be a mutated EPSPS. Glyphosate-tolerant plants can also be obtained by expressing a gene that encodes a glyphosate oxido-reductase enzyme. Glyphosate-tolerant plants can also be obtained by expressing a gene that encodes a glyphosate acetyl transferase enzyme. Glyphosate-tolerant plants can also be obtained by selecting plants containing naturally-occurring mutations of the above-mentioned genes. Plants expressing EPSPS genes that confer glyphosate tolerance are described. Plants comprising other genes that confer glyphosate tolerance, such as decarboxylase genes, are described.

Other herbicide resistant plants are for example plants that are made tolerant to herbicides inhibiting the enzyme glutamine synthase, such as bialaphos, phosphinothricin or glufosinate. Such plants can be obtained by expressing an enzyme detoxifying the herbicide or a mutant glutamine synthase enzyme that is resistant to inhibition. One such efficient detoxifying enzyme is an enzyme encoding a phosphinothricin acetyltransferase (such as the bar or pat protein from Streptomyces species). Plants expressing an exogenous phosphinothricin acetyltransferase are described.

Further herbicide-tolerant plants are also plants that are made tolerant to the herbicides inhibiting the enzyme hydroxyphenylpyruvatedioxygenase (HPPD). HPPD is an enzyme that catalyze the reaction in which para-hydroxyphenylpyruvate (HPP) is transformed into homogentisate. Plants tolerant to HPPD-inhibitors can be transformed with a gene encoding a naturally-occurring resistant HPPD enzyme, or a gene encoding a mutated or chimeric HPPD enzyme as described in WO 96/38567, WO 99/24585, WO 99/24586, WO 2009/144079, WO 2002/046387, or US 6,768,044. Tolerance to HPPD-inhibitors can also be obtained by transforming plants with genes encoding certain enzymes enabling the formation of homogentisate despite the inhibition of the native HPPD enzyme by the HPPD-inhibitor. Such plants and genes are described in WO 99/34008 and WO 02/36787. Tolerance of plants to HPPD inhibitors can also be improved by transforming plants with a gene encoding an enzyme having prephenate deshydrogenase (PDH) activity in addition to a gene encoding an HPPD-tolerant enzyme, as described in WO 2004/024928. Further, plants can be made more tolerant to HPPD-inhibitor herbicides by adding into their genome a gene encoding an enzyme capable of metabolizing or degrading HPPD inhibitors, such as the CYP450 enzymes shown in WO 2007/103567 and WO 2008/150473.

Still further herbicide resistant plants are plants that are made tolerant to acetolactate synthase (ALS) inhibitors. Known ALS-inhibitors include, for example, sulfonylurea, imidazolinone, triazolopyrimidines, pryimidinyoxy(thio)benzoates, and/or sulfonylaminocarbonyltriazolinone herbicides. Different mutations in the ALS enzyme (also known as acetohydroxyacid synthase, AHAS) are known to confer tolerance to different herbicides and groups of herbicides, as described for example in Tranel and Wright (2002, Weed Science 50:700-712). The production of sulfonylurea-tolerant plants and imidazolinone-tolerant plants is described. Other imidazolinone-tolerant plants are also described. Further sulfonylurea- and imidazolinone-tolerant plants are also described.

Other plants tolerant to imidazolinone and/or sulfonylurea can be obtained by induced mutagenesis, selection in cell cultures in the presence of the herbicide or mutation breeding as described for example for soybeans in U.S. Patent 5,084,082, for rice in WO 97/41218, for sugar beet in U.S. Patent 5,773,702 and WO 99/057965, for lettuce in U.S. Patent 5,198,599, or for sunflower in WO 01/065922.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are insect-resistant transgenic plants, i.e. plants made resistant to attack by certain target insects. Such plants can be obtained by genetic transformation, or by selection of plants containing a mutation imparting such insect resistance.

An “insect-resistant transgenic plant”, as used herein, includes any plant containing at least one transgene comprising a coding sequence encoding:

1) an insecticidal crystal protein from *Bacillus thuringiensis* or an insecticidal portion thereof, such as the insecticidal crystal proteins listed by Crickmore et al. (1998, Microbiology and Molecular Biology Reviews, 62: 807-813), updated by Crickmore et al. (2005) at the *Bacillus thuringiensis* toxin nomenclature, or insecticidal portions thereof, e.g., proteins of the Cry protein classes Cry1Ab, Cry1Ac, Cry1B, Cry1C, Cry1D, Cry1F, Cry2Ab, Cry3Aa, or Cry3Bb or insecticidal portions thereof (e.g. EP 1999141 and WO 2007/107302), or such proteins encoded by synthetic genes as e.g. described in US Patent Application No 12/249,016 ; or

2) a crystal protein from *Bacillus thuringiensis* or a portion thereof which is insecticidal in the presence of a second other crystal protein from *Bacillus thuringiensis* or a portion thereof, such as the binary toxin made up of the Cry34 and Cry35 crystal proteins (Moellenbeck et al. 2001, Nat. Biotechnol. 19: 668-72; Schnepf et al. 2006, Applied Environm. Microbiol. 71, 1765-1774) or the binary toxin made up of the Cry1A or Cry1F proteins and the Cry2Aa or Cry2Ab or Cry2Ae proteins (US Patent Appl. No. 12/214,022 and EP 08010791.5); or

3) a hybrid insecticidal protein comprising parts of different insecticidal crystal proteins from *Bacillus thuringiensis,* such as a hybrid of the proteins of 1) above or a hybrid of the proteins of 2) above, e.g., the Cry1A.105 protein produced by corn event MON89034 (WO 2007/027777); or

4) a protein of any one of 1) to 3) above wherein some, particularly 1 to 10, amino acids have been replaced by another amino acid to obtain a higher insecticidal activity to a target insect species, and/or to expand the range of target insect species affected, and/or because of changes introduced into the encoding DNA during cloning or transformation, such as the Cry3Bb1 protein in corn events MON863 or MON88017, or the Cry3A protein in corn event MIR604; or

5) an insecticidal secreted protein from Bacillus thuringiensis or Bacillus cereus, or an insecticidal portion thereof, such as the vegetative insecticidal (VIP) proteins listed at known databases, proteins from the VIP3Aa protein class; or

6) a secreted protein from *Bacillus thuringiensis* or *Bacillus cereus* which is insecticidal in the presence of a second secreted protein from *Bacillus thuringiensis* or *B. cereus*, such as the binary toxin made up of the VIP1A and VIP2A proteins (WO 94/21795); or

7) a hybrid insecticidal protein comprising parts from different secreted proteins from *Bacillus thuringiensis* or *Bacillus cereus,* such as a hybrid of the proteins in 1) above or a hybrid of the proteins in 2) above; or

8) a protein of any one of 5) to 7) above wherein some, particularly 1 to 10, amino acids have been replaced by another amino acid to obtain a higher insecticidal activity to a target insect species, and/or to expand the range of target insect species affected, and/or because of changes introduced into the encoding DNA during cloning or transformation (while still encoding an insecticidal protein), such as the VIP3Aa protein in cotton event COT102; or

9) a secreted protein from *Bacillus thuringiensis* or *Bacillus cereus* which is insecticidal in the presence of a crystal protein from *Bacillus thuringiensis*, such as the binary toxin made up of VIP3 and Cry1A or Cry1F (US Patent Appl. No. 61/126083 and 61/195019), or the binary toxin made up of the VIP3 protein and the Cry2Aa or Cry2Ab or Cry2Ae proteins (US Patent Appl. No. 12/214,022 and EP 08010791.5).

10) a protein of 9) above wherein some, particularly 1 to 10, amino acids have been replaced by another amino acid to obtain a higher insecticidal activity to a target insect species, and/or to expand the range of target insect species af-

fected, and/or because of changes introduced into the encoding DNA during cloning or transformation (while still encoding an insecticidal protein).

Of course, an insect-resistant transgenic plant, as used herein, also includes any plant comprising a combination of genes encoding the proteins of any one of the above classes 1 to 10. In one embodiment, an insect-resistant plant contains more than one transgene encoding a protein of any one of the above classes 1 to 10, to expand the range of target insect species affected when using different proteins directed at different target insect species, or to delay insect resistance development to the plants by using different proteins insecticidal to the same target insect species but having a different mode of action, such as binding to different receptor binding sites in the insect.

An "insect-resistant transgenic plant", as used herein, further includes any plant containing at least one transgene comprising a sequence producing upon expression a double-stranded RNA which upon ingestion by a plant insect pest inhibits the growth of this insect pest.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are tolerant to abiotic stresses. Such plants can be obtained by genetic transformation, or by selection of plants containing a mutation imparting such stress resistance. Particularly useful stress tolerance plants include:

1) plants which contain a transgene capable of reducing the expression and/or the activity of poly(ADP-ribose) polymerase (PARP) gene in the plant cells or plants.

2) plants which contain a stress tolerance enhancing transgene capable of reducing the expression and/or the activity of the PARG encoding genes of the plants or plants cells.

3) plants which contain a stress tolerance enhancing transgene coding for a plant-functional enzyme of the nicotineamide adenine dinucleotide salvage synthesis pathway including nicotinamidase, nicotinate phosphoribosyltransferase, nicotinic acid mononucleotide adenyl transferase, nicotinamide adenine dinucleotide synthetase or nicotine amide phosphorybosyltransferase.

Plants or plant cultivars (obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention show altered quantity, quality and/or storage-stability of the harvested product and/or altered properties of specific ingredients of the harvested product such as :

1) transgenic plants which synthesize a modified starch, which in its physical-chemical characteristics, in particular the amylose content or the amylose/amylopectin ratio, the degree of branching, the average chain length, the side chain distribution, the viscosity behaviour, the gelling strength, the starch grain size and/or the starch grain morphology, is changed in comparison with the synthesised starch in wild type plant cells or plants, so that this is better suited for special applications.

2) transgenic plants which synthesize non starch carbohydrate polymers or which synthesize non starch carbohydrate polymers with altered properties in comparison to wild type plants without genetic modification. Examples are

plants producing polyfructose, especially of the inulin and levan-type, plants producing alpha-1,4-glucans, plants producing alpha-1,6 branched alpha-1,4-glucans, plants producing alternan,

3) transgenic plants which produce hyaluronan,

4) transgenic plants or hybrid plants, such as onions with characteristics such as 'high soluble solids content', 'low pungency' (LP) and/or 'long storage' (LS).

Plants or plant cultivars (that can be obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are plants, such as cotton plants, with altered fiber characteristics. Such plants can be obtained by genetic transformation, or by selection of plants contain a mutation imparting such altered fiber characteristics and include:

a) Plants, such as cotton plants, containing an altered form of cellulose synthase genes;

b) Plants, such as cotton plants, containing an altered form of rsw2 or rsw3 homologous nucleic acids Plants, such as cotton plants, with increased expression of sucrose phosphate synthase;

c) Plants, such as cotton plants, with increased expression of sucrose synthase;

d) Plants, such as cotton plants, wherein the timing of the plasmodesmatal gating at the basis of the fiber cell is altered, e.g. through downregulation of fiber-selective β-1,3-glucanase;

e) Plants, such as cotton plants, having fibers with altered reactivity, e.g. through the expression of N-acetylglucosaminetransferase gene including nodC and chitin synthase genes.

Plants or plant cultivars (that can be obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are plants, such as oilseed rape or related Brassica plants, with altered oil profile characteristics. Such plants can be obtained by genetic transformation, or by selection of plants contain a mutation imparting such altered oil profile characteristics and include:

a) Plants, such as oilseed rape plants, producing oil having a high oleic acid content.

b) Plants such as oilseed rape plants, producing oil having a low linolenic acid content.

c) Plant such as oilseed rape plants, producing oil having a low level of saturated fatty acids.

Plants or plant cultivars (that can be obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are plants, such as potatoes which are virus-resistant, e.g. against potato virus Y (event SY230 and SY233 from Tecnoplant, Argentina), which are disease resistant, e.g. against potato late blight (e.g. RB gene), which show a reduction in cold-induced sweetening (carrying the Nt-Inhh, IIR-INV gene) or which possess a dwarf phenotype (Gene A-20 oxidase).

Plants or plant cultivars (that can be obtained by plant biotechnology methods such as genetic engineering) which may also be treated according to the invention are plants, such as oilseed rape or related Brassica plants, with altered seed shattering characteristics. Such plants can be obtained by genetic transformation, or by selection of plants contain a mutation imparting such altered seed shattering characteristics and include plants such as oilseed rape plants with delayed or reduced seed shattering.

Particularly useful transgenic plants which may be treated according to the invention are plants containing transformation events, or combination of transformation events, that are the subject of petitions for non-regulated status, in the United States of America, to the Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) whether such petitions are granted or are still pending. At any time this information is readily available from APHIS (4700 River Road Riverdale, MD 20737, USA). On the filing date of this application the petitions for non-regulated status that were pending with APHIS or granted by APHIS were those which contains the following information:

- Petition : the identification number of the petition. Technical descriptions of the transformation events can be found in the individual petition documents which are obtainable from APHIS, for example on the APHIS website, by reference to this petition number. These descriptions are herein incorporated by reference.
- Extension of Petition : reference to a previous petition for which an extension is requested.
- Institution : the name of the entity submitting the petition.
- Regulated article : the plant species concerned.
- Transgenic phenotype : the trait conferred to the plants by the transformation event.
- Transformation event or line : the name of the event or events (sometimes also designated as lines or lines) for which nonregulated status is requested.
- APHIS documents : various documents published by APHIS in relation to the Petition and which can be requested with APHIS.

Particularly useful transgenic plants which may be treated according to the invention are plants which comprise one or more genes which encode one or more toxins, such as the following which are sold under the trade names YIELD GARD® (for example maize, cotton, soya beans), KnockOut® (for example maize), BiteGard® (for example maize), Bt-Xtra® (for example maize), StarLink® (for example maize), Bollgard® (cotton), Nucotn® (cotton), Nucotn 33B®(cotton), NatureGard® (for example maize), Protecta® and NewLeaf® (potato). Examples of herbicide-tolerant plants which may be mentioned are maize varieties, cotton varieties and soya bean varieties which are sold under the trade names Roundup Ready® (tolerance to glyphosate, for example maize, cotton, soya bean), Liberty Link® (tolerance to phosphinotricin, for example oilseed rape), IMI® (tolerance to imidazolinones) and STS® (tolerance to sulphonylureas, for example maize). Herbicide-resistant plants (plants bred in a conventional manner for herbicide tolerance) which may be mentioned include the varieties sold under the name Clearfield® (for example maize).

Additional particularly useful plants containing single transformation events or combinations of transformation events are listed for example in the databases from various national or regional regulatory agencies.

When applying the compounds according to the invention the application rates can be varied within a broad range. The dose of active compound/application rate usually applied in the method of treatment according to the invention is generally and advantageously

- for treatment of part of plants, e.g. leafs (foliar treatment): from 0.1 to 10,000 g/ha, preferably from 10 to 1,000 g/ha, more preferably from 50 to 300g/ha; in case of drench or drip application, the dose can even be reduced, especially while using inert substrates like rockwool or perlite;
- for seed treatment: from 2 to 200 g per 100 kg of seed, preferably from 3 to 150 g per 100 kg of seed, more preferably from 2.5 to 25 g per 100 kg of seed, even more preferably from 2.5 to 12.5 g per 100 kg of seed;
- for soil treatment: from 0.1 to 10,000 g/ha, preferably from 1 to 5,000 g/ha.

The doses herein indicated are given as illustrative examples of the method according to the invention. A person skilled in the art will know how to adapt the application doses, notably according to the nature of the plant or crop to be treated.

The combination according to the invention can be used in order to protect plants within a certain time range after the treatment against pests and/or phytopathogenic fungi and/or microorganisms. The time range, in which protection is effected, spans in general 1 to 28 days, preferably 1 to 14 days, more preferably 1 to 10 days, even more preferably 1 to 7 days after the treatment of the plants with the combinations or up to 200 days after the treatment of plant propagation material.

The invention is illustrated by – but not limited to – the examples below.

<u>Use Examples</u>

<u>Example A: Test Potato</u>

The potato variety Shepody (夏波蒂) was planted in zinc deficiency black soil (pH 8.35, available zinc content 0.34 µg/g in soil, organic material 8.86 %) in Gansu: altitude 2050 m, average temperature 16.4°C to 19.7°C, rainfall 18 mm to 43.3 mm, and relative humidity 34. 5% to 67.8 % during June to September.

There are 4 replicates per treatment. Each plot has 500 hills with an area of 100 m^2. The control product was commercially available fungicide product Mancozeb 80 % WP. No disease infection in the field. The field management is similar among treatments: Seeded on April 28th, 2010 and earthed up on June 25th, 2010; three-time irrigations on May 6th, June 19th and August 12th, respectively and 50 liters each time; twice weeding on June 9th and July 23rd, respectively. Fertilized before seeding with $(NH_4)H_2PO_3$ at rate of 210 kg/ha, $Ca(H_2PO_4) \cdot H_2O$ at 750 kg/ha and $CO(NH_2)_2$ at 165 kg/ha.

The effect of Propineb on the nutrition quality enhancement of potato tuber has been evaluated after harvest. The sampling of each treatment was randomly selected 2-3 tubers to the laboratory for nutrition quality test.

Soluble protein content tested by method of Coomassie brilliant blue G-250: 0.5g potato tuber tissue were ground in water (2 mL) and homogenized in 6 mL water. The homogenates were centrifuged at 4°C for 10 min at 4000 rpm, and the supernatant was used as a source of soluble protein. Then it was dyed with Coomassie brilliant blue G-250. The absorbance was measured at 595 nm. Protein content is expressed as µg/g fresh weight (FW).

Starch content test method: 25 g potato tuber tissue were ground and dried at 80°C. The sample of 500 mg was extracted with ethanol (80 %) at 80°C for 10 min and the supernatant was removed. The residue was treated with HCl (2 %) and kept boiling in water bath for 3 h to transfer all the starch into sugar. Then the sugar content was tested with relation to the content of starch. $Ba(OH)_2$ solution was used to settle the protein. Phenolphthalein is as an indicator and 5 % $ZnSO_4$ solution was slowly added until the supernatant turned light red. Starch content is expressed as µg/g fresh weight (FW).

Dry matter test method: Potato tuber of 1000 g for each fresh sample was dried at 200°C in oven till the weight was stable. Dry matter content is expressed as percentage of weight.

Zinc content test method: Referenced the National Standard of P.R. China: Determination of Zinc in Foods (GB/T 5009. 14-2003, ICS 67.040 C 53).

No.	Treatment	Dose Rate	Application Timing
1	Untreated (control)		Water application at the same time
2	Antracol 70 % WP (propineb)	2100 g ai/ha	1st at 25 DAS* 2nd at 40 DAS 3rd at 70 DAS
3	Mancozeb 80 % WP	2160 g ai/ha	1st at 25 DAS* 2nd at 40 DAS 3rd at 70 DAS

* DAS = days after sowing

The yield and the nutrition quality of tuber has been determined after harvest.

Content	**Tuber type**	**1 Untreated (control)**	**2 Antracol 70 % WP (Propineb)**	**3 Mancozeb 80 % WP**
Yield kg/ha	Top class[1]	7215 (100 %)	21398 (297 %)	11805 (164 %)
	1st class[2]	7913 (100 %)	10740 (136 %)	10043 (127 %)
	2nd class[3]	7395 (100 %)	4635 (63 %)	7200 (97 %)
Soluble proteins mg/kg	Top class	1105.9 (100 %)	1340.9 (121 %)	1268.6 (115 %)
	1st class	1221.7 (100 %)	1461.66 (120 %)	1327.9 (109 %)
	2nd class	1337.2 (100 %)	1592.6 (119 %)	1448.0 (108 %)
Starch mg/kg	Top class	2144.8 (100 %)	3859.8 (180 %)	3426.1 (160 %)
	1st class	2584.3 (100 %)	4218.5 (163 %)	3803.5 (147 %)
	2nd class	2339.8 (100 %)	4001.7 (171 %)	3618.0 (155 %)
Dry matter %	Top class	22.27 (100 %)	26.78 (107 %)	23.25 (104 %)
	1st class	26.35 (100 %)	29.03 (110 %)	27.54 (105 %)
	2nd class	24.78 (100 %)	26.78 (108 %)	25.83 (104 %)
Zinc mg/kg	Top class	18.88 (100 %)	19.65 (104 %)	17.73 (93.9 %)

[1] top class: single weight of tuber > 150 g
[2] 1st class: single weight of tuber > 100 g
[3] 2nd class: single weight of tuber >50 g

The soluble protein, starch content, zinc content and dry matter of potato tuber treated with Antracol shows a significant increase in comparison to the untreated control and the farmer's practice.

Example B: Test Rice (Field Trial)

The rice variety Yang II you 6 (扬II优6号) was planted on a 40 m^2 plot with a seeding rate of 22.5 kg/ha (3 replications per treatment). The following treatments have been carried out using commercially available Antracol 70 WP (Propineb 700 g/kg) and the Zinc fertilizer $ZnSO_4$.

The field management is conventional and similar among treatments: The former crop is winter oil seed rape and the rice was seeded on June 15^{th} , 2010. Fertilized before seeding with $(NH_4)_2PO_3$ at rate of 300 kg/ha, KCl at 150 kg/ha and $CO(NH_2)_2$ at 375 kg/ha.

The effect of Propineb on the zinc content of rice grain has been evaluated under field conditions in China. The sampling of each treatment was randomly selected 500 g to the laboratory for zinc content test.

Zinc content method: Referenced the National Standard of P. R. China: Determination of Zinc in Foods (GB/T 5009. 14-2003, ICS 67.040 C 53).

No.	Treatment	Dose Rate per treatment (g ai/ha)	Application Timing[1]
1	Untreated (control)	–	–
2	Antracol 70 % WP	315, 630, 945	A, B, C
3	Antracol 70 % WP	315, 945, 1417.5	A, B, C
4	$ZnSO_4$	450, 900, 1350	A, B, C

[1] A: 40 DAS (days after sowing), B: 52 DAS, C: 66 DAS

The zinc content of leaf and grain at harvest was determined.

No.	Treatment	Leaf (mg/kg)	Grain (mg/kg)
1	Untreated (control)	17.16 (100 %)	13.73 (100 %)
2	Antracol 70 % WP	19.00 (111 %)	17.43 (127 %)
3	Antracol 70 % WP	30.78 (179 %)	19.07 (139 %)
4	$ZnSO_4$	21.47 (125 %)	15.05 (110 %)

The soluble zinc content of rice leaf and grain shows a significant increase in comparison to the untreated control and the farmer's practice when the rice plants treated with Antracol.

Example C: Test Corn (Field Trial)

The corn variety Fuyu No. 2 (富裕2号) was planted on a 80 m^2 plot with a seeding rate of 60 kg/ha (3 replications per treatment) in the trial station of Tianjin Institute of Plant Protection. The soil type is black soil with pH 7.5, organic material 7.54 %. The following treatments have been carried out using commercially available Antracol 70 WP (Propineb 700 g/kg) and the zinc fertilizer $ZnSO_4$.

The field management is conventional and similar among treatments: The former crop is winter wheat and the wheat was seeded on June 22nd , 2010; three-time irrigations during stem elongation period, tassel period and milking stage, respectively. Fertilized before seeding with $(NH_4)_2PO_3$ at rate of 225 kg/ha, KCl at 150 kg/ha and $CO(NH_2)_2$ at 450 kg/ha.

The effect of Propineb on the zinc content of corn grain has been evaluated under field conditions in China. The sampling of each treatment was randomly selected 1000 g to the laboratory for zinc content test.

Zinc content method: Referenced the National Standard for Food safety of P. R. China: Determination of Zinc in Foods (GB/T 5009. 14-2003, issued by Ministry of Health of P. R. China . ICS 67.040 C 53).

No.	Treatment	Dose Rate per treatment (g ai/ha)	Application Timing[1]
1	Untreated (control)	–	–
2	Antracol 70 % WP	1575, 1575	A, B
3	$ZnSO_4$	1350, 1350	A, B

[1] A: 30 DAS (days after sowing), B: 54 DAS

The zinc content of leaf and grain at harvest was determined .

No.	Treatment	Leaf (mg/kg)	Grain (mg/kg)
1	Untreated (control)	58.85 (100 %)	30.02 (100 %)
2	Antracol 70 % WP	62.75 (107 %)	34.26 (114 %)
3	$ZnSO_4$	57.76 (98.0 %)	33.32 (111 %)

The soluble zinc content of corn leaf and grain shows a significant increase in comparison to the untreated control and the farmer's practice when the corn plants treated with Antracol.

Example D: Test Rice (Field Trial)

The rice variety Danjing jiahua No. 1 (单粳嘉花1号) was planted on a 30 m^2 plot with a seeding rate of 30 kg/ha (4 replications per treatment). The following treatments have been carried out using commercially available Antracol 70 WP (Propineb 700 g/kg).

The effect of Propineb on the nutrition quality enhancement of rice grain has been evaluated under field conditions in China. The sampling of each treatment was randomly selected 1000 g to the laboratory for nutrition quality test.

Fibre content test method: Referenced the National Standard for safety of P. R. China: Determination of Fibre in Foods (GB/T 5515. 5-2008, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Crude protein content test method: Referenced the National Standard for safety of P. R. China: Determination of Protein in Foods (GB/ 5009. 5-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Vitamin B_1 test method: Referenced the National Food Standard of P. R. China: Determination of Vitamin B_1 for infants and young Children, milk and milk products (GB/ 5413. 11-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Vitamin B_2 test method: Referenced the National Food Standard of P. R. China: Determination of Vitamin B_2 for infants and young Children, milk and milk products (GB/ 5413. 12-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Iron content method: Referenced the National Food Standard of P. R. China: Determination of Iron, Magnesium and Manganese in Foods (GB/T 5009. 90-2003, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

No.	Treatment	Dose Rate per treatment (g ai/ha)	Application Timing[1]
1	Untreated (control) 1	–	–
2	Antracol 70 % WP	1575	A, B

[1] A: 40 DAS (days after sowing), B: 52 DAS

The nutrition quality at harvest was determined.

Treatment	1 Untreated (control)	2 Antracol 70 WP
Crude proteins (%)	9.02 (100 %)	9.53 (106 %)
Vitamin B_1 (mg/100 g)	0.114 (100 %)	0.139 (122 %)
Vitamin B_2 (mg/100 g)	0.0524 (100 %)	0.0622 (119 %)
Iron (mg/100 g)	1.76 (100 %)	1.74 (99 %)
Fibre content (%)	2.2 (100 %)	1.4 (64 %)

The crude protein, Vitamin B_1 and Vitamin B_2 of rice grain when the plants treated with Antracol show a significant increase in comparison to the untreated control and the farmer's practice.

Example E: Test Corn (Field Trial)

The corn variety Jiyuan No. 1 (纪元1号) was planted on a 50 m^2 plot with a seeding rate of 45 kg/ha (4 replications per treatment). The following treatments have been carried out using commercially available Antracol 70 WP (Propineb 700 g/kg):

The effect of Propineb on the nutrition quality enhancement of corn grain has been evaluated under field conditions in China. The sampling of each treatment was randomly selected 1000 g to the laboratory for nutrition quality test.

Crude protein content test method: Referenced the National Standard for safety of P. R. China: Determination of Protein in Foods (GB/ 5009. 5-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Vitamin E content test method: Referenced the National for Food Standard of P. R. China: Determination of Vitamin A, D, E in Foods for infants and young Children, milk and milk products (GB/T 5413. 9-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Vitamin B_1 test method: Referenced the National Food Standard of P. R. China: Determination of Vitamin B_1 for infants and young Children, milk and milk products (GB/ 5413. 11-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Vitamin B_2 test method: Referenced the National Food Standard of P. R. China: Determination of Vitamin B_2 for infants and young Children, milk and milk products (GB/ 5413. 12-2010, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

Iron content method: Referenced the National Food Standard of P. R. China: Determination of Iron, Magnesium and Manganese in Foods (GB/T 5009. 90-2003, issued by Ministry of Health of P. R. China. ICS 67.040 C 53).

No.	Treatment	Dose Rate per treatment (g ai /ha)	Application Timing[1]
1	Untreated (control) 1	–	–
2	Antracol 70 % WP	1575	A, B

[1] A: 32 DAS (days after sowing), B: 55 DAS

The nutrition quality at harvest was determined.

Treatment	1 Untreated (control)	2 Antracol 70 WP
Crude proteins (%)	6.87 (100 %)	7.13 (104 %)
Vitamin E (mg/100 g)	1.51 (100 %)	1.60 (106 %)
Vitamin B_1 (mg/100 g)	0.118 (100 %)	0.128 (108 %)
Vitamin B_2 (mg/100 g)	0.0956 (100 %)	0.0962 (101 %)
Iron (mg/100 g)	2.25 (100 %)	2.16 (96 %)

The crude protein, Vitamin E, Vitamin B_1 and Vitamin B_2 of corn grain when the plants treated with Antracol show a significant increase in comparison to the untreated control and the farmer's practice.

Example F: Test Grape (Field Trial)

Aiming of verifying the effect of Propineb application on the quality of the production and the vegetation of a vineyard, several grape varieties were compared in modules with and without the application of Antracol 70 % WP.

Methodology

The trial was performed in different vineyards (Vinha Grande de Algeruz [VGA]; Vinha das Faias [VF]; Vinha do Desembargador [VD] and Quinta dos Cistus [QC]), all located approximately 40 km south of Lisbon, in the region of Península de Setúbal, in different type of soils (sandy and clay-chalky with zinc content between 1.1 and 0.5 ppm) and with different varieties. The grape rootstocks were 41B (QC) and 1103-Paulsen in the remaining locations. The age of the vineyards is between 1 year (QC) and 20 years (VG).

Table 1: Grape varieties, vineyard in the region of Península de Setúbal and characterization

Variety	Vineyard	Type of Soil	Age (years)	pH
Tannat	VGA	Sandy	20	5.8
Aragonês	VGA	Sandy	20	5.8
Touriga Nacional	VGA	Sandy	20	5.8
Pinot Blanc	VGA	Sandy	20	5.8

Variety	Vineyard	Type of Soil	Age (years)	pH
Sauvignon Blanc	VGA	Sandy	20	5.8
Loureiro	VGA	Sandy	20	5.8
Tinta Barroca	VGA	Sandy	20	5.8
Tinto Cão	VGA	Sandy	20	5.8
Touriga Franca	VGA	Sandy	20	5.8
Syrah	VGA	Sandy	20	5.8
Trincadeira	VF	Sandy	7	4.9
Arinto	VF	Sandy	7	4.9
Verdelho	VF	Sandy	5	4.9
Touriga Franca	VF	Sandy	5	4.9
Syrah	VD	Clay-chalky	8	8.1
Cabernet Sauvignon	VD	Clay-chalky	8	8.1
Viognier	QC	Clay-chalky	1	8.3
Rabigato	QC	Clay-chalky	1	8.3
Moscatel Roxo	QC	Clay-chalky	1	8.3

The application was carried out with a knapsack sprayer. The water volume was between 322 and 355 L/ha, whereas the concentration was adjusted to keep the fixed dose.

Both the treated and untreated plots comprised 2 blocks of 6 plants (12 in total).

In the treated plot were made 4 applications of Antracol 70 % WP at 2.5 kg/ha. The applications were performed with the maximum Exposed Wall Surface, between the growth stages BBCH 77 and 85.

Treatment	Dose Rate per treatment (g ai/ha)	Application Timing
Untreated (control)	—	—
Antracol 70 % WP	1750	1st on 16/06 2nd on 21/06 3rd on 30/06 4th on 05/07

Table 2: Grape varieties, vineyard and application timing at certain growth stages

Varieties	Vineyard	Application Timing	Growth stages
Tannat	VGA	16/06	77
	VGA	21/06	77
	VGA	30/6	79_80
	VGA	05/07	79_80
Aragonês	VGA	16/06	77
	VGA	21/06	79_80
	VGA	30/6	79_80
	VGA	05/07	81-83

Varieties	Vineyard	Application Timing	Growth stages
Touriga Nacional	VGA	16/06	75
	VGA	21/06	77
	VGA	30/6	77
	VGA	05/07	79_80
Sauvignon Blanc	VGA	16/06	77
	VGA	21/06	79_80
	VGA	30/6	81-83
	VGA	05/07	85
Loureiro	VGA	16/06	77
	VGA	21/06	77
	VGA	30/6	79_80
	VGA	05/07	81-83
Tinta Barroca	VGA	21/06	77
	VGA	21/06	77
	VGA	30/6	79_80
	VGA	05/07	79_80
Tinto Cão	VGA	16/06	75
	VGA	21/06	77
	VGA	30/6	77
	VGA	05/07	77
Touriga Franca	VGA	16/06	77
	VGA	21/06	77
	VGA	30/6	79_80
	VGA	05/07	79_80
Syrah	VGA	77	77
	VGA	21/06	77
	VGA	30/6	79_80
	VGA	05/07	79_80
Pinot Blanc	VGA	16/06	79_80
	VGA	21/06	79_80
	VGA	30/6	79_80
	VGA	05/07	81_83
Trincadeira	VF	16/06	77
	VF	21/06	77
	VF	30/6	79_80
	VF	05/07	79_80
Arinto	VF	16/06	75
	VF	21/06	77
	VF	30/6	77
	VF	05/07	79_80
Verdelho	VF	16/06	77

Varieties	Vineyard	Application Timing	Growth stages
	VF	21/06	77
	VF	30/6	79_80
	VF	05/07	79_80
Touriga Franca	VF	16/06	77
	VF	21/06	79_80
	VF	30/6	81-83
	VF	05/07	85
Syrah	VD	16/06	77
	VD	21/06	77
	VD	30/6	79_80
	VD	05/07	79_80
Cabernet Sauvignon	VD	16/06	77
	VD	21/06	77
	VD	30/6	79_80
	VD	05/07	79_80
Viognier	Quinta dos Cistus	16/06	—
	Quinta dos Cistus	21/06	—
	Quinta dos Cistus	30/6	—
	Quinta dos Cistus	05/07	—
Rabigato	Quinta dos Cistus	16/06	—
	Quinta dos Cistus	21/06	—
	Quinta dos Cistus	30/6	—
	Quinta dos Cistus	05/07	—
Verdelho	Quinta dos Cistus	16/06	—
	Quinta dos Cistus	21/06	—
	Quinta dos Cistus	30/6	—
	Quinta dos Cistus	05/07	—

Leaves were sampled on 18/08, for foliar analysis to evaluate the zinc content.

At harvesting, microvinifications of the untreated and treated plots were conducted. Later, the wines were submitted to an organoleptic test. The organoleptic tasting, although the evolution registered in the evaluation of wines, is still a determinant and decisive factor in the evaluation of a wine. There is not a single chemical analysis that allows determining the organoleptic features of a wine, so, the organoleptic tasting is still irreplaceable.

Results

Foliar analysis

Table 3: Zinc content in mg/kg

Variety	Vineyard	Without Antracol treatment	With Antracol treatment
Tannat	VGA	49	106

Variety	Vineyard	Without Antracol treatment	With Antracol treatment
Aragonês	VGA	52	94
Touriga Nacional	VGA	31	116
Pinot Blanc	VGA	124	176
Sauvignon Blanc	VGA	79	121
Loureiro	VGA	72	123
Tinta Barroca	VGA	76	115
Tinto Cão	VGA	66	149
Touriga Franca	VGA	68	123
Syrah	VGA	67	89
Trincadeira	VF	75	128
Trincadeira	VF	54	99
Trincadeira	VF	58	105
Arinto	VF	85	110
Arinto	VF	89	261
Arinto	VF	88	128
Verdelho	VF	51	84
Touriga Franca	VF	66	134
Syrah	VD	33	78
Cabernet Sauvignon	VD	45	93
Viognier	VC	70	306
Rabigato	VC	50	161
Moscatel Roxo	VC	55	157

Analysis performed by INIA (Unidade de Investigação de Ambiente e Recursos Naturais) (Internal Method – LAP. PL12 VD (2009/09/20)

Organoleptic tasting

The organoleptic tasting was made by 4 professional wine tasters with more than 20 years of experience, who were unaware of the wines in cause. The wines were codified and distributed in an aleatory order. A differential tasting of Pair of Stimulus (Cover, 1936) was made, in which the wine taster was confronted with the treated and untreated plot and had to indicate the one of his preference.

Grape variety	Number of Preferences	
	Without Antracol treatment	With Antracol treatment
Tannat	1	3
Touriga Nacional	3	1
Pinot Blanc	1	3
Sauvignon Blanc	1	3
Loureiro	1	3

Tinto Cão	0	4
Touriga Franca	1	3
Trincadeira	1	3
Trincadeira	1	3
Trincadeira	1	3

From the above table, we can observe the results by grape variety, or focusing our analysis only on the effect of the application or no application of Antracol, observing the X^2 distribution. Being N equal total number of tastes, X_1 the number of favourable tastes of wines with Antracol application, and X_2 the number of favourable tastes of wines without Antracol.

$$X^2 = [(|X_1 - X_2|) - 1]^2 / N$$

We concluded that X^2 is equal to 8.1, meaning that the preferences of the tasters by the modalities with Antracol reached a significance level of 5%.

Patent Claims

1. Method for improving the plant quality, characterized in that a crop plant and/or the locus where the crop plant is growing or is intended to grow and/or the plant propagules are treated with a plant quality improving amount of a micronutrient containing active ingredient.

2. Method according to Claim 1, characterized in that the micronutrient containing active ingredient is fungicidally active.

3. Method according to Claim 1 or 2, characterized in that the micronutrient containing active ingredient is selected from the group consisting of active ingredients containing at least one metal ion selected from the group consisting of zinc, manganese, molybdenum, iron and copper or the micronutrient boron.

4. Method according to Claim 3, characterized in that the micronutrient containing active ingredient is selected from the group consisting of Propineb, Polyoxin Z (zinc salt), Zineb, Ziram, zinc thiodazole, zinc naphthenate and Mancozeb (also containing manganese), Maneb, Metiram and Mancopper (also containing copper), Ferbam, Bordeaux mixture, copper oxychloride, tribasic copper sulphate, copper oxide, copper octanoate, copper hydroxide, oxine copper and copper naphthenate.

5. Method according to Claim 4, characterized in that the micronutrient containing active ingredient is selected from the group consisting of Propineb and Mancozeb.

6. Method according to Claim 5, characterized in that the micronutrient containing active ingredient is Propineb.

7. Method according to any of Claims 1 to 6, wherein "plant quality" (quality of a plant) is defined as a condition of the crop plant and/or its products which is determined by several aspects alone or in combination with each other such as yield (for example increased biomass, increased content of valuable ingredients and/or improved content or composition of certain ingredients) and plant vigor (for example improved plant growth and/or greener leaves).

8. Method according to Claim 7, characterized in that at least one of the following properties of a crop plant is improved:
   - increased plant weight,
   - increased plant height,
   - increased zinc content,
   - increased iron content,
   - increased calcium content,
   - increased biomass such as higher fresh weight (FW) and/or dry weight (DW),
   - higher grain yield,

- higher acidity,
- higher anthocyanin content,
- more tillers,
- larger leaves,
- increased shoot growth,
- increased protein content (e.g. of soluble proteins),
- increased oil content,
- increased starch content,
- increased pigment content,
- increased nutrient content,
- increased protein content,
- increased vitamin content (e.g. of Vitamin B_1, B_2, C and E),
- increased content of fatty acids,
- increased metabolite content,
- increased carotenoid content (e.g. of Vitamin A),
- increased amount of essential amino acids,
- improved nutrient composition,
- improved protein composition,
- improved composition of fatty acids,
- improved metabolite composition,
- improved carotenoid composition,
- improved sugar composition,
- improved amino acids composition,
- improved or optimal fruit color,
- improved leaf color,
- higher storage capacity,
- higher processability of the harvested products,
- improved vitality of the plant,
- improved plant growth,
- improved plant development,
- improved visual appearance,
- improved plant stand (less plant verse/lodging),
- improved emergence,
- enhanced root growth and/or more developed root system,
- enhanced nodulation, in particular rhizobial nodulation,
- bigger leaf blade,

- bigger size,
- increased plant weight,
- increased fresh weight (FW),
- increased dry weight (DW),
- increased plant height,
- increased tiller number,
- increased shoot growth,
- increased root growth (extensive root system), increased yield when grown on poor soils or unfavorable climate,
- enhanced photosynthetic activity,
- enhanced pigment content (e.g. Chlorophyll content),
- earlier flowering,
- earlier fruiting,
- earlier and improved germination,
- earlier grain maturity,
- better size distribution
- higher grain hardness
- improved self-defence mechanisms,
- improved stress tolerance and resistance of the plants against biotic and abiotic stress factors such as fungi, bacteria, viruses, insects, heat stress, cold stress, drought stress, UV stress and/or salt stress,
- less non-productive tillers,
- less dead basal leaves,
- less input needed (such as fertilizers or water),
- greener leaves,
- complete maturation under shortened vegetation periods,
- less fertilizers needed,
- less seeds needed,
- easier harvesting,
- faster and more uniform ripening,
- longer shelf-life,
- longer panicles,
- delay of senescence,
- stronger and/or more productive tillers,
- better extractability of ingredients,
- improved quality of seeds (for being seeded in the following seasons for seed production),

- reduced production of ethylene and/or the inhibition of its reception by the plant.

9. Method according to Claim 8, characterized in that depending on the type of improved property the plant quality is increased by at least 5 %, 10 %, 25 %, 50 % or even more compared to the respective untreated control plant.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/074075

A. CLASSIFICATION OF SUBJECT MATTER
INV. C05D9/02 C05G3/02 A01N47/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C05D C05G A01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 199 38 737 A1 (BAYER AG [DE]) 22 February 2001 (2001-02-22) page 13, line 25 - line 62	1-9
X	US 6 086 923 A (STOLLER JERRY HERMAN [US]) 11 July 2000 (2000-07-11) claims column 1, line 19 - line 24 column 2, line 51 - line 55 column 3, line 65 - column 4, line 12	1-9
X	US 3 826 846 A (NOVEROSKE R) 30 July 1974 (1974-07-30) claims column 1, line 43 - line 72 column 4, line 37 - line 75	1-9

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2012	31/05/2012

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/074075

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 667 795 A (FRALEY RICHARD WAYNE [US] ET AL) 16 September 1997 (1997-09-16) column 1, line 50 - line 65 claims column 2, line 60 - line 67 -----	1-4,7-9
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