(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
09 January 2020 (09.01.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/008480 A1

(51) International Patent Classification:
A01N 55/10 (2006.01) *A01N 25/00* (2006.01)
A01N 31/00 (2006.01)

(21) International Application Number:
PCT/IN2019/050500

(22) International Filing Date:
05 July 2019 (05.07.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
201841024440 06 July 2018 (06.07.2018) IN

(71) Applicant: **FERTIS INDIA PVT. LTD.** [IN/IN]; 6-3-668/10/56, Plot No 56, 1st Floor, Durga Nagar Colony, Punjagutta, Hyderabad, Telangana 500082 (IN).

(72) Inventor: **KANUMURU, Rahul Raju**; Digvijayam, Plot No. 933A, Road No 47, Jubilee Hills, Hyderabad, Telangana 500 033 (IN).

(74) Agent: **P., Aruna Sree**; Gopakumar Nair Associates, 'Shivmangal', 3rd Floor, Near Big Bazaar, Akurli Road, Kandivali (East), Mumbai, Maharashtra 400101 (IN).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*
— *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

(54) Title: NOVEL COMPOSITION OF SILICA WITH PHENOLIC COMPOUNDS TO ENHANCE YIELDS AND DECREASE BIOTIC AND ABIOTIC STRESSES

(57) Abstract: The present invention discloses novel composition comprising silica and phenolic compounds for agricultural applications. More particularly, the present invention relates to novel composition comprising silica and phenolic compounds to enhance the yields of agricultural produce and decrease Biotic and Abiotic stresses in the plants.

WO 2020/008480 A1

"NOVEL COMPOSITION OF SILICA WITH PHENOLIC COMPOUNDS TO ENHANCE YIELDS AND DECREASE BIOTIC AND ABIOTIC STRESSES"

TECHNICAL FIELD OF THE INVENTION:

The present invention relates to novel composition comprising silica and phenolic compounds for agricultural applications. More particularly, the present invention relates to novel composition comprising silica and phenolic compounds to enhance the yields of agricultural produce and decrease Biotic and Abiotic stresses in the plants.

BACKGROUND AND PRIOR ART OF THE INVENTION:

Silicon as nutrient has been gaining prominence over the last 3 decades. Silicon supplementation has been shown to provide increased yield, produce quality, crop stresses etc.

From early 1990'sonwards silicates in foliar sprays were in use. In 2003, foliar sprays with (stabilized) silicic acid were introduced, and more recently foliar sprays with silica nanoparticles have also been applied to the plants. Foliar sprays with silicates are effective as pesticides. The limited data on foliar silica sprays show a tendency to decrease biotic stress and to stimulate a limited increase in growth and yield. There is ample literature available on silica based compositions for foliar spray.

US20130130902 discloses dissolved silicate compositions in which the dissolved silicate is stabilized by at least two selected osmolytes and is therefore bioavailable.

EP2309862A2 discloses a foliarly applicable plant nutrient composition which comprises, in aqueous solution, (a) a first component comprising an agriculturally acceptable source of foliarly absorbable silicon; (b) a second component selected

from agriculturally acceptable sources of thiosulfate ions, agents effective to inhibit polymerization of silicic acid or silicate ions, and mixtures thereof; and (c) as a third component, an agriculturally acceptable mixture of compounds selected from the group consisting of organic acids, organic compounds having functional groups capable of reversibly binding or complexing with inorganic anions, and mixtures thereof.

US8221791B1 describes silica based antibacterial and antifungal nanoformulation for agricultural purposes having a plurality of copper ions embedded in a silica nanogel, and wherein the plurality of interconnected nanoparticles of the nanogel contain a plurality of Cu ions electrostatically bound to the nanoparticle core, a plurality of Cu ions covalently bound to a hydrated shell surface and nanopores of the nanoparticle, and a plurality of Cu oxide/hydroxide as nanoclusters/nanoparticles bound to the surface of the nanoparticle.

However, the prior art formulations have failed to improve plant metabolic pathway to achieve good antioxidant property as well as antimicrobial property through shikimic pathway, and also to improve resistance from abiotic and biotic stresses.

OBJECTIVE OF THE INVENTION:

Therefore, it is an objective of the present invention to improve the plant metabolic pathway to achieve good antioxidant property as well as antimicrobial property through shikimic pathway, and to improve resistance from abiotic and biotic stresses.

The objective of the present invention is to provide stabilized compositions comprising silica along with phenolic compounds to increase growth and yield with decreased biotic and abiotic stresses in the plants.

SUMMARY OF THE INVENTION

In line with the above objective, the present invention provides a novel composition of Silica and Phenolic compounds to enhance growth and yields of agricultural produce and decrease Biotic and Abiotic stresses.

The foliar spray composition with silicon and combination of Phenolic compound as provided in the present invention is entirely new phenomenon to enhance yields and decrease Biotic and Abiotic stresses.

By applying Phenolic compounds in combination with silica as foliar spray, it helps in metabolism to generate or accelerate antioxidant pathway in plant system. The compositions of Silicon formulated with phenols have shown to provide significant enhancement in yield, yield quality and nutrition profile, decrease abiotic and biotic stress.

The present invention provides compositions comprising essentially Silica and Polyphenols such as Benzoates and/or Gallates.

The compositions of Silicon with Phenolic compounds can be formulated directly or in combination with other materials including but not limited to materials containing proteins and/or amino acids and/or enzymes and/or vitamins and minerals and/or carbohydrates and/or lipids and/or hormones and/or hormone containing substances and/ or hormone mimics and / or hormone precursors and/ or tannins and/or organic acids and/or fertilizers and/or pesticides and/or antioxidant pathway inducers and/or resistance inducers and/or humic substances and/or pyruvates and/or alcohols and formulation additives like stabilizers and/or surfactants and/or stickers and/or spreaders etc.

The compositions of the present invention induce crop resistance against pest, enhance yield, abiotic stress resistance (water, temperature etc.), and produce quality and nutrient profile and shelf life of produce.

The said formulation can be used across all crops for seed, foliar, fertigation or soil application.

The silicon compounds according to the present invention include but not limited to silicic acid and/or silicon polymers and/or salts and/or metallic silicon, and/or silicon particles and/or silicon containing substances etc., present in the composition in an amount ranging from 0.001 to 99.999%.

The Phenolic compounds according to the present invention include but not limited to phenols, polyphenols in forms of acids, Phenolic salts (including but not limited to benzoates and/or salicylates and/or Cinnamic acid and or coumaric acid, etc., and /or Phenolic precursors (including but not limited to phenylalanine and/or capsacin and/or valine etc.) and/or phenol containing substances etc., present in the composition in an amount ranging from 0.001 to 99.999%. The ratio of silicon to Phenolic compound in compositions according to the invention will be 0.001 to 99.999%.

In another aspect, the compositions of the present invention optionally comprise Minerals such as Calcium, Potassium, Copper, Zinc, Iron, Manganese, Magnesium, Molybdenum, cobalt, Nickel, Iodine etc.

In yet another aspect, the compositions of the present invention includes Amino Acids such as Taurine, Cysteine, Methionine, Alanine etc.; Carbohydrates such as Trehalose, Oligosaccharides, polysaccharides, chitin, Chitosan, etc., and hormones like Salicylic acid , Jasmonic acid etc.

DETAILED DESCRIPTION OF INVENTION:

The invention will now be described in detail in connection with certain preferred and optional embodiments, so that various aspects thereof may be fully understood and appreciated.

The present invention provides a novel composition of Silica and Phenolic compounds to enhance yields of agricultural produce and decrease Biotic and Abiotic stresses in plants.

The use of foliar sprays with silicon in combination with Phenolic compounds as provided in the present invention is entirely new phenomenon to enhance yields of agricultural produce and decrease Biotic and Abiotic stresses.

The novel combination of Silica and Phenolic compounds according to the present invention enhances the resistance as well as antioxidant property in the plants thereby facilitates more yields in agriculture.

The present invention provides compositions comprising essentially Silica and Polyphenols such as Benzoates and/or Gallates.

The compounds of Silica that can be used in the present invention can be selected from the group consisting of Silicic acid, silicon dioxide, potassium silicate, Magnesium silicate, Manganese silicate and or other metallic silicates.

In a preferred embodiment the composition comprises Silica compounds together with Phenolic compound with ratio of silica ranging from 0.01 to 99.99%.

In another embodiment, the invention provides compositions comprising metal silicates and Phenolic compounds in the form of solutions and or powders and or granules. These formulations can be prepared with different concentrations to give specific characteristics of Antioxidant and antimicrobial property along with Abiotic and biotic stress controlling capacity.

In another preferred embodiment, the compositions of the present invention optionally comprise a surfactant selected from anionic and Non-ionic and Cationic

surfactants such as CMC, lignosulphonates, etc. to ensure uniform and wide spreading of the composition on the plant when applied to give complete application of foliage by maintaining surface tension of leaf and molecule contact to the plant.

Silicon with Phenolic compounds may be formulated optionally in combination with proteins (including but not limited to hydrolysate proteins, protein isolates) and/or amino acids (including but not limited to Taurine, Cystine Methionine, Alanine, phenylalanine, valine, proline etc.) and or enzymes (including but not limited to phenyl alanine, amino lyase) and or coenzymes (including but not limited to NADH, NADPH and adenosine triphosphate (ATP). Certain coenzymes, such as flavin mononucleotide (FMN), flavin adenine dinucleotide (FAD), thiamine pyrophosphate(TPP), and tetrahydrofolate (THF), derived from vitamins), wherein, the optional ingredients can be used in an amount of 0.01 % to 50 % ; and/or

Silicon with Phenolic compounds may be formulated in combination with Vitamins including but not only limited to Alpha tocopherol and /or vitamin-D and/or vitamin –K and/or Ascorbic acid and the like in an amount of 0.001 % to 10 %; and/or

Silicon with Phenolic compounds may be formulated in combination with minerals including but not limited to Calcium, Potassium. Phosphate, Copper, Zinc, Iron, Manganese Magnesium, Molybdenum, cobalt, Nickel, Iodine etc. in an amount of 0.01 % to 80 %; and/or

Silicon with Phenolic compounds in combination with carbohydrates including but not limited to Sugars (like Trehalose) and / or sugar alcohols (including but not limited to mannitol etc.,) and/or Oligosaccharides (raffinose and/or fructose etc), and/or polysaccharides (including but not limited to lamilarine fucoidien and/or chitin and/or Chitosan and/or Alginic acid etc.) and/or carbohydrate

containing substances etc., in an amount of 0.01 % to 50 %; and/or

Silicon with Phenolic compounds in combination with alcohols (including but not limited to Monohydric alcohols (including but not limited to ethanol and/or methanol and/or propanol and/or ethyl alcohol etc.) and/or polyhydric alcohols (including but not limited to ethylene glycol and/or propylene glycol and/or mannitol and/or sorbitol etc.) and/or Alicyclic alcohols(including but not limited to Inositol and/or Menthol etc.) in an amount of 0.01 to 30 %; and /or

Silicon with Phenolic compounds in combination with pyruvates (including but not limited to pyruvic acid and/or phosphophenol pyruvates etc.) in an amount of 0.001 to 20 %; and/or

Silicon with Phenolic compounds in combination containing lipids (including but not limited to monoglycerides and/or diglycerides and/or triglycerides and/or phospholipids) in an amount of 0.01 % to 25 % and/or

Silicon with Phenolic compounds in combination with natural and/or synthetic hormones (including but not limited to auxins and/ or gibberellins and/or cytokinines and/or Jasmonates, and/or Salicylates and/or lenolinic acid, and/or Naphthalene acetic acid, Indole acetic acid, Indole butyric acid etc.) and/or hormone precursors (including but not limited to lenolinic acid etc.,) and/or hormone elicitors etc., in an amount of 0.001 % to 10 %; and/or

Silicon with Phenolic compounds in combination with hormone mimic substances (including but not limited to bile and/or bile salts etc., in an amount of 0.01 to 80 %; and/or

Silicon with Phenolic compounds in combination with tannins in an amount of 0.01 to 80 %; and/or

Silicon with Phenolic compounds in combination with organic acids (including

but not limited to citric acid and/or Malic acid and/or tartaric acid, etc.,) in an amount of 0.01 to 80 %; and/or

Silicon with Phenolic compounds directly or in combination with other materials including but not limited to materials containing fertilizers (including but not limited to N,P, K and other secondary nutrients calcium and/or Magnesium etc.,) and/or pesticides and/or antioxidant pathway inducers (coumaric acid and/or cinnamic acid and/or salicylic acid etc.) in an amount of 0.01 to 50 %; and/or

Silicon with Phenolic compounds directly or in combination with other materials including but not limited to materials containing humic substances(humic acid and/or fulvic acid and/or humin) in an amount of 0.01 to 80 %; and/or

Silicon with Phenolic compounds directly or in combination with other materials including but not limited to materials containing resistance inducers etc. and/or also formulation additives like stabilizers and/or surfactants (including ionic and/or non-ionic and/or cationic surfactants and/or lignosulfonates,) and/or stickers (gum acasia and/or organic and/or inorganic binders) and/or spreaders etc.

Silicon with Phenolic compounds directly or in combination with other materials including but not limited to materials containing proteins and/or amino acids and/or enzymes and/or enzyme precursors and/or vitamins and minerals and/or carbohydrates and/or lipids and/or hormones and/or hormone containing substances and/ or hormone mimics and / or hormone precursors and/ or tannins and/or organic acids and/or fertilizers and/or pesticides and/or antioxidant pathway inducers and/or resistance inducers and/or humic substances etc. and / or Pyruvates and also formulation additives like stabilizers and/or surfactants and/or stickers and/or spreaders etc. are formulated to induce crop resistance against pest, enhance yield of agricultural produce, reduce abiotic stress resistance (water, temperature etc.), and enhance the quality, nutrient profile and shelf life of produce.

The use of above stated combinations will induce crop resistance against pest, enhance yield of agricultural produce, reduce abiotic stress resistance (water, temperature etc.), decrease biotic stress resistance (bacterial plant pathogens: *Burkholderia,* Proteobacteria, *Xanthomonas* spp., *Pseudomonas* spp,, fungal pathogens include Rice blast, caused by a necrotrophic fungus, **Ascomycetes:** *Fusarium* spp. (Fusarium wilt disease), *Thielaviopsis* spp. (canker rot, black root rot, *Thielaviopsis* root rot), *Verticillium* spp., *Magnaporthegrisea* (rice blast), *Sclerotinia sclerotiorum* (cottony rot) **Basidiomycetes:** *Ustilago* spp. (smuts), *Rhizoctonia* spp., *Phakosporapachyrhizi* (soybean rust) *Puccinia* spp. (severe rusts of cereals and grasses), *Armillaria* spp. (honey fungus species, virulent pathogens of trees) and also against significant oomycete plant pathogens such as *Pythium* spp., *Phytophthora* spp., including the potato blight and viral diseases caused by-Tobacco mosaic virus and nematodes, to enhance quality, nutrient profile and shelf life of the produce.

The said formulation can used across all crops for seed, foliar, fertigation or soil application.

Besides the major role of silica and phenols combination in protection against biotic (microbes or herbivores) and abiotic (UV radiation, pollutants) stress factors, they are also involved in the attraction of pollinators.

Methods to enhance the yield of agricultural produce, reducethe abiotic stress resistance, decrease the biotic stress resistance comprises applying the composition of silicon and phenolic compounds of the present invention to the seeds or foliar of the crops or to the soil or fertigation. Particularly, the method includes spraying the seeds or foliar of the crops or the soil or fertigation with the composition of the present invention.

The following examples, which fully illustrate the practice of the preferred embodiments of the present invention, are intended to be for illustrative purpose only, and should not be considered to be limiting to the scope of the present

invention.

Examples:

Example 1: FOLIAR VARIANTS WITH COMBINATION OF SILICA AND PHENOL COMPOUNDS

Table 1:

FOLIAR VARIANTS WITH COMBINATION OF SILICA AND PHENOL COMPOUNDS						
S.No	**Name of The Variant**	**BA**	**SA**	**Silica**	**Chitosan**	**Alkyl Gallate**
1	Plain silica	-	-	2 %	-	
2	Silica + Benzoic Acid + Salicylic Acid	500 PPM	200 PPM	2 %	-	
3	Silica + Benzoic Acid + Chitosan	500 PPM	-	2 %	25 PPM	
4	Amino Acids+ KOH	AMINO ACIDS NEUTRALIZED TO P^H 7 WITH KOH				
5	Silica + Benzoic Acid + Salicylic Acid + Chitosan	500 PPM	200 PPM	2 %	200PPM	
6	Silica + Alkyl Gallate + Benzoic Acid	500 PPM	-	2 %		200 PPM
7	Silica + Alkyl Gallate + Benzoic Acid+ Salicylic Acid	500 PPM	200 PPM	2 %	-	200PPM

Example 2: C-PLEX VARIANTS FOR IMPROVED VERSION PRODUCT EFFICACY TRIALS

Table2:

C-PLEX VARIANTS FOR IMPROVED VERSION PRODUCT EFFICACY TRIALS											
S.No	**Name of The Variant**	**BA**	**SA**	**RBE**	**Chitosan**	**GB**	**FA**	**Proline**	**JA**	**AA**	**KOH**
1	C PLEX	-	-	-	-	-	-	-			-
2	C-PLEX (Improved Silica With Phenol)	RICE HUSK - STEAM EXPLOSION -ETHANOL EXTRACT -KOH EXTRACT Silica and phenolic compounds extracted from rice husk									
3	C-PLEX + Benzoic Acid + Salicylic Acid	500 PPM	200 PPM	-	-	-	- -	-	-		-
4	C -PLEX + Rice Bran Extract	-	-	600 PPM	-	-	- -	-	-		-
5	C -PLEX + Benzoic Acid + chitosan	500 PPM	-	-	25 PPM	-	- -	-	-		-
6	C-PLEX + glycine betaine	-	-	-	-	0.25 Mm	- -	-	-		-

7	C-PLEX + (Glycine Betaine with KOH + Fulvic Acid)	-	-	-	-	0.25 Mm	3% -	-	-		1%
8	C -PLEX + Rice Bran Extract+ benzoic acid + salicylic acid + Potassium Peroxy Mono Sulfate	500 PPM	200 PPM	600 PPM	-	-	-	-	-		1%
9	C-PLEX + Glycine Betaine + Proline +KOH	-	-	-	-	0.25 mM	- -	200 PPM	-		1%
10	C-PLEX + Glycine Betaine + Proline	-	-	-	-	0.25 mM	- -	200 PPM	-		-
11	C- PLEX + Benzoic	500 PPM	200 PPM	-	-	-	- -	-	0.1 Mm		1%

	Acid + Salicylic Acid + Jasmonic Acid+ KOH										
12	C-PLEX + (Amino Acids+ KOH)									10% PH-7	
13	Amino Acids+ KOH	AMINO ACIDS NEUTRALIZED TO PH 7 WITH KOH									
14	C-PLEX with stevia extract	10 % OF STEVIA EXTRACT IN HOT WATER IN C-PLEX									

C-PLEX-soluble organic silica with phenol compounds

BA-Benzoic Acid

SA-Salicylic Acid

RBE- Rice Bran Extract

GB-Gibberellic Acid

FA-Fulvic Acid; JA-Jasmonic Acid; AA-Acetic Acid

Example 3: First and second harvesting of Chilli at NIC Wargal

Table 3:

Treatment number	Description/ Composition	Total avg both harvests	% of yield increment on control
T1	C-PLEX (Organic extracted Soluble silica with phenol compounds)	2337	39
T2	C-PLEX with Tagatose	2520	50
T 3	C-PLEX with Laminarin	2790	66
T 4	CONTROL	1683	0

Results: Clear Indication of Yield enhancement

Example 4: Cabbage Harvesting

Table 4:

Treatment number	Description/ Composition	Avg % of yield increment on control
T 1	NITROPLEX WITH 100 PPM 5-ALA	14
T 2	NITROPLEX WITH 100 PPM 5-ALA AND 200 PPM METHIONINE	16
T 3	NITROPLEX WITH N-ACETYLCYSTEIN	13
T 4	NITROPLEX WITH N-ACETYLCYSTEIN AND 100 PPM 5-ALA	8
T 5	CONTROL	6

NITROPLEX = (10% AMINOACID SOLUTION+KOH=PH-7 IN C- PLEX)

Example5: Tomato harvesting
Table 5:

	Tomato foliar first harvesting	Total avg of 5 harvest	% of yield Increment over control
T1	PLAIN C-PLEX (soluble silica with phenol compounds)	45870	22

T2	NITROPLEX = (10% AMINOACID SOLUTION+KOH=PH-7 IN C PLEX)	44512	19
T3	NITROPLEX WITH 1 % POTASSIUM FORMATE (3ML FORMIC ACID+3.5G KOH/100 ML)	50354	34
T5	NITROPLEX WITH 100 PPM 5-ALA	45542	21
T6	NITROPLEX WITH 100 PPM 5-ALA AND 200 PPM METHIONINE	49292	31
T7	**Control**	37555	

Results:

Based on above experiment, significant yield along with biotic and Abiotic stress tolerance was observed. Combination of Silica with phenolic compounds and different combination of Amino acids results in enhanced crop yields, quality and nutrition profile.

We Claim;

1. Composition of Silica and Phenolic compounds to enhance yields of agricultural produce and decrease Biotic and Abiotic stresses in plants, wherein ratio of silica ranges from 0.01 to 99.99%.

2. The composition according to claim 1, wherein the silica is selected from the group consisting of Silicic acid, silicon dioxide, potassium silicate, Magnesium silicate, Manganese silicate and/ or other metallic silicates.

3. The composition according to claim 1, wherein the phenolic compounds is selected from Polyphenols such as Benzoates and/or Gallates.

4. The composition according to claim 1, wherein the silica with phenolic compounds may comprise materials including but not limited to materials containing proteins and/or amino acids and/or enzymes and/or enzyme precursors and/or vitamins and minerals and/or carbohydrates and/or lipids and/or hormones and/or hormone containing substances and/ or hormone mimics and / or hormone precursors and/ or tannins and/or minerals and/or organic acids and/or fertilizers and/or pesticides and/or antioxidant pathway inducers and/or resistance inducers and/or humic substances etc. and / or Pyruvates and also formulation additives like stabilizers and/or surfactants and/or stickers and/or spreaders.

5. The composition according to claim 4, wherein the said composition comprises;
    a) proteins selected from hydrolysate proteins, protein isolates and the like;
    b) amino acids selected from Taurine, Cystine, Methionine, Alanine, phenylalanine, valine, proline and the like;

c) enzymes selected from phenyl alanine, amino lyase and the like;
d) coenzymes selected from NADH, NADPH, adenosine triphosphate (ATP), flavin mononucleotide (FMN), flavin adenine dinucleotide (FAD), thiamine pyrophosphate(TPP), and tetrahydrofolate (THF);

in an amount of 0.01 % to 50 %.

6. The composition according to claim 4, wherein the said composition comprises;
    a) vitamins selected from Alpha tocopherol and /or vitamin-D and/or vitamin –K and/or Ascorbic acid and the like is in an amount of 0.001 % to 10 %;
    b) minerals selected from Calcium, Potassium. Phosphate, Copper, Zinc, Iron, Manganese Magnesium, Molybdenum, cobalt, Nickel, Iodine and the like is in an amount of 0.01 % to 80 %;
    c) carbohydrates selected from Sugars and / or sugar alcohols and/or Oligosaccharides and/or polysaccharides and/or carbohydrate containing substances in an amount of 0.01 % to 50 %;
    d) lipids selected from monoglycerides and/or diglycerides and/or triglycerides and/or phospholipids in an amount of 0.01 % to 25 %.

7. The composition according to claim 4, wherein the said composition comprises;
    a) hormones selected from natural and synthetic hormones such as auxins and/ or gibberellins and/or cytokinines and/or Jasmonates, and/or Salicylates and/or lenolinic acid, and/or Naphthalene acetic acid, Indole acetic acid, Indole butyric acid and the like; and /or hormone precursors such as lenolinic acid and the like; and/or hormone elicitors in an amount of 0.001 % to 10 %;
    b) hormone mimic substances such as bile and/or bile salts and the like in an amount of 0.01 to 80 %.

8. The composition according to claim 4, wherein the said composition comprises;
    a) alcohols selected from Monohydric alcohols and/or polyhydric alcohols and/or Alicyclic alcohols in an amount of 0.01 to 30 %;
    b) tannins in an amount of 0.01 to 80 %;
    c) organic acids such as citric acid Malic acid, tartaric acid and the like in an amount of 0.01 to 80 %;
    d) pyruvates such as pyruvic acid and/or phosphophenol pyruvates and the like in an amount of 0.001 to 20 %.

9. The composition according to claim 4, wherein the said composition comprises;
    a) fertilizers such as N,P, K and secondary nutrients such as calcium and/or Magnesium and the like; and/or pesticides and/or antioxidant pathway inducers such as coumaric acid and/or cinnamic acid and/or salicylic acid and the like in the said composition is in an amount of 0.01 to 50 %;
    b) humic substances such as humic acid and/or fulvic acid and/or humin and the like is in an amount of 0.01 to 80 %;
    c) resistance inducers and/or formulation additives like stabilizers and/or surfactants which include but not limited to ionic and/or non-ionic and/or cationic surfactants and/or lignosulfonates; and/or stickers such as gum acasia and/or organic and/or inorganic binders and/or spreaders.

10. A method of enhancing the yield of agricultural produce, reducing the abiotic stress resistance, decreasing the biotic stress resistance comprising applying the composition of silicon and phenolic compounds according to claims 1 to 9 to the seeds or foliar of the crops or to the soil or fertigation.

11. The Composition of Silica and Phenolic compounds according to the claims 1 to 9 for use in all crops for seed, foliar, fertigation or soil application in inducing crop resistance against pest, enhance yield of agricultural produce, reduce abiotic stress resistance, decrease biotic stress resistance, enhance quality, nutrient profile and shelf life of the produce and in the attraction of pollinators.

12. The composition according to claim 11, wherein the said composition is formulated in the form of solutions and or powders and or granules.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2019/050500

A. CLASSIFICATION OF SUBJECT MATTER
A01N55/10,A01N31/00,A01N25/00 Version=2019.01

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)

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)

TotalPatent One, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Bhatt D, Sharma G. Role of silicon in counteracting abiotic and biotic plant stresses. IJCS. 2018; 6(2):1434-42. abstract, introduction, pages 1437-1438	1-12
Y	Fauteux F et al. Silicon and plant disease resistance against pathogenic fungi. FEMS Microbiology letters. 2005 Aug 1; 249(1):1-6. abstract, introduction	1-12
Y	Meena VD, et al. A case for silicon fertilization to improve crop yields in tropical soils. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences. 2014 Sep 1;84(3):505-18. abstract	1-12
Y	Seal P et al. Versatile potentiality of silicon in mitigation of biotic and abiotic stresses in plants: a review. American Journal of Plant Sciences. 2018 Jun 8;9(07):1433-1454. abstract, conclusion	1-12

☒ Further documents are listed in the continuation of Box C. ☒ 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
"D" document cited by the applicant in the international application
"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
28-10-2019	28-10-2019
Name and mailing address of the ISA/ Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Authorized officer Akash Kumar Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2019/050500

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Ma JF. Role of silicon in enhancing the resistance of plants to biotic and abiotic stresses. Soil science and plant nutrition. 2004 Feb 1;50(1):11-18. abstract	1-12
Y	EP3217794A1 [AGRO INNOVATION INTERNATIONAL] 20/09/2017 (20 SEPTEMBER 2017) abstract	1-12

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2019/050500

Citation	Pub.Date	Family	Pub.Date
EP 3217794 A1	20-09-2017	WO 2016075421 A1	19-05-2016
		BR 112017010082 A2	14-02-2018
		FR 3028382 A1	20-05-2016
		ES 2721538 T3	01-08-2019