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(54) Title: SUPER ABSORBENT POLYMER AND A METHOD OF INCREASING SUGAR CONTENT IN PLANTS

(57) Abstract: Disclosed herein a composition of super absorbent polymer and optionally at least one sugar enhancing agent to increase the sugar content in plants. The present invention also provides a method of increasing the sugar content of plant.



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SUPER ABSORBENT POLYMER AND A METHOD OF INCREASING SUGAR CONTENT IN PLANTS

Field of invention

The present invention relates to a method of increasing sugar content in plants using super absorbent polymers. The present invention also relates to a method of cultivating a plant using superabsorbent polymer in order to increase the sugar content in said plant.

Background of invention

Sugarcane (*Saccharum* spp.) is a large, perennial, tropical or subtropical crop. It is one of the world's most produced crops contributing about 80% of the world sugar production. Sugarcane also plays an increasingly important role in the biofuel field accounting for ethanol production worldwide. Sugarcane mature stalks contain about 9 to 18% of sucrose.

Sucrose is one of the most important sources of ethanol in world and is also a major human food. The sucrose is primarily harvested from sugarcane, sugar beet and other plants. With the increasing demand in the sugarcane industry, high sucrose content in cane stalks is a high priority for farmers, and consequently for breeders and agronomists as well.

Various alternative methods have been developed for cultivars with improved sugar content. Among such known method to increase sucrose content use of synthetic chemicals such as chlorocholine chloride, cetyltrimethylammonium bromide, trichlorobenzoic acid, β,β -trichloroethanephosphonic acid, N,N-bis(phosphoromethyl)glycine and tetradecyltrimethylammonium chloride, are found beneficial. Further molecular markers or cell biology and genomic approach are also adopted. Sucrose content depends greatly on the stage of development and general growing conditions. A moderately dry and sunny season is required for ripening of sugarcane. The temperature has been found to be contributor factor for low sugar content. The high temperature leads to the conversion of sucrose to fructose and glucose, thus resulting in low sugar content. Ample moisture is needed throughout the growing period as the cane growth is directly proportional to the transpiration. In the sugarcane production process, water is the most important factor. Water deficit leads to cane's yield reduction by slowing down germination and rate stalk elongation which leads to sugar content loss in comparison to the sugar being formed (Book- Lignocellulosic Biomass Production and Industrial Applications by Anindam Kuila, Vinay Sharma).

US4362549 describes a method for increasing the sugar content of sugarcane and sorghum comprising: applying to the sugarcane and sorghum prior to harvest an effective amount of certain sulfonylurea compounds.

US4404012 disclose a method for increasing sucrose yield in sugarcane by treating sugarcane a few weeks prior to harvest with a sucrose yield enhancing amount of a 2-(2-imidazolin-2-yl)pyridine compound.

WO2012008367 disclose a sugar content-increasing agent for sugarcane which has an excellent effect of increasing sugar and can sufficiently promote the growth and ripening, and a method for promoting the growth and ripening of sugarcane using the same. The sugar content-increasing agent for sugarcane comprising, as the active ingredient compound, 3-[5-(difluoromethoxy)-1-methyl-3-(trifluoromethyl) pyrazol-4-ylmethylsulfonyl]-4,5-dihydro-5,5-dimethyl-1,2-oxazole.

Since, most of these compounds are chemical structure and have phytotoxic, hormonal or growth regulating effects on plants and cause damage to nature and animal and human health upon consumption. Thus, there exist a need for developing a new method for increasing sugar content in plants particularly sugarcane that is environmentally safe, easy to use and effective to enhance the sugar content of plant.

Object of the invention

An object of the present invention is to solve at least the above problems and / or disadvantages and to provide at least the advantages to be described later.

It is an object of the present invention to use superabsorbent polymer for increasing sugar content in plants.

In another object when superabsorbent polymer is used for agricultural purposes, it enhances the sugar content of the plants.

Yet another object of this invention is the use of superabsorbent polymer as water retention agent for increasing sugar content in plants.

It is an object of this invention to provide a method for increasing the recoverable sugar content contained plant.

Another object of the present invention is the method of maintaining optimum water for supply to plant using super absorbent polymers.

Further object of this invention is to provide a method of cultivation of plant for increasing sugar content.

Summary of the invention

In an aspect the present invention provides superabsorbent polymer for increasing the sugar content in plants.

In an aspect the present invention provides a composition for increasing the sugar content in plants, said composition comprising a superabsorbent polymer.

In another aspect the present invention provides superabsorbent polymer for increasing the sugar content in sugarcane.

In another aspect the present invention provides a composition comprising superabsorbent polymer for increasing the sugar content in sugarcane.

In another aspect the present invention provides a composition comprising combination of superabsorbent polymer and at least one sugar enhancing agent for increasing the sugar content in sugarcane.

In another aspect the present invention provides a method of increasing sugar content in the plants when superabsorbent polymer is mixed with soil for agricultural purposes.

Yet another aspect of this invention is the use of super absorbent polymers as water retention agent for increasing sugar content in plants preferably sugar cane.

Further aspect of this invention is to provide a method of cultivation of plants, particularly in the plants having sugar content as agronomically important trait.

In another aspect the present invention provides a method of cultivation of sugarcane for increasing sugar content.

In another aspect the present invention provides a method of maintaining optimum water in the soil using super absorbent polymers.

In another aspect the present method has the advantages that this method is simple in operation, and the superabsorbent polymer is sprayed into the furrows before the sugarcane seedlings are cultivated and are beneficial to improving the permeability of soil and the sugar content of the sugarcane can be further increased.

Advantages of the invention

The super absorbent polymer and combination of super absorbent polymer with sugar enhancing agent increases the height of cane, internodes and also number of millable canes.

The super absorbent polymer and combination of super absorbent polymer with sugar enhancing agent increases the leaf moisture.

The super absorbent polymer and combination of super absorbent polymer with sugar enhancing agent increases the leaf phosphorous content that is related to the hasten the crop maturity.

The super absorbent polymer and combination of super absorbent polymer with sugar enhancing agent increases the leaf potassium content which is responsible for juice quality and sugar yield.

The super absorbent polymer and combination of super absorbent polymer with sugar enhancing agent increases the overall yield of the sugarcane.

Detailed description of the invention

For convenience, before further description of the present disclosure, certain terms employed in the specification, and examples are described here. These definitions should be read in the light of the remainder of the disclosure and understood as by a person of skill in the art. The terms used herein have the meanings recognized and known to those of skill in the art. However, for convenience and completeness, particular terms and their meanings are set forth below.

As used herein the term 'plant' refers to an agricultural plant having sugar content as agronomically important trait for example wheat, rye, barley, rice, triticale, oats, sorghum,

sugarcane, , beet, sugar beet or fodder beet, fruits like pomes, apples, pears, plums, peaches, almonds, cherries, strawberries, raspberries, blackberries or gooseberries, leguminous plants, such as lentils, peas, alfalfa or soybeans, oil plants, such as rape, oil-seed rape, canola, juncea, linseed, mustard, olives, sunflowers, coconut, cocoa beans, castor oil plants, oil palms, ground nuts or soybeans, cucurbits, such as squashes, cucumber or melons, fiber plants, such as cotton, flax, hemp or jute, citrus fruit, such as oranges, lemons, grapefruits or mandarins, vegetables, such as spinach, lettuce, asparagus, cabbages, carrots, onions, tomatoes, cucurbits or paprika, lauraceous plants, such as avocados, cinnamon or camphor, energy and raw material plants, such as corn, soybean, rape, canola, oil palm, corn, tobacco, nuts, coffee, tea, bananas, vines, hop, turf, natural rubber plants or ornamental and forestry plants, such as flowers and shrubs.

The terms “superabsorbent polymer” or “SAP” referred herein refer to the water swellable polymers which can absorb water many times their weight in an aqueous solution. Without wishing to be bound by theory, the term superabsorbent polymers also apply to polymers that absorb water as well as de-sorb the absorbed water. The superabsorbent polymer may be selected from but not limited to water-swellable or water absorbing or water-retentive polymers such as cross-linked polymers that swell without dissolving in the presence of water, and may, absorb at least 10, 100, 1000, or more times their weight in water.

The superabsorbent polymer is used as water retention agent and refers to an agent that has the capacity to hold water and release it as and when needed by the plant.

In any aspect or embodiment described hereinbelow, the phrase comprising may be replaced by the phrases “consisting of” or “consisting essentially of” or “consisting substantially of”. In these aspects or embodiment, the combination or composition described includes or comprises or consists of or consists essentially of or consists substantially of the specific components recited therein, to the exclusion of other fungicides or insecticide or plant growth promoting agents or adjuvants or excipients not specifically recited therein.

The term “cultivation” as used herein refers to an activity to grow plants in any stage from the seeding stage to maturation stage. It means to artificially grow plants over the entire or in partial period from the seeding stage to the maturation stage and in each following stage or in stages by the combination of two or more of the stages such as (1) from nursery stage to maturation stage; (2) from nursery plants to maturation stage; (3) from seeds to nursery plants;

(4) from the stage between before the desired maturation to the desired maturation and (5) from the nursery plants to the stage before the desired maturation.

Maturation stage includes the maturation stage in which the desired plant bodies or one of parts of fruits, flowers, leaves, buds, branches, stems, roots and bulbs of the plant bodies are at least made available to be harvested, or in which seeds or nursery plants are made available to be harvested from the plant bodies. Typically, the method of the present invention may be applied to other known varieties/species of plants.

Surprisingly the present inventors found that super absorbent polymer when used during the cultivation of plants it sufficiently increases the sugar content in plants such that there is maximum sugar content in the plant at the time of harvest.

In an aspect the present invention provides a superabsorbent polymer for increasing sugar content in the plants. The superabsorbent polymer may be selected from synthetic, semi-synthetic, natural origin, degradable, non-degradable or hybrid.

In preferred embodiment the plant is sugarcane

In an aspect the present invention provides a superabsorbent polymer for increasing sugar content in the plants particularly sugarcane. The superabsorbent polymer may be selected from synthetic, semi-synthetic, natural origin, degradable, non-degradable or hybrid.

In another embodiment, the present invention provides the use of a superabsorbent polymer for increasing the sugar content in plants.

In an embodiment, the superabsorbent polymer may be a selected from, but not limited to, copolymer of acrylamide and sodium acrylate; hydrolyzed starch-polyacrylonitrile; 2-propenenitrile homopolymer, hydrolyzed, sodium salt or poly(acrylamide co-sodium acrylate) or poly(2-propenamide-co-2-propanoic acid, sodium salt); starch-g-poly(2-propenamide-co-2-propanoic acid, mixed sodium and aluminum salts); starch-g-poly(2-propenamide-co-2-propanoic acid, potassium salt); poly(2-propenamide-co-2-propanoic acid, sodium salt); poly(2-propanoic acid, sodium salt); starch-g-poly(acrylonitrile) or poly(2-propenamide-co-sodium acrylate); starch/acrylonitrile copolymer; crosslinked copolymers of acrylamide and sodium acrylate; acrylamide/sodium polyacrylate crosslinked polymers ; anionic polyacrylamide; starch grafted sodium polyacrylates; acrylic acid polymers, sodium salt; crosslinked potassium

polyacrylate/polyacrylamide copolymers; sodium polyacrylate; superabsorbent polymer laminates and composites; partial sodium salt of crosslinked polypropenoic acid; potassium polyacrylate, lightly crosslinked; sodium polyacrylate, lightly crosslinked; sodium polyacrylates; poly(sodiumacrylate) homopolymer; polyacrylamide polymers, carrageenan, agar, alginic acid, guar gums and its derivatives, and gellan gum; Specific superabsorbent polymers include crosslinked copolymer of acrylamide and potassium acrylate.

In a preferred embodiment, the superabsorbent polymer may be starch-g-poly (2-propenamide-co-2-propenoic acid) potassium salt or crosslinked polyacrylic acid potassium salt.

In an embodiment, the super absorbent polymer is starch based super absorbent polymer.

In another embodiment the starch based super absorbent polymer is used for increasing the sugar content in sugarcane plants.

In one embodiment, the superabsorbent polymer is ZebaTM.

In another aspect the present invention provides a composition comprising superabsorbent polymer, said composition being characterized in increasing the sugar content in sugarcane.

In an embodiment the composition comprising superabsorbent polymer is preferably in the form of granules.

In another aspect the present invention provides a composition comprising a superabsorbent polymer and at least one sugar enhancing agent for increasing the sugar content in sugarcane.

In an embodiment the sugar content enhancing agent is selected from the group of natural or synthetic sugar content enhancing agent.

In an embodiment sugar content enhancing agent is known to a person skilled in the art.

In an embodiment the sugar content enhancing agent is plant ripening delaying agent.

In an embodiment the sugar content enhancing agent is a herbicide.

In an embodiment the composition comprising at least one plant ripening delaying agent, or a herbicide, or both.

In an embodiment the sugar content enhancing agent is selected from the group, but not limited to, the compound 2-[[4,6-dimethylpyrimidin-2-yl)aminocarbonyl]aminosulfonyl]benzoate, 2-(2-imidazolin-2-yl)pyridine, 3-[5-(difluoromethoxy)-1-methyl-3-(trifluoromethyl)pyrazol-4-ylmethylsulfonyl]-4,5-dihydro-5,5-dimethyl-1,2-oxazole and glyphosate.

In an embodiment the sugar content enhancing agent is selected from the group, but not limited to, imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, , glufosinate, glufosinate-P, glyphosate, or combinations thereof

In an embodiment the composition comprising superabsorbent polymer may be applied in granular form, or in a powder form or in a liquid form or other agrochemically acceptable form of delivery.

In a preferred embodiment, the composition of the present invention is in the form of granules.

In an embodiment, the composition of the present invention may be applied to plant, root, seed, or seedling by various methods, including, but not limited to dipping the plant, root, seed, or seedling into the superabsorbent polymer composition, a slurry of the superabsorbent polymer, composition, or a paste including the superabsorbent polymer composition of the, invention; mixing another plant growth media with the superabsorbent polymer composition and later planting a plant, root, seed, or seedling into the plant growth media comprising the superabsorbent polymer composition of the invention; or forming a slurry of the superabsorbent polymer composition that is applied directly to the growing substrate.

In an embodiment the super absorbent polymer is applied with at least one plant advantageous additive.

In an embodiment the composition comprises a super absorbent polymer and at least one agronomically advantageous plant additive.

In an embodiment, the plant advantageous additive is selected from fertilizers, mycorrhiza, micronutrients, acaricides, algicides, antifeedants, avicides, bactericides, bird repellents, chemosterilants, fungicides, herbicide safeners, herbicides, insect attractants, insect repellents,

insecticides, mammal repellents, mating disruptors, molluscicides, nematicides, plant activators, plant-growth regulators, rodenticides, synergists, virucides, derivatives thereof, biological control agents and mixtures thereof.

In an embodiment, the fertilizer is selected from organic and inorganic fertilizers such as those selected from but not limited to urea, NPK, nitrogen based fertilizers, phosphate, calcium, potassium, magnesium, sulfur, copper, iron, manganese, molybdenum, zinc, nickel, cobalt, boron and their salts and derivatives.

Exemplary organic fertilizer may be selected from peat, limestone, rock phosphate, blood meal, bone meal, compost, humic acid, seaweed extracts, digested proteins, fish meal, feather meal, corn meal, alfalfa meal etc.

Exemplary inorganic fertilizer may be selected from NPK, derivatives of potassium, zinc, phosphate such as those selected from but not limited to potassium fertilizers such as potassium carbonate, potassium chloride (also known as muriate of potash), potassium sulfate, potassium nitrate, sulfate of potash magnesia; zinc fertilizers such as those selected from zinc sulfate, zinc oxide, zinc ammonia complex; phosphate fertilizer such as Di-ammonium phosphate, Monoammonium phosphate, Ammonium polyphosphate, Triple superphosphate or mixtures thereof.

In an embodiment, the present invention provides a composition comprising at least one superabsorbent polymer and at least one fertilizer.

In an embodiment, the composition of the present invention may comprise at least one agrochemical.

In an embodiment, the composition of the present invention may comprise a pesticide.

In a preferred feature, the agrochemical is a fungicide, herbicide, or an insecticide.

In an embodiment, the herbicide may be selected from but not limited to, a isoxazolidinone herbicide, a urea herbicide, a triazine herbicide, a hydroxybenzonitrile herbicide, a thiocarbamate herbicide, a pyridazine herbicide, chloroacetanilide herbicides; benzothiazole herbicides; carbanilate herbicides, cyclohexene oxime herbicides; picolinic acid herbicides; pyridine herbicides; quinolinecarboxylic acid herbicides; chlorotriazine herbicides,

aryloxyphenoxypropionic herbicides, oxadiazolone herbicides; phenylurea herbicides, sulfonanilide herbicides; triazolopyrimidine herbicides, amide herbicides, pyridazine herbicides, dinitroaniline herbicides or combinations thereof.

In an embodiment, the insecticide may be selected from organic or inorganic insecticide, natural or synthetic insecticide such as those selected from but not limited to: Acetylcholine esterase inhibitors (Carbamates, Triazemate, Organophosphates); GABA-gated chloride channel antagonists (Cyclodiene organochlorines, Phenylpyrazoles (Fiproles)); Nicotinic Acetylcholine receptor agonists (allosteric) (Spinosyns); Chloride channel activators (Avermectins, Milbemycins); Inhibitors of chitin biosynthesis, type 0, Lepidopteran (Benzoylureas); Inhibitors of chitin biosynthesis, type 1, Homopteran (Buprofezin); Moulting disruptor, Dipteran (Cyromazine); Ecdysone agonists / moulting disruptors (Diacylhydrazines, Azadirachtin); Octopaminergic agonists (Amitraz); Neuronal inhibitors (unknown mode of action) (Bifenazate); Aconitase inhibitors (Fluoroacetate); Synergists (P450-dependent monooxygenase inhibitors, Esterase inhibitors); Ryanodine receptor modulators (diamide); Compounds with unknown mode of action (Benzoximate, Chinomethionat, Dicofol, Pyridalyl, Borax, Tartar emetic); Compounds of unknown or non-specific mode of action (fumigants) (Alkyl halides, Chloropicrin, Sulfuryl fluoride); Sodium channel modulators (DDT, Methoxychlor, Pyrethroids, Pyrethrins); Microbial disruptors of insect midgut membranes (B.t. subsp. Israelensis, B. sphaericus, B.t. subsp. Aizawai, B.t. subsp. kurstaki, B.t. subsp. tenebrionis); Mitochondrial complex IV electron transport inhibitors (Aluminium phosphide, Cyanide, Phosphine); Mitochondrial complex III electron transport inhibitors (Coupling site II) (Hydramethylnon, Acequinocyl, Fluacrypyrim); Compounds of unknown or non-specific mode of action (Clofentezine, Hexythiazox, Etoxazole); Nicotinic Acetylcholine receptor agonists / antagonists (Neonicotinoids, Nicotine, Bensultap, Cartap hydrochloride, Nereistoxin analogues); Juvenile hormone mimics (Juvenile hormone analogues, Fenoxycarb, Pyriproxyfen); Inhibitors of oxidative phosphorylation, disruptors of ATP formation (inhibitors of ATP synthase) (Diafenthiuron, Organotin miticides, Propargite, Tetradifon); Mitochondrial complex I electron transport inhibitors (METI acaricides, Rotenone); Voltage-dependent sodium channel blockers (Indoxacarb); Inhibitors of lipid synthesis (Tetronic acid derivatives); Mitochondrial complex IV electron transport inhibitors (Aluminium phosphide, Cyanide, Phosphine); Compounds of unknown or non-specific mode of action (selective feeding blockers) (Cryolite, Pymetrozine, Flonicamid); Uncouplers of oxidative phosphorylation via disruption of proton gradient (Chlorfenapyr, DNOC).

In an embodiment, the insecticide may be selected from chlorantraniliprole, thiomethoxam or carbofuran.

In an aspect the present invention provides a method of increasing the sugar content of plant, said method comprising treating the plant or a plant propagation material thereof with a super absorbent polymer.

In preferred embodiment the plant is a sugarcane plant.

In an embodiment the present invention provides a method of increasing sucrose content in sugarcane.

In an embodiment the present invention provides a method of increasing the sugar content of plant, said method comprising treating the plant with a starch based super absorbent polymer.

In an embodiment the method comprises applying said composition to sugarcane crop growing or intended to be grown in a field.

In one embodiment, the super absorbent polymer is used in amount of 0.5 kgs to 5kgs/Acre.

Typically, the super absorbent polymer for example ZebaTM is used in an amount of 5kgs/Acre at planting applied along with basal fertilizers in seed furrows.

Surprisingly it has been observed that the sugar content in plant preferably in sugarcane is increased by using superabsorbent polymer.

Further according to the present invention, the cultivated plant using super absorbent polymer are treated with one foliar spray of sugar enhancing agent at 45 days prior to maturity has high sugar content preferably upto 10% or more sucrose content in cane.

Accordingly, foliar application comprises applying an effective amount of a composition comprising at least one sugar enhancing agent and agrochemically acceptable carriers to the target plant.

In an embodiment, the constituents of the composition of the present invention may be tank mixed and sprayed at the locus, or may be alternatively be mixed with surfactants and then sprayed.

In an embodiment, the constituents of the composition of the present invention may be used for foliar application, ground or applications to plant propagation materials.

In an embodiment, the compositions of the present invention may typically be produce by mixing the active in the composition with an inert carrier, and adding surfactants and other adjuvants and carriers as needed and formulated into solid, or liquid formulations, including but not limited to wettable powders, granules, dusts, Soluble (liquid) concentrates, suspension concentrates, oil in water emulsion, water in oil emulsion, emulsifiable concentrates, capsule suspensions, ZC formulations, oil dispersions or other known formulation types.

Examples of the solid carrier used in formulation include fine powders or granules such as minerals such as kaolin clay, attapulgite clay, bentonite, montmorillonite, acid white clay, pyrophyllite, talc, diatomaceous earth and calcite; natural organic materials such as corn rachis powder and walnut husk powder; synthetic organic materials such as urea; salts such as calcium carbonate and ammonium sulfate; synthetic inorganic materials such as synthetic hydrated silicon oxide; and as a liquid carrier, aromatic hydrocarbons such as xylene, alkylbenzene and methylnaphthalene; alcohols such as 2-propanol, ethyleneglycol, propylene glycol, and ethylene glycol monoethyl ether; ketones such as acetone, cyclohexanone and isophorone; vegetable oil such as soybean oil and cotton seed oil; petroleum aliphatic hydrocarbons, esters, dimethylsulfoxide, acetonitrile and water.

Examples of the surfactant include anionic surfactants such as alkyl sulfate ester salts, alkylaryl sulfonate salts, dialkyl sulfosuccinate salts, polyoxyethylene alkylaryl ether phosphate ester salts, lignosulfonate salts and naphthalene sulfonate formaldehyde polycondensates; and nonionic surfactants such as polyoxyethylene alkyl aryl ethers, polyoxyethylene alkylpolyoxypropylene block copolymers and sorbitan fatty acid esters and cationic surfactants such as alkyltrimethylammonium salts.

Examples of the other formulation auxiliary agents include water-soluble polymers such as polyvinyl alcohol and polyvinylpyrrolidone, polysaccharides such as Arabic gum, alginic acid and the salt thereof, CMC (carboxymethyl- cellulose) , Xanthan gum, inorganic materials such

as aluminum magnesium silicate and alumina sol, preservatives, coloring agents and stabilization agents such as PAP (acid phosphate isopropyl) and BHT.

In another embodiment the present invention provides a method of increasing the sugar content of plant, said method comprising treating the plant with a starch based super absorbent polymer and subsequent treatment with a formulation comprising at least one sugar enhancing agent.

In an embodiment, the sugar enhancing agent is applied to plant before the maturity of the plant.

Typically, the plant is treated with sugar enhancing agent at least 25 days before the harvest.

Typically, the plant is treated with sugar enhancing agent at least 30 days before the harvest.

Typically, the plant is treated with sugar enhancing agent at about 45 days before the harvest. Preferably, the sugar enhancing agent is applied once as foliar sprays at 45 days prior to maturity.

In an embodiment the present invention provides a method of maintaining optimum water in the soil using super absorbent polymer for effective growth and ripening of plant.

In an embodiment the present invention provides a method of cultivation of plant comprising the steps of

- a) applying superabsorbent polymer to the locus at which a plant is growing or is intended to be grown, said superabsorbent polymer being applied to the locus between 0 to 30 days of sowing.

In a preferred feature, the method comprises carrying out pre-planting preparation at the locus at which the plant is intended to be grown.

In another preferred feature, the method comprises treating the locus with a growth medium before, during or shortly after planting with at least one agronomically advantageous plant additive.

In an embodiment the method comprises treatment of the locus with at least one agronomically advantageous plant additive before harvest.

In another embodiment the method for cultivating sugarcane for increasing the sugar content comprises applying super absorbent polymer to the stalks or to the locus at which sugarcane is growing or intended to be grown.

In a preferred feature, the superabsorbent polymer is applied between 0 to 30 days of sowing or planting the crop.

In a preferred feature, the method of cultivating sugarcane comprises at least or more of the following features:

- a) cutting the stalk of an old sugar cane plant into pieces; or
- b) carrying out pre-planting preparation before sugarcane seedlings/stalks are cultivated;
or
- c) sowing/planting stalk pieces in the soil; or
- d) treating the soil with growth medium before, during or after planting with at least one agronomically advantageous plant additive.

In an embodiment the method comprises applying a super absorbent polymer once between 0 to 30 days of sowing or planting the stalks.

In an embodiment super absorbent polymer is applied at the time of sowing of crop.

In another embodiment the method of sowing sugarcane is either trench or furrow.

In another embodiment the spacing between sugarcane at the time of sowing is 30 cm to 50 cm.

In another embodiment the spacing between sugarcane at the time of sowing is 20 cm to 80 cm, more preferably 36 cm to 48 cm.

In another embodiment the number of irrigations carried out till harvest is 8 to 15 times.

In an embodiment the method comprises applying super absorbent polymer in combination with at least one sugar enhancing agent.

Preferably super absorbent polymer is applied at the time of sowing and sugar enhancing agent is applied separately, together or simultaneously or subsequently or before, during and/or after the planting or sowing of plant.

In an embodiment the method of increasing the sugar content of plant comprises applying a starch based super absorbent polymer to the soil before harvest.

In another embodiment the super absorbent polymer is used during the cultivation of sugarcane for increasing the sucrose content of harvested sugarcane.

According to the present invention the cultivated plant using super absorbent polymer has high sugar content preferably upto 10% or more sucrose content in cane.

According to the present invention the cultivated plant using super absorbent polymer has high sugar content preferably upto 15% or more sucrose content in cane.

According to the present invention cane juice having upto 10% increase in sugar content.

According to the present invention cane juice having upto 15% increase in sugar content.

According to the present invention sugar yield obtained from said cane is increased upto 60%.

According to the present invention expected sugar recovery is increased between 10% -100%.

According to the present invention expected sugar recovery is increased between 10% -80%.

According to the present invention expected sugar recovery is increased between 10% -70%.

According to the present invention expected sugar recovery is increased between 10% -60%.

According to the present invention expected sugar recovery is increased between 10% -50%.

In another aspect, the present invention provides a method of improving the quality of plants by contacting the soil with a composition comprising a superabsorbent polymer.

Typically, using super absorbent polymer the quality of plant has improved in accordance with the present invention which include but not limited to the quality of the plant determined by increased nutrient content, increased protein content, increased content of fatty acids, increased metabolite content, increased carotenoid content, increased sugar content, increased content of amino acids, improved leaf color, increased yield, increased plant height, increased productivity, increased number of nodes, increased girth and combinations thereof.

The cultivated sugarcane according to the method of cultivation of the present invention has increased sugar content, increased girth, increased height, increased nodes, reduced irrigation need and increased productivity.

In an embodiment, the compositions as described hereinbefore may be combined with at least one fertilizers, micronutrients and other agronomically advantageous plant additives.

In an embodiment the components of the composition can be applied to the field separately, together or simultaneously or subsequently or before, during and/or after the planting or sowing of plant. Methods for applying the components of compositions to the soil or locus of the stem section and their application rates are known to a skilled person, and conventionally practiced.

In an embodiment the mesh size of the starch based super absorbent polymer may range from about 20 mesh to about 500 mesh. In another embodiment, mesh size may range from 60 mesh to about 150 mesh, preferably in the range of about 80 to 120 mesh.

In another embodiment the application of super absorbent polymer is in the range of 0.5-1000Kg/Acre.

In another embodiment, the application of super absorbent polymer is in the range of 1-500 Kg/Acre, more preferable 1-500 Kg/Acre, more preferable 1-100 Kg/Acre, more preferable 1-10 Kg/Acre, more preferably 0.5-5 Kg/Acre.

In another embodiment super absorbent polymer is applied during cultivation by spreading the superabsorbent polymer over the soil or by any other conventional agricultural techniques.

In an embodiment the present invention provides use of a superabsorbent polymer for increasing the sugar content of a plant crop or a produce thereof.

In an embodiment, the present invention provides a method for improving the yield of a crop by applying the superabsorbent polymer of the invention to roots of the plant.

In an embodiment, the present invention provides a multi-pack agricultural product comprising a superabsorbent polymer component; and an instruction manual instructing an user to administer the admixture to a locus.

In an embodiment, the multi-pack comprising at least one plant advantageous additive or at least one sugar enhancing agent.

In another aspect, the superabsorbent polymer and optionally the plant advantageous additive may be packaged as a kit-of-parts which facilitates the addition of the superabsorbent polymer and optionally the plant advantageous additive at the time of application.

Therefore, in this aspect, the present invention provides a multi-pack agricultural product comprising a superabsorbent polymer; optionally a container comprising at least one plant advantageous additive; and an instruction manual instructing an user to administer the admixture to a locus.

In an embodiment, present invention provides a multi-pack agricultural product comprising:
a first container comprising at least one superabsorbent polymer;
a second container comprising at least one fertilizer or insecticide or both; and
an instruction manual instructing an user to admix the contents of said first and second container and administering the admixture to a field.

The advantages offered by the present invention will be more apparent from the examples set forth herein below. These examples are provided merely as illustrations of the invention and are not intended to be construed as a limitation thereof.

EXAMPLES

The following examples are meant to illustrate the present invention. The examples are presented to exemplify the invention and are not to be considered as limiting the scope of the present invention.

Example 1:

Field trials

Seven plots of sugar cane plant were evaluated. Each plot was divided into two parts. In one part super absorbent polymer was spread at the time of sowing, in another part super absorbent polymer (SAP) was not sprayed (control). The quantity of sprayed super absorbent polymer (SAP, Zeba) is in the range of 5 Kg/acre. The cultivation was done as per the parameters such as sowing of sugarcane is either trench or furrow, spacing between sugarcane at the time of sowing is 30 cm to 48 cm and irrigation till harvest is 8 to 15 times. The plants were surface irrigated to maintain normal growth. The crop was harvested. The cane stalks from each plot were collected randomly after treatment. The results are presented in table 1.

Plot	SAP/Control	Brix %	Pol %	Exp. Recovery	% Increase in Exp. Recovery w.r.t control
Plot 1	SAP	19.02	16.43	11.64	32.3
	Control	15.62	12.79	8.80	
Plot 2	SAP	18.58	15.84	9.10	27.3
	Control	15.99	13.49	7.15	
Plot 3	SAP	18.08	15.26	8.69	60.3
	Control	14.69	11.48	5.42	
Plot 4	SAP	19.08	16.37	9.49	20.0
	Control	17.98	14.36	7.91	
Plot 5	SAP	19.18	16.67	9.70	46.1
	Control	17.39	12.89	6.64	
Plot 6	SAP	18.42	16.75	9.76	54.0
	Control	15.52	12.76	6.34	
Plot 7	SAP	21.12	18.81	11.24	12.8
	Control	19.52	17.51	9.97	

Conclusion:

It was observed that percent sucrose content in cane treated with starch based super absorbent polymer has increased. Thus, it can be concluded that use of SAP showed increase in sucrose content (pol%, expected sugar recovery and brix %) as compared to the results without super absorbent polymer.

Advantageously, expected sugar recovery was increased upto 60% than in the control plots.

Example 2:

Field trials

A plot was planted with two eyes (buds) Sugarcane set in seed furrows and six rows were planted like this. Six treatments were created as per table 2:

T1	Control	
T2	Super Absorbent Polymer	5 kgs/Acre at planting applied along with basal fertilizers in seed furrows
T3	Imazapyr	One foliar sprays @ 1.2 L/Acre (Formulation) at 45 days prior to maturity
T4	Glyphosate	One foliar sprays @ 1.2 L/Acre (Formulation) at 45 days prior to maturity
T5	Super Absorbent Polymer + Imazapyr	Zeba + One foliar sprays @ 1.2 L/Acre (Formulation) at 45 days prior to maturity
T6	Super Absorbent Polymer + Glyphosate	Zeba + One foliar sprays @ 1.2 L/Acre (Formulation) at 45 days prior to maturity

Brix%, Pol%, content was analyzed at different intervals to identify the best time to harvest cane for optimal sugar recovery by standard methods provided in International Commission for Uniform Methods of Sugar Analysis (ICUMSA), 1994.

Standard irrigation and other farm practices were followed.

The observation is listed in below tables:

Sugar Recovery -

A representative sample containing 5 canes/plot were analysed for cane juice analysis and sugar recovery.

Table 3:

	Sugar Recovery @ spraying	Sugar Recovery @ 30 DAS*	Sugar Recovery Increase %w.r.t. control @ 30 DAS*
Control	11.8	11.8	0.3
Glyphosate	11.5	11.4	-3.6
Zeba+Glyphosate	11.2	12.8	8.4

Table 4:

	Sugar Recovery @ spraying	Sugar Recovery @ 45 DAS	Sugar Recovery Increase %w.r.t. control @ 45 DAS
Control	11.8	11.9	1.3
Zeba	11.8	12.3	4.2

Table 5 –

Pol%

	Pol% @ spraying	Pol% @ 30 DAS*	Pol Increase % w.r.t. control @ 30 DAS*
Control	15.7	17.2	9.6
Glyphosate	17.1	14.8	-5.5
Zeba+Glyphosate	17.3	18.4	17.4

Table 6

	Pol% @ spraying	Pol% @ 30 DAS*	Pol Increase % w.r.t. control @ 30 DAS*	Pol% @ 45 DAS	Pol Increase % w.r.t. control @ 45 DAS*
Control	15.7	17.2	9.6	16.4	4.8
Zeba	17.6	17.6	12.0	17.6	11.9

Table 7

	Pol% @ spraying	Pol% @ 45 DAS	Pol Increase % w.r.t. control @ 45 DAS*
Control	15.7	16.4	4.8
Imazapyr	17.4	17.2	9.8
Zeba+Imazapyr	17.7	17.6	11.9

Table 8

A representative sample containing 5 canes/plot were analyzed for yield 45 days after spraying.

	Sugarcane Yield Mt/Acre
Control	71.28
Zeba	95
Imazapyr	75.072
Glyphosate	74.796

Zeba+Imazapyr	94.3
Zeba+Glyphosate	94.1

Table 9

A representative sample containing 5 canes/plot were analysed for phosphorous, moisture and potassium content in leaves:

A study of impact of SAP alone or in combination with sugar enhancing agent on different parameters (Moisture%, Phosphorous%, Potassium%, Nitrogen%) to assess crop maturity

		Moisture, %	Total Phosphorous, %	Total Potassium, %	Total Nitrogen, %
Observation @ Spraying	Control	53.57	0.33	1.62	0.79
	SAP	55.1	0.29	1.78	0.8
	Imazapyr	54.56	0.3	1.67	0.81
	Glyphosate	56.12	0.3	1.81	0.84
	SAP+Imazapyr	57.82	0.35	1.82	0.79
	SAP+Glyphosate	58.1	0.33	1.76	0.78
Observation @ 30 days after spraying	Control	50.06	0.21	1.08	0.85
	SAP	55.23	0.23	1.21	0.79
	Imazapyr	55.12	0.24	1.48	0.74
	Glyphosate	52.1	0.28	1.42	0.91
	SAP+Imazapyr	54.14	0.31	1.6	0.97

	SAP+Glyphosate	54.62	0.23	1.57	0.85
Observation @ 45 days after spraying	Control	53.1	0.22	1.14	0.85
	SAP	56.12	0.2	1.43	0.74
	Imazapyr	53.6	0.19	1.34	0.85
	Glyphosate	54.35	0.19	1.28	0.91
	SAP+Imazapyr	54.38	0.28	1.73	0.79
	SAP+Glyphosate	53.6	0.28	1.01	0.97

SAP= Super Absorbent Polymer

Conclusion:

It was observed that recoverable sugar and Brix% increases when the sugarcane is treated with super absorbent polymer alone or in combination with a sugar enhancing agent i.e. glyphosate and imazapyr. Also yield, leaf moisture content, potassium content and phosphorous content was also observed to be increased.

It was clearly observed that the combination of Super Absorbent Polymer and Glyphosate is much more effective in increasing the sugar content and juice quality of cane @ 30 days after spraying of Glyphosate as compared to SAP or Glyphosate alone.

WE CLAIM:

1. A composition for increasing the sugar content in plants, said composition comprising a superabsorbent polymer.
2. The composition as claimed in claim 1, wherein the superabsorbent polymer is selected from the group consisting of: copolymer of acrylamide and sodium acrylate; hydrolyzed starch-polyacrylonitrile; 2-propenenitrile homopolymer, hydrolyzed, sodium salt or poly(acrylamide co-sodium acrylate) or poly(2-propenamide-co-2-propanoic acid, sodium salt); starch-g-poly(2-propenamide-co-2-propanoic acid, mixed sodium and aluminum salts); starch-g-poly(2-propenamide-co-2-propanoic acid, potassium salt); poly(2-propenamide-co-2-propanoic acid, sodium salt); poly-2-propanoic acid, sodium salt; starch-g-poly(acrylonitrile) or poly(2-propenamide-co-sodium acrylate); starch/acrylonitrile copolymer; crosslinked copolymers of acrylamide and sodium acrylate; acrylamide/sodium polyacrylate crosslinked polymers; anionic polyacrylamide; starch grafted sodium polyacrylates; acrylic acid polymers, sodium salt; crosslinked potassium polyacrylate/polyacrylamide copolymers; sodium polyacrylate; superabsorbent polymer laminates and composites; partial sodium salt of crosslinked polypropenoic acid; potassium polyacrylate, lightly crosslinked; sodium polyacrylate, lightly crosslinked; sodium polyacrylates; poly(sodiumacrylate) homopolymer; polyacrylamide polymers, carrageenan, agar, alginic acid, guar gums and its derivatives, and gellan gum.
3. The composition as claimed in claim 1 or claim 2, wherein the superabsorbent polymer is starch-g-poly (2-propenamide-co-2-propenoic acid) potassium salt or crosslinked polyacrylic acid potassium salt.
4. The composition as claimed in any one of the preceding claims in the form of granules or powder.
5. The composition as claimed in any one of the preceding claims further comprising at least one plant ripening delaying agent, or a sugar enhancing agent, or both.
6. The composition as claimed in claim 5 comprising at least one sugar enhancing agent selected from the group of 2-[[4,6-dimethylpyrimidin-2-yl)aminocarbonyl]aminosulfonyl]benzoate, 2-(2-imidazolin-2-yl)pyridine, 3-[5-

(difluoromethoxy)-1-methyl-3-(trifluoromethyl)pyrazol-4-ylmethylsulfonyl]-4,5-dihydro-5,5-dimethyl-1,2-oxazole or glyphosate.

7. The composition as claimed in claim 5, wherein the sugar enhancing agent is selected from the group consisting of imazamethabenz, imazamox, imazapic, imazapyr, imazaquin, imazethapyr, glufosinate, glufosinate-P, glyphosate, and combinations thereof.
8. The composition as claimed in any one of the preceding claims comprising at least one plant advantageous additive selected from fertilizers, mycorrhiza, micronutrients, acaricides, algicides, antifeedants, avicides, bactericides, bird repellents, chemosterilants, fungicides, herbicide safeners, herbicides, insect attractants, insect repellents, insecticides, mammal repellents, mating disruptors, molluscicides, nematocides, plant activators, plant-growth regulators, rodenticides, synergists, virucides, derivatives thereof, biological control agents or mixtures thereof.
9. The composition as claimed in claim 8, wherein the plant advantageous additive is a fertilizer.
10. The composition as claimed in any one of the preceding claims further comprising at least one agrochemical.
11. The composition as claimed in claim 10, wherein the agrochemical is a fungicide, herbicide, or an insecticide.
12. The composition as claimed in any one of the preceding claims, wherein said composition is applied to sugarcane crop growing or intended to be grown in a field.
13. A method of increasing the sugar content of plant, said method comprising treating the plant or a plant propagation material thereof with a super absorbent polymer.
14. The method as claimed in claim 13, wherein the plant is a sugarcane plant.
15. The method as claimed in claims 13 – 14, wherein the superabsorbent polymer is applied to the locus, at which the crop is growing or intended to be grown, between 0 to 30 days of sowing.

16. The method as claimed in claims 13 – 15 comprising treating the locus further with at least one agronomically advantageous plant additive before harvest.
17. The method as claimed in claims 13 – 16, wherein the method comprises applying said super absorbent polymer optionally in combination with at least one sugar enhancing agent.
18. The method as claimed in claim 17 plant is treated with sugar enhancing agent at least 25-45 days before the harvest, preferably 30-45 days, more preferably 45 days before the harvest.
19. A cane juice obtained from any of the preceding claim having upto 10%-100% increase in expected sugar recovery.
20. Use of a superabsorbent polymer for increasing the sugar content of a plant crop or a produce thereof.
21. Use as claimed in claim 20 wherein sugar content increased by treating the plant or a plant propagation material with a super absorbent polymer.
22. Use as claimed in claim 20, wherein the plant is a sugarcane plant.
23. Use as claimed in claim 21, wherein the superabsorbent polymer is applied to the plant, at which the crop is growing or intended to be grown, between 0 to 30 days of sowing.
24. Use as claimed in claim 21 further comprising treating the plant with at least one agronomically advantageous plant additive before harvest.
25. Use of super absorbent polymer in combination with at least one sugar enhancing agent for increasing sugar content in the plant, where in sugar enhancing agent is applied at least 25-45 days before the harvest, preferably 30-45 days, more preferably 45 days before the harvest.
26. A multi-pack agricultural product comprising a superabsorbent polymer component; and an instruction manual instructing an user to administer the admixture to a locus.

27. The product of claim 26 comprising at least one plant advantageous additive or at least one sugar enhancing agent.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2020/053195

A. CLASSIFICATION OF SUBJECT MATTER

C09K 17/18 (2006.01) C09K 17/16 (2006.01) A01N 43/50 (2006.01) A01N 57/20 (2006.01) C05G 3/80 (2020.01)
C05G 3/60 (2020.01) A01G 24/35 (2018.01) A01G 22/55 (2018.01)

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)

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)

EPOQUE 5.2 (PATENW): Applicant/Inventor names (UPL Ltd, N S Bhonsle, S Kheraliya), CPC/IPC symbols (C09K 17/18, 17/16; A01G 24/35, 22/55; C08F 251/00; A01N 43/50, 57/20), Keywords (superabsorbent polymer, (starch, propenamide, propenoic), Zeba, sugarcane, sugar, sucrose, imazapyr, glyphosate, *etc.*). **NEW STN (CAPlus, BIOSIS, CABA, Registry, CN/DE/FR/IN/JP/KR FULL):** Applicant/Inventor names (*as above*); CAS Registry numbers (107830-79-5, 81334-34-1, 1071-83-6); Control Terms (superabsorbents); Keywords ((starch, propenamide, propenoic), superabsorbent, sugarcane, sugar, sucrose, moisture, soil, retain, glyphosate, imazapyr, *etc.*). **ONLINE DATABASES (Espacenet, Google):** Applicant/Inventor names (*as above*); Keywords (superabsorbent polymer, SAP, Zeba, starch-g-poly (2-propenamide-co-2-propenoic acid) potassium salt, Zeba, sugarcane, sugar content, sucrose, moisture, imazapyr, glyphosate, soil conditioner, fertiliser, cane juice, *etc.*). **INTERNAL DATABASES:** Applicant/Inventor names (*as above*).

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	



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	"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
"D" document cited by the applicant in the international application	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search
11 June 2020

Date of mailing of the international search report
11 June 2020

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INTERNATIONAL SEARCH REPORT		International application No.
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		PCT/IB2020/053195
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2016/113727 A2 (BASF SE) 21 July 2016 Abstract, p1 ln 1 to p2 ln 13, p19 ln 35 to p24 ln 10, p24 ln 36-40, Claims 1, 4, 9-11	1-18 & 20-27
X	WATANABE, K. <i>et al.</i> , "Effects of Superabsorbent Polymer on Soil Water Content and Sugarcane Germination and Early Growth in Sandy Soil Conditions", <i>Sugar Tech</i> (2019) vol 21, no 3, pages 444-450 [published online 28 September 2018]. Abstract, Introduction (par 2 & 4), Materials and Methods, Discussion (par 4)	1, 4, 12 & 26
X	SINGH, I. <i>et al.</i> , "Growth, Yield, Irrigation Water Use Efficiency, Juice Quality and Economics of Sugarcane in Pusa Hydrogel Application Under Different Irrigation Scheduling", <i>Sugar Tech</i> (2018) vol 20, pages 29-35. Abstract, Introduction (par 3), Materials and Methods, "Yield Attributes, Yield and Juice Quality Parameters", Table 2	19 & 26
X	MARQUES, T. A. <i>et al.</i> , "Water absorbent polymer in sugarcane crop", <i>Eng. Agric.</i> (2013) vol 33, no 1, pages 99-108. Abstract, p100 par 3 & 5-6, p101 par 1 & 3, p103 par 1-3, p104 par 1-3, p105 par 3, Tables 2-3, Conclusions	26
X	US 2007/0163173 A1 (SAVICH) 19 July 2007 Abstract, [0040, 0045, 0049, 0058], Claim 17 & 21	1-11 & 26-27
X	WO 2015/044150 A2 (BASF AGROCHEMICAL PRODUCTS B.V. et al.) 02 April 2015 Abstract, p7 ln 5-6	1-8, 10-12 & 26-27
X	WO 2013/096531 A1 (E. I. DU PONT DE NEMOURS AND COMPANY et al.) 27 June 2013 Abstract, pp25-26, Example 38 (p128)	1-2, 4, 8-10, 12 & 26
X	WO 2005/122668 A2 (BIOCENRAL LABORATORIES LIMITED) 29 December 2005 Abstract, p5 ln 1-11, p7 ln 7-11, p8 ln 10-19	1-2, 4, 8, 12, 19 & 26
Form PCT/ISA/210 (fifth sheet) (July 2019)		

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Supplemental Box for Details

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Supplemental Box**Continuation of: Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1-18 & 20-27 are directed to a composition comprising a superabsorbent polymer (SAP) or a method or use thereof for increasing sugar content in a plant.. The feature of a composition comprising a superabsorbent polymer is specific to this group of claims.
- Claim 19 is directed to a cane juice. It is noted that claim 19 is drafted as a product-by-process and so is not limited by the methods of the previous claims (see Box V for further detail).. The feature of a cane juice having up to 10-100% increase in expected sugar recovery is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a priori*.

INTERNATIONAL SEARCH REPORT		International application No.	
Information on patent family members		PCT/IB2020/053195	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
WO 2016/113727 A2	21 July 2016	WO 2016113727 A2	21 Jul 2016
US 2007/0163173 A1	19 July 2007	US 2007163173 A1	19 Jul 2007
		US 7607259 B2	27 Oct 2009
		BR PI0706548 A2	29 Mar 2011
		EP 1973954 A2	01 Oct 2008
		US 2007163172 A1	19 Jul 2007
		US 2007167327 A1	19 Jul 2007
		US 2007167330 A1	19 Jul 2007
		US 2009261132 A1	22 Oct 2009
		WO 2007084550 A2	26 Jul 2007
		ZA 200806201 B	29 Apr 2009
		WO 2015/044150 A2	02 April 2015
AR 099271 A1	13 Jul 2016		
AU 2014327408 A1	07 Apr 2016		
AU 2014327408 B2	15 Feb 2018		
CN 105873437 A	17 Aug 2016		
MX 2016003735 A	07 Dec 2016		
MX 362696 B	01 Feb 2019		
US 2016213000 A1	28 Jul 2016		
ZA 201602657 B	31 Jul 2019		
WO 2013/096531 A1	27 June 2013	WO 2013096531 A1	27 Jun 2013
		AU 2012358929 A1	26 Jun 2014
		AU 2012358929 B2	20 Apr 2017
		BR 102012032801 A2	10 Sep 2013
		BR 112014015240 A2	04 Jul 2017
		CA 2859976 A1	27 Jun 2013
		CN 104284579 A	14 Jan 2015
		CO 7010786 A2	31 Jul 2014
		EP 2793551 A1	29 Oct 2014
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.			
Form PCT/ISA/210 (Family Annex)(July 2019)			

INTERNATIONAL SEARCH REPORT Information on patent family members		International application No. PCT/IB2020/053195	
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.			
Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	Publication Date	Publication Number	Publication Date
WO 2005/122668 A2	29 December 2005	MX 2014007449 A	29 Oct 2015
		PH 12014501407 A1	22 Sep 2014
		US 2013174483 A1	11 Jul 2013
		WO 2005122668 A2	29 Dec 2005
		AU 2005253652 A1	29 Dec 2005
		AU 2005253652 B2	24 Feb 2011
		BR PI0512344 A	04 Mar 2008
		CA 2568887 A1	29 Dec 2005
		EP 1771531 A2	11 Apr 2007
		EP 1771531 B1	21 May 2014
		NZ 551719 A	26 Jun 2009
		US 2008066509 A1	20 Mar 2008
		US 7922785 B2	12 Apr 2011
		ZA 200610145 B	29 Oct 2008
End of Annex			
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001. Form PCT/ISA/210 (Family Annex)(July 2019)			