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(54) **TRIPLOID WATERMELON PLANTS WITH A BUSH GROWTH HABIT**

TRIPLOIDE WASSERMELONENPFLANZEN MIT EINER "BUSH" WACHSTUMSFORM

PLANTES DE PASTÈQUE TRIPLOÏDE AVEC UNE FORME DE CROISSANCE "BUSH"

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of plant breeding and plant improvement. Provided are new hybrid watermelon plants and seeds from which such plants can be grown, which are "*bush*" in growth habit (comprising the recessive *"bush* gene", designated "*b*") and triploid (2n = 3x = 33) in their chromosomal makeup. When these triploid hybrid plants are pollinated with normal diploid (2n = 2x = 22) pollen (obtainable from pollenizers), these plants produce triploid, seedless fruit of high quality. As the triploid hybrid plant has a *bush* growth habit, having short longest vines (equal to or below 150 cm, more preferably equal to or below 140 cm, especially equal to or below 100 cm) and short internode length, this plant can be grown at a higher density in the field compared to traditional *non-bush* triploid watermelon hybrids, leading to a higher fruit yield per hectare compared to triploid hybrids with normal growth habit (having an average longest vine length of above 200 or above 300 cm). The average plant diameter of a triploid *bush* plant according to the invention is equal to or below 300 cm, preferably 280 cm, especially equal to or below 200 cm, while other characteristics, such as leaf size and fruit size are similar to that of normal growth type triploid watermelon plants. Also provided are inbred diploid *bush* watermelon plants *(bb)* and inbred tetraploid (2n = 4x = 44) *bush* watermelon plants *(bbbb),* which are used as male and female parent, respectively, in order to produce the triploid *bush* hybrid watermelon plants *(bbb)* according to the invention. In addition triploid, seedless fruit, obtainable from the triploid *bush* plants according to the invention, are provided, as are seeds from which the triploid *bush* hybrid plants can be grown. Further methods for cultivating triploid *bush* hybrids are provided.

BACKGROUND OF THE INVENTION

[0002] Seedless watermelon (*Citrullus lanatus* (Thunb.) Matsum. And Nak.) are produced by using pollen from diploid male parent plants to fertilize flowers of tetraploid maternal parent plants. Pollination of the tetraploid flowers with diploid pollen leads to hybrid F1 seeds which are triploid (Kihara, 1951, Proceedings of American Society for Horticultural Science 58: 217-230; Eigsti 1971, Hort Science 6: 1-2). The triploid hybrid plants grown from these F1 seeds are self-infertile as they produce sterile pollen due to chromosome imbalance (Fehr, 1987). The triploid hybrids, therefore, need to be pollinated by a diploid pollenizer to produce watermelon fruit.

[0003] Triploid plants are, therefore, interplanted with pollenizer plants for fruit production. The "seedless" fruit produced after pollination on the triploid hybrid plant are not truly seedless, but often contain some undeveloped, small, pale seeds, which are edible.

[0004] For optimal fruit set, sufficient viable pollen is required. Plants are generally planted at a ratio of 1 pollenizer per every 2-4 triploid plants. Triploid plants and pollenizers are either planted in separate rows (e.g. 1 row of pollenizer and 2-4 rows of triploids), or interplanted within rows (e.g. planting 1 pollenizer plant in between 2 to 3 triploid plants in the same row), or interplanted in narrow rows between rows of triploids (see US 2006/0168701 Table 2). The fruit produced on the pollenizer plants preferably has a different rind pattern from the fruit on the triploid hybrids, so that these can be easily distinguished.

[0005] Some problems remain with seedless watermelon production, such as the production of the tetraploid mother line (chromosome doubling through colchicines treatment of seedlings), finding compatibility between diploid pollenizer and tetraploid mother plants and triploid seeds often have a thicker seed coat, which decreases their vigor and germination. Fruit quality and uniformity is also often a problem, as are the high production costs of triploid seeds due to the above requirements.

[0006] Making a stable, tetraploid inbred mother line with the desired trait(s) is not straight forward, as it is not as simple as selecting a good diploid and doubling the chromosomes using e.g. colchicines treatment. After some cells with doubled chromosomes are obtained and a plant is regenerated, a number of generations of self pollination (inbreeding) are needed to stabilize (fix) the tetraploid and to eliminate undesired chromosomal aberrations.

[0007] Compact (or dwarf) diploid pollenizer plants having shorter vines and/or shorter internodes are often used to induce seedless-fruit set on normal (non-dwarf) hybrid triploid female parents and/or to produce seed-comprising fruit on the pollenizer plant itself. For example the variety Side Kick (Harris Morin) is used as pollenizer for normal hybrid triploids (seedless) and/or pollenizer fruit production (seeded). Side Kick is a diploid pollenizer comprising the recessive allele *hmbn* (US 7,314,979 B2) in homozygous form, which leads to more branching (multibranching) and thereby more "compact" diploid pollenizer plants. Also the diploid pollenizer fruits of homozygous *hmbn hmbn* plants are smaller than normal fruits (1.6 kg compared to 8.98 kg of a normal diploid). On the other hand, the triploid, seedless fruit produced when a normal hybrid triploid is pollinated with a pollenizer such as Side Kick are large, seedless fruit of 13-21 pounds (5.8 - 9.5 kg). The HMBN compact type (*hmbn hmbn*) is not as compact as the known diploid dwarf mutants (*dw-1 dw-1*, such as variety Bush Jubilee or *dw-2 dw-2*, such as variety J86), but is more compact than the standard diploid types (e.g. Allsweet), see Table 1 of US 7,314,979 and Table 1 of US 8,034,999. The HMBN compact type (*hmbn hmbn*) has

many more secondary branches (average 44.9) than a normal diploid (average 14.7) or than a known dwarf diploid (average 19.3 and 7.3), while the internode length is longer (average 4.4 cm) than in the known dwarf diploids (average 3.4 and 4.1 cm), but shorter than in normal type diploids (average 7.2 cm).

[0008] US 7,164,059 describes a short-vine, diploid pollenizer and its use to pollinate normal growth habit (normal growth type) triploid hybrids. The short-vine pollenizer is described as having an average internode length of less than 3 inches (less than 7.6 cm) and/or a plant diameter of less than 1.8 meter. By using a short-vine pollenizer in combination with normal habit triploids it is stated that 33% to 50% more triploids per acre can be planted (about 2000 triploids per acre, plus 400 to 1200 diploid pollenizers per acre; this equals about 4942 triploids per hectare, plus 988 to 2965 diploid pollenizers per hectare).

[0009] US 7,115,800 describes the production of seedless watermelon fruit having an average weight of less than 5.4 kg (3.6 to 4.0 kg). The triploid watermelon plants are produced using "small" inbred tetraploid and "small" inbred diploid parental lines, whereby "small" refers to the fruit size and not to the plant size. The triploid hybrid plants, producing small fruit, have a normal growth type, with vine lengths of 320 cm or more and internode lengths of 8 or more cm.

[0010] US 2008/0005814 and US 2008163388 describe the development of a tetraploid watermelon plant, which is suitable as a female parent in triploid hybrid production having small, seedless fruit. The tetraploid plant has a normal vegetative growth habit. When pollinated with a diploid pollenizer, small fruit (1.5 to 2.5 kg) are produced.
US2008/0244764 describes a tetraploid watermelon line of normal growth type developed from the diploid Calsweet.

[0011] US 2006/0168701 and US 2003/0172414 describe diploid pollenizers ("Super Pollenizers") useful for pollinating triploid plants, thereby initiating fruit set of triploid, seedless fruit. The pollenizer has small leaves 5 to 12 times less than the surface area of a typical diploid pollenizer such as Sangria) and can be grown in close proximity of the normal type triploid hybrid. The pollenizer is heavily branched (lacy vined or open vines) and reduces the space, nutrients and light needed, leaving more space, nutrients and light for the triploid hybrid plants. According to the patent application 25% to 33% more seedless watermelons are produced per acre using this pollenizer.

[0012] US 6,355,865 B1 describes a pollenizer plant having at least two of the features selected from (a) distinguished fruit phenotype, (b) high number of male flowers, (c) continued flowering, (d) early flowering and/or (e) modified plant morphology an growth habit, having more slender vines. As the diploid pollenizer is more slender and produces more flowers it may be planted in a 1:3 to 1:5 ratio (pollenizer : triploid hybrid), rather than the usual 1:2 ratio.

[0013] Besides the *hmbn* (mutlibranching) mutation described above, also four other genes have been described which lead to dwarf / compact plant habit in diploid watermelons when the mutant allele is present in homozygous form. These are named *dw-1, dw-1^s* (allelic to *dw-1*), *dw-2* and *dw-3* (Guner and Wehner 2004, Hort Science 39(6): 1175-1182). Some of these mutants have been used to develop dwarf or short-vined diploid pollenizers, such as Bush Jubilee.

[0014] However, it has so far not been possible to produce triploid *bush* hybrid plants, which are capable of producing seedless fruits of high quality.

[0015] It is an object of the invention to provide triploid hybrids which have a *bush* growth habit and produce seedless fruit of high quality. Also provided are methods for producing such triploid hybrid plants and/or triploid fruits.

[0016] *Bush* triploid plants take less space in the field and can be grown in closer proximity to each other and/or to the pollenizers compared to normal type triploids, such as Boston F1 or Fashion F1. At least 1.5 times, 1.7 times, 2 times, 2.5 times or even 3 times as many *bush* triploid plants can be grown per hectare compared to *non-bush* (normal growth habit) watermelon triploid hybrids, such Boston F1 or Fashion F1. As the *bush* triploid plants have a reduced plant diameter but without affecting leaf size or fruit size, higher triploid fruit yields per hectare can be achieved. Using the triploid *bush* hybrids according to the invention at least about 1.25 times, preferably at least about 1.5 times as many fruits per hectare are produced compared to normal type triploid hybrids.

[0017] In one embodiment also a method is provided for cultivating *bush* triploid watermelon plants in commercial, seedless fruit production.

[0018] Also seeds from which triploid hybrid *bush* plants can be grown are encompassed herein, as are plant parts, *in vitro* propagations, cell or tissue cultures, harvested fruits, etc.

[0019] In another embodiment tetraploid *bush* plants and seeds from which such tetraploid *bush* plants can be grown are provided herein, as well as plant parts (cells, pollen, anthers, ovules, flowers, etc.) and *in vitro* propagations of such plants.

GENERAL DEFINITION

[0020] The verb "to comprise" and its conjugations is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. In addition, reference to an element by the indefinite article "a" or "an" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements. The indefinite article "a" or "an" thus usually means "at least one", e.g. "a plant" refers also to several cells plants, etc. Similarly, "a fruit" or "a plant" also refers to a plurality of fruits and plants.

[0021] As used herein, the term "plant" includes the whole plant or any parts or derivatives thereof, preferably having the same genetic makeup as the plant from which it is obtained, such as plant organs (e.g. harvested or non-harvested fruits, leaves, flowers, anthers, etc.), plant cells, plant protoplasts, plant cell tissue cultures from which whole plants can be regenerated, plant calli, plant cell clumps, plant transplants, seedlings, plant cells that are intact in plants, plant clones or micropropagations, or parts of plants, such as plant cuttings, embryos, pollen, anthers, ovules, fruits (e.g. harvested tissues or organs), flowers, leaves, seeds, clonally propagated plants, roots, stems, root tips, grafts (scions and/or root stocks) and the like. Also any developmental stage is included, such as seedlings, cuttings prior or after rooting, etc.

[0022] As used herein, the term "variety" or "cultivar" means a plant grouping within a single botanical taxon of the lowest known rank, which can be defined by the expression of the characteristics resulting from a given genotype or combination of genotypes.

[0023] The term "allele(s)" means any of one or more alternative forms of a gene at a particular locus, all of which alleles relate to one trait or characteristic at a specific locus. In a diploid cell of an organism, alleles of a given gene are located at a specific location, or locus (loci plural) on a chromosome. One allele is present on each chromosome of the pair of homologous chromosomes. A diploid plant species may comprise a large number of different alleles at a particular locus. These may be identical alleles of the gene (homozygous) or two different alleles (heterozygous).

[0024] The term "locus" (loci plural) means a specific place or places or a site on a chromosome where for example a gene or genetic marker is found.

[0025] "Diploid plant" refers to a plant, vegetative plant part(s), or seed from which a diploid plant can be grown, having two sets of chromosome, designated herein as 2n.

[0026] "Triploid plant" refers to a plant, vegetative plant part(s), or seed from which a triploid plant can be grown, having three sets of chromosomes, designated herein as 3n.

[0027] "Tetraploid plant" refers to a plant, vegetative plant part(s), or seed from which a tetraploid plant can be grown, having four sets of chromosomes, designated herein as 4n.

[0028] "Pollenizer plant" or "pollenizer" refers to the (inbred or hybrid) diploid plant, or parts thereof (e.g. its pollen or scion), suitable as pollenizer for inducing fruit set on triploid plants. A pollenizer plant is, thus, able to lead to good fruit set (and good triploid fruit yield) of triploid plants, by producing an appropriate amount of pollen at the appropriate day-time and for an appropriate period of time.

[0029] "Male parent" refers to the pollenizer plant used as male parent for inducing fruit set and seed production on a tetraploid female parent, resulting in F1 hybrid triploid seeds. Both the male parent and the female parent are inbred so that each parent is nearly homozygous and stable. "Female parent" or "tetraploid parent" refers to the plant which is pollinated with pollen of the male parent, leading to the production of fruits containing triploid seeds. The female parent is inbred so that it is nearly homozygous and stable.

[0030] "Hybrid triploid plant" or "F1 triploid" is a triploid plant grown from hybrid, triploid seed obtained from cross fertilizing a male diploid parent with a female tetraploid parent.

[0031] "Seedless fruit" are triploid fruit which contain no mature seeds. The fruit may contain one or more small, edible, white ovules.

[0032] "Interplanting" refers to the combination of two or more types of seeds and/or transplants sown or transplanted on the same field, especially the sowing and/or transplanting of pollenizers in the same field as triploid hybrid plants (for seedless fruit production on the triploid plants and diploid fruit production on the pollenizer plants). For example, the pollenizer may either be planted in separate rows or interplanted with the triploid plants in the same row (e.g. in hills within each row). Pollenizers may also be planted in between rows of triploids. Also seeds of pollenizers and triploid hybrids may be mixed prior to seeding, resulting in random seeding. The transplants of the triploid hybrid plants and/or pollenizer plants may also comprise a rootstock of a different plant. Suitable rootstocks are known in the art. Watermelon plants with a different rootstock are referred to as "grafted".

[0033] "Planting" or "planted" refers to seeding (direct sowing) or transplanting seedlings (plantlets) into a field by machine or hand.

[0034] "Vegetative propagation" refers to propagation of plants from vegetative tissue, e.g. by *in vitro* propagation or grafting methods (using scions). *In vitro* propagation involves *in vitro* cell or tissue culture and regeneration of a whole plant from the *in vitro* culture. Grafting involves propagation an original plant by grafting onto rootstock. Clones (i.e. genetically identical vegetative propagations) of the original plant can thus generated by either *in vitro* culture or grafting.

[0035] "Recessive" refers to an allele which expresses its phenotype when no functional dominant allele is present in the genome. The recessive *bush* allele (*b*) according to the invention, as found in (and obtainable from) NCIMB accession numbers provided herein, results in a *bush* growth habit when present in two copies in a diploid plant (*bb*), in four copies in a tetraploid plant *(bbbb)* or in three copies in a triploid plant (*bbb*), whereby a functional dominant Bush allele (*B*) is absent in these plants. The *B* allele is thus essentially the wild type, non-mutated allele, found in plants lacking the mutant *b* allele.

[0036] "*Bush* type" or *"bush* growth type" or *"bush* growth habit" or *"bush* habit" refers to the heritable (genetically determined by the *bush* allele) vegetative growth habit of a plant line or variety at maturity having an average internode

length of about 7 cm or less (but at least about 4.7 cm, preferably at least about 5.0 cm) and an average longest vine length of about 150 cm or less, about 140 cm or less, about 130 cm or less, preferably about 100 cm or less (but at least about 70 cm). Also the average leaf size is not reduced by the *bush* allele and is at least about 11 cm length and/or 15 cm width or larger. A "*non-bush*" growth type is any other type (having a *B* allele), such as normal triploid growth types (e.g. Fashion F1 or Boston F1) producing an average longest vines of significantly more than 100 cm, for example generally more than 200 cm or more than 300 cm (see also the Examples).

[0037] "Longest vine length" or "average longest vine length" refers to the average length of the longest vine of a plurality of plants of a watermelon line or variety, when these are fully grown (at maturity). The longest vine may herein also be referred to as the stem (thus, "stem" and "longest vine" are used interchangeably herein).

[0038] "Plant diameter" refers to the average diameter of a plurality of plants of a watermelon line or variety when fully grown, i.e. the diameter from the tip of the longest vine on one side of the plant to the tip of the longest vine on the other side of the plant.

[0039] "Internode length" refers to the average length of the internodes on a vine of a plurality of plants of a specific line or variety.

[0040] "Internode number" refers to the average number of internodes on a vine, e.g. on the longest vine.

[0041] "Backcrossing" is a process whereby hybrid progeny, for example an F1 hybrid, is repeatedly crossed back to one of the parents of the hybrid. Backcrossing can be used to introduce one or several single locus conversions from one background to another.

[0042] Throughout this document "average" and "mean" are used interchangeably and refer to the arithmetic mean.

[0043] "Single gene conversion" or "single gene converted" refers to plants developed by backcrossing, wherein essentially all the desired morphological and physiological characteristics of a plant (e.g. an inbred) are retained in addition to a single gene transferred into the plant via backcrossing or genetic engineering.

[0044] "Yield" means the total weight of all watermelon fruits harvested per hectare of a particular line or variety.

[0045] "Marketable yield" means the total weight of all marketable watermelon fruits, especially seedless triploid fruit of at least 2.5 kg, harvested per hectare of a particular line or variety, i.e. fruits suitable for being sold for fresh consumption, having good flavour (no off-flavours), at least 10% brix and flesh color properties and no deficiencies such as hollow heart.

[0046] "Allelism test" refers to a genetic test whereby it can be tested whether two phenotypes seen in two plants are determined by the same gene or by different genes. For example, if a homozygous diploid *bush* plant *(bb)* is crossed with another watermelon plant that is homozygous for a different recessive gene, at a different locus (e.g. the *hmbn* allele determining multibranching), the F1 plant will not have the *bush* growth type and not the multibranching phenotype and the F2 generation will segregate for the two phenotypes (*bush* and multibranching) independently, in a ratio of 9:3:3:1, i.e. 9 (*non-bush*/ non-multibranching) : 3 (*bush* / non-multibranching) : 3 (*non-bush* / multibranching) : 1 (*bush* / multibranching).

DETAILED DESCRIPTION

[0047] In one aspect of the invention (seed of) a plant of the species *Citrullus lanatus* is provided, wherein said plant is triploid and has a *bush* growth habit (as defined herein). The plant comprising three copies of a recessive allele designated *bush,* wherein a representative sample of seed containing said allele has been deposited under accession numbers NCIMB 41907 (and/or NCIMB 41905 and NCIMB 41906). Ploidy can be easily determined by chromosome counting or flow cytometry or other known methods (Sari et al. 1999, Scientia Horticulturae 82: 265 - 277).

[0048] The triploid *bush* hybrid has, due to the presence of the recessive *bush* allele "*b*" (and the absence of the dominant *B* allele), a longest vine length of not longer than about 150 cm, preferably not longer than about 140 cm, more preferably not longer than about 100 cm, whereby the average plant diameter is about 300 cm or less, 280 cm or less, or 200 cm or less, and an average internode length on the longest vine of about 7 cm or less, but at least about 4.7 cm, preferably at least about 5.0, 5.5, 6.0, 6.5 or 7.0 cm. Especially plants having an average internode length of 6.0 cm or 7.0 cm, or of 6.0 to 7.0 cm, are encompassed. The recessive *bush* allele does not affect leaf size, so that the plant according to the invention comprises leaves of similar (average) size as found in normal growth type triploid hybrids (such as Boston F1), i.e. of at least about 11, 12, 13, 14 or 15 cm long and/or at least about 15 cm wide, encompassing average leaf lengths of at least about 11, 12, 13, 14, 15, 16 or 17 cm and/or average leaf widths of at least about 15, 16, 17, 18 or 19 cm. In one embodiment the product of average leaf length multiplied by average leaf width is preferably at least about 140 or 150, such as at least about 160, 170, 180, 190 or 200, or even at least about 225, 250, 300 or more.

[0049] In one embodiment the ratio of the (average) longest vine length to the (average) number of internodes on the longest vine is 7 or less. In another aspect the triploid *bush* hybrid has not more than (on average) 15 internodes on the longest vine. Especially, the number of internodes on the longest vine is about 50% of the number found in Boston F1 or Fashion F1.

[0050] Also the (average) stem diameter, measured in the middle of the longest vine, is bigger than in normal triploid hybrids such as Boston F1, e.g. the average stem diameter is at least about 8 mm, preferably at least about 9 mm and

may even be at least about 10 mm, 11 mm or 12 mm. The average stem diameter of a triploid *bush* hybrid according to the invention is thus preferably at least 1.2 times, 1.3 times, 1.4 times 1.5 times or 1.6 times the average stem diameter of a *non-bush* (normal growth type) triploid hybrid, comprising the *B* allele.

[0051] The recessive *bush* allele can be transferred into any other watermelon plant, by e.g. making crosses with plants grown from the deposited seeds, or by regenerating plants from tissue or cell cultures of the plants for which seeds have been deposited and making crosses with such regenerated plants, or by identifying diploid watermelon plants comprising the *bush* allele (e.g. plants which may not show the *bush*-growth type because they also contain the *B* allele). The other watermelon plants into which the *b* allele can be transferred are thus, for example, plants which lack the recessive *b* allele. Thus, to transfer the *bush* allele, a watermelon plant comprising the *bush* allele is crossed with another watermelon plant e.g. lacking the *b* allele and the F1 is selfed to produce an F2 or further generation. The F2 or further generation progeny which contain the *bush* allele in homozygous form in diploids (or in three or four copies in triploids or tetraploids) will show the *bush* growth habit and can thus easily be identified.

[0052] In order to test whether another watermelon plant has a *bush* allele or not, an allelism test can be done.

[0053] To determine and/or select plant lines having the *bush* growth characteristics as described above (for example when transferring the *bush* allele into other watermelon plants lacking the recessive *bush* allele), it is understood that several plants of a line are grown in one or more locations under the same environmental conditions, including appropriate control varieties or lines, and measurements are done on a plurality of plants of a line (at least 3, preferably at least 5 or 10 or more plants) in order to be able to calculate a mean value.

[0054] Fruit characteristics are not influenced by the presence of three copies of the *bush* allele (absence of the *B* allele), so that triploid hybrids with any size of fruit, any fruit shape, color and fruit rind pattern can be produced by crossing the *bush* allele into genetic backgrounds which have different fruit characteristics. The *bush* allele can, for example, be backcrossed into different genetic backgrounds by using seed deposited herein as a source of the *bush* allele, as described elsewhere herein. Alternatively, genes determining different fruit characteristics can be backcrossed into plants comprising the *bush* growth type. Thus, average fruit weight of a triploid hybrid comprising the *bush* growth type may be at least about 5, 6, 7, 8, 9, 10, 11, 12, 13 or 14 kg. In another embodiment average fruit weight of a triploid hybrid comprising the *bush* growth type may be less than 5 kg, e.g. 4, 3, 2, 1.5 or 1 kg. For producing hybrid triploids with such small fruits one can for example introduce the *bush* allele into varieties such as Liliput, Extazy or Fantazy (Hazera) or Valdoria F1,Vanessa F1, Pixie F1 or Bonny F1 (Nunhems) or, *vice versa*, genes determining small fruit size can be backcrossed into plants deposited herein, having a *bush* growth type.

[0055] Likewise, any other fruit characteristics may be combined with the *bush* growth type by breeding. As mentioned, for example fruit shape (e.g. elongate, oval, blocky, spherical or round), fruit surface (furrow, smooth), flesh color (scarlet red, coral red, orange, salmon, yellow, canary yellow or white), rind color (e.g. light green; dark green; green-striped with narrow, medium or wide stripes; grey types; with or without spotting; Golden yellow), rind thickness, rind toughness, rind pattern (e.g. striped, non-striped, netted), brix (total soluble solids), flesh structure / flesh firmness, higher lycopene and/or vitamin content, different sugar : acid ratios, very good fruit flavour, etc. may be modified by breeding. See Guner and Wehner 2004, Hort Science 39(6): 1175-1182, in particular pages 1180-1181 describing genes for fruit characteristics. Generally important breeding objectives are early maturity, high fruit yield, high internal fruit quality (good uniform color, high sugar, proper sugar : acid ratio, good flavor, high vitamin and lycopene content, firm flesh texture, non-fibrous flesh texture, freedom from defects such as hollow heart, rind necrosis, blossom-end rot or cross stitch and good rind characteristics and cracking-resistance).

[0056] In one embodiment of the invention, the fruits preferably also do not have a "brittle rind" and/or an "explosive rind" as described in WO03/075641 on page 13 and 14, i.e. the fruits do not break under pressure in the range of 90 to 140 g/mm^2.

[0057] The *bush* allele can be introduced into other watermelon plants lacking the *bush* allele using known breeding methods. Known breeding methods can be used alone or in combination, such as (but not limited to) recurrent selection, pedigree breeding, backcross breeding, inbred development, hybrid testing, marker assisted breeding, etc. Progeny are then selected which retain the *bush* growth habit, which can be easily identified phenotypically. Thus, selection of progeny plants having the *bush* growth habit can be done by phenotypic selection of the *bush* growth habit characteristics and by discarding plants which do not have the *bush* growth habit characteristics, e.g. which have longer main vines, longer internodes and smaller leaves compared to a *bush* plant according to the invention.

[0058] Thus, in one aspect a plant of the species *Citrullus lanatus* is provided, wherein said plant is triploid and has a *bush* growth habit, and comprises three copies of a recessive allele designated *bush,* wherein the *bush* allele is obtainable by (can be obtained by) crossing a watermelon plant of which seeds were deposited under Accession number NCIMB41906 or NCIMB41905, or progeny of any of these plants (e.g. obtained by selfing and/or crossing and which progeny retain the *bush* allele and/or the *bush* growth habit), with another watermelon plant.

[0059] In one aspect, the triploid plant having a *bush* growth habit is obtainable by crossing a diploid *bush* watermelon plant with a tetraploid *bush* watermelon plant, wherein the *bush* allele is obtainable by (can be obtained by) crossing a watermelon plant of which seeds were deposited under Accession number NCIMB41906 or NCIMB41905, or progeny

of any of these plants (e.g. obtained by selfing and/or crossing and which progeny retain the *bush* allele and/or the *bush* growth habit), with another watermelon plant.

[0060] In one aspect a plant of the species *Citrullus lanatus* is provided, wherein said plant is triploid and has a *bush* growth habit, and comprises three copies of a recessive allele designated *bush,* wherein the plant is obtainable by (can be obtained by) vegetative propagation of plant cells or plant tissue of a watermelon plant of which seeds were deposited under Accession number NCIMB 41907.

[0061] As the *b* allele is recessive, the *bush* growth habit is only seen if no dominant *B* allele is present. When transferring the *b* allele from a diploid seed deposit made herein (e.g. NCIMB 41906 or progeny thereof) to another watermelon plant which does not contain the recessive *b* allele, the F1 will be heterozygous and will not display the *bush* growth habit and the breeder first needs to self the F1 to identify plants comprising the *bush* growth habit. Likewise, when transferring the *b* allele from a tetraploid watermelon plant *(bbbb),* such as grown from seeds of NCIMB41905 or progeny thereof, to another tetraploid watermelon plant not comprising the recessive *b* allele, the F1 will be heterozygous and not display the *bush* growth habit and again the *bush* phenotype will only be seen in the F2 generation. A diploid *bush* plant can also be regenerated from the haploid cells of a tetraploid *bush* plant (e.g. pollen or anther culture and regeneration of a plant) and the derived diploid *bush* plant may then be used in further breeding and in generating watermelon plants having a *bush* growth habit. This may be referred to as a haploid tetraploid plant having a *bush* growth habit. Such plants are encompassed herein.

[0062] Alternatively, molecular markers may be developed which are linked to the *b* allele and then selection of the *bush* growth habit may be done by selecting for plants having the linked molecular markers. Linked markers can be developed using a range of techniques, such as Bulk Segregant Analysis, and a range of markers, such as AFLP markers, RFLP markers, SNP markers, mini-or micro- satellite markers, etc. For marker development a segregating population should be generated by e.g. crossing a plant having a *bush* growth type (e.g. a diploid *bb*) with a plant having a normal growth type (e.g. a diploid *BB*) and developing segregating population therefrom (e.g. an F2 or F3 population or backcross population). Markers can then be identified which are closely associated (linked) with the *bush* growth habit and the *bush* allele, i.e. co-segregates with the *b* allele. See for example Wolukau et al. (HortScience February 2009 vol. 44 no. 1 32-34) the use of Bulk Segregant Analysis in melon to identify markers linked to a resistance gene. A molecular marker is a DNA sequence or single nucleotide polymorphism (SNP) which is found on the chromosome close to the *b* allele (e.g. within a genetic distance of 5 cM or less) and which is different from the DNA sequence or SNP found close to the *B* allele. Thus, in one embodiment the *b* allele can be introduced into other watermelon plants lacking the *b* allele by marker assisted breeding methods, using a molecular marker closely linked to the *b* allele.

[0063] For seedless fruit production, the triploid *bush* hybrid according to the invention may be interplanted with a suitable diploid pollenizer, such as for example Jenny F1 (Nunhems) or Polimax F1 (Nunhems) or other pollenizers, such as SP-1, SP-2, SP-3, SP-4 or SP-5 (Syngenta) or Sidekick. Fruit are then harvested from the triploid plants of the invention. As the triploid plants have a smaller plant diameter, a higher seeding or planting density is possible compared to normal growth type triploids (such as plants having a main vine length of above 200, 250, or 300 cm). Thereby also a higher triploid fruit yield per hectare is achieved.

[0064] In one embodiment a method for producing seedless triploid fruits is provided, comprising:

a) interplanting triploid hybrid *bush* plants and diploid pollenizer plants, wherein the triploid plants are at a density which is at least 1.5 times the planting density of a normal growth type triploid hybrid plants,
b) allowing pollination of the female flowers on the triploid *bush* plants to occur, and
c) harvesting the fruits from the triploid hybrid *bush* plants.

[0065] The density of the triploid bush plants in step a) depends on whether or not the plants are grown in the greenhouse or in the open field and whether or not the triploids are grafted onto rootstocks or not. Thus, the density of triploid *bush* plants in the greenhouse is preferably at least about 7500 plants per hectare (grafted triploids) or 15000 plants per hectare (non-grafted triploids). The density of triploid *bush* plants in the open field is preferably at least about 6000, 7000 or 8000 plants per hectare (grafted triploids) or at least about 12000, 13000, 14000 or 15000 plants per hectare (non-grafted triploids).

[0066] The triploid fruit yield in step c) is at least 1.25 times the triploid fruit yield of normal growth type triploids, such as Boston F1 or Fashion F1. Thus in the open field (non-grafted) at least about 75 tonnes triploid seedless fruits (comprising three copies of the *b* allele) per hectare is harvested in step c), preferably even at least about 80, 85 or 90 tonnes per hectare. Thus in one embodiment the method comprises step d) harvesting at least 75 tonnes per hectare triploid fruits. These can then be sorted, packaged in containers etc. Containers comprising or consisting of triploid fruits, preferably marketable fruits, comprising the *b* allele are also an embodiment of the invention.

[0067] Also seeds from which triploid hybrid plants having a *bush* growth type can be grown are provided herein. Thus, in one embodiment a watermelon seed is provided from which a triploid *bush* plant as described above can be grown. The seed contains three copies of the *b* allele. In one embodiment a representative sample of seeds has been deposited

under Accession number NCIMB 41907. In one embodiment the mature seeds are small, comprising an average seed size of equal to or less than 5 mm length. Packages (bags, containers, etc.) comprising a plurality of such seeds are encompassed herein.

[0068] Also seedlings, scions and rootstocks, as well as cells and tissues, and cell cultures and tissue cultures, and vegetative propagations of the triploid hybrid plants having a *bush* growth type are encompassed herein. Thus whole plants obtained from seedlings, scions and rootstocks, as well as cells and tissues, cell cultures and tissue cultures and vegetative propagations of the triploid hybrid plants retaining the *bush* growth type according to the invention when regenerated into a plant and grown under the same environmental conditions are provided herein.

[0069] Likewise seedless triploid fruit (*bbb*) harvested from a triploid *bush* plant according to the invention are encompassed herein. The fruits may be harvested for fresh consumption or for processing. Containers comprising or consisting of a plurality of such fruits are a further embodiment of the invention. Preferably the containers comprise marketable fruits.

[0070] The triploid hybrid plant having a *bush* growth type (*bbb*) is an F1 - hybrid produced from a cross between a diploid inbred male parent line, which has a *bush* growth habit, and a tetraploid inbred parent line, which has a *bush* growth habit (see Figure 1). Thus, to produce seeds of triploid hybrid plants having a *bush* growth type (*bbb*) one can either vegetatively propagate the triploid hybrid plant or, alternatively, one can produce inbred *bush* diploid (*bb*) and inbred tetraploid *bush (bbbb)* parent lines. The skilled person can, thus, introduce different characteristics (such as various fruit sizes etc.) into a triploid *bush* hybrid by first generating male and female parents having different characteristics, but retaining the *bush* growth type as described herein.

[0071] A vegetatively propagated triploid hybrid having a *bush* growth habit is also an embodiment of the invention. In one aspect, the watermelon plant has the *bush* allele as found in seeds deposited under NCIMB41907, NCIMB41906 or NCIMB41905. In one aspect the vegetatively propagated hybrid is obtained from (obtainable from) plant tissue ofNCIMB 41907.

[0072] As mentioned above, the *b* allele can be transferred from seed deposits provided herein into other watermelon plants and thereby other inbred *bush* diploids and/or other inbred *bush* tetraploids can be made. In one embodiment an inbred diploid *bush* plant and/or an inbred tetraploid *bush* plant comprising the *b* allele as found in seeds deposited under Accession numbers NCIMB 41905, NCIMB 41906 and/or NCIMB 41907 is provided.

[0073] When referring to a diploid or tetraploid watermelon plant having a *bush* growth habit, it is understood that the same *bush* growth habit characteristics as described above for the triploid *bush* hybrid are referred to, i.e. the diploid or tetraploid *bush* plant has, due to the presence of the recessive *bush* allele "*b*" in two or four copies (and the absence of the dominant *B* allele), a longest vine length of no longer than about 150 cm, 140 cm, or 100 cm, whereby the average plant diameter is about 300 cm, 280 cm or 200 cm or less and an average internode length on the longest vine of about 7 cm or less, but at least about 4.7 cm, preferably at least about 5.0, 5.5, 6.0 or 6.5 cm. The recessive *bush* allele does not affect leaf size, so that the plant according to the invention comprises leaves of similar size as found in normal growth type diploids (such as variety Milady) or normal growth type tetraploids, i.e. of at least about 11 cm long and/or at least about 15 cm wide, encompassing leaf lengths of at least about 11, 12, 13, 14, 15, 16 or 17 cm and/or leaf widths of at least about 15, 16, 17, 18 or 19 cm. Similarly, the ratio of the (average) longest vine length to the (average) number of internodes on the longest vine is 7 or less. In another aspect the diploid *bush* or tetraploid *bush* has not more than (on average) 25, 21, or 15 internodes on the longest vine. Also the (average) stem diameter, measured in the middle of the longest vine, is in one aspect bigger than in normal growth type diploids or tetraploids, e.g. the stem diameter is at least about 8 mm, preferably at least about 9 mm and may even be at least about 10 mm, 11 mm or 12 mm. The average stem diameter of a diploid or tetraploid *bush* plant according to the invention is, thus, preferably at least 1.2 times, 1.3 times, 1.4 times 1.5 times or 1.6 times the average stem diameter of a *non-bush* diploid or tetraploid, comprising the *B* allele. Fruit characteristics (e.g. average fruit size, weight, etc.) are in one embodiment no different than in normal growth type diploids or tetraploids.

[0074] A diploid *bush* inbred line can be made wherein the *bush* allele (*b*) is derivable e.g. from the seed deposit made under Accession number NCIMB 41906 or from progeny thereof, e.g. progeny obtained by selfing and/or crossing NCIMB41906 with another watermelon plant. This may for example be done by breeding with NCIMB 41906, or progeny thereof, and selecting in the progeny generations for the *bush* growth type, while discarding plants which do not have the *bush* growth type. The *bush* allele may also be derived from other plants or plant parts comprising the *bush* allele, e.g. pollen or ovaries of a tetraploid *bush* plant, such as seeds deposited under NCIMB 41905.

[0075] Alternatively, new diploid *bush* inbred lines can be made by identifying diploid varieties or lines which may comprise a *bush* allele even though they may not have a *bush* growth type (due to the dominant *B* allele being present). For example diploids which are suspected to maybe contain a *b* allele may be used. An allelism test can be done to determine whether a recessive *bush* allele is present. Preferably the diploid is self-pollinated for one or more generations and a diploid which is homozygous for the *bush* allele is identified by selecting progeny plants having the *bush* growth type as determined by the *bush* allele in homozygous form. Varieties which might be suitable are Garden Baby, Bush Charleston Gray and Bush Sugar Baby or Sugar Bush.

[0076] A tetraploid *bush* inbred line can be made wherein the *bush* allele is derivable e.g. from the seed deposit made

under Accession number NCIMB 41905 or NCIMB 41906, or from progeny of any of these. This may, for example, be done by breeding with NCIMB 41905 and/or NCIMB 41906, or progeny of these, and selecting in the progeny generations for the *bush* growth type, while discarding plants which do not have the *bush* growth type. When NCIMB 41906, or progeny thereof, is/are used, chromosome doubling techniques may be used to generate tetraploids, followed by selection of the *bush* growth habit in the tetraploids and in progeny of the tetraploids obtained by selfing selected tetraploids and stabilization of the *bush* growth habit in further generations.

[0077] Alternatively, new tetraploid *bush* inbred lines can be made starting from new diploid *bush* plants as described above and inbreeding said plants for several generations, while selecting for the *bush* growth type as defined herein, and doubling the chromosome of a select inbred *bush* diploid line to generate a tetraploid *bush* line. The tetraploid line is then inbred further for several generations, selecting for the *bush* growth type as described herein.

[0078] In one aspect, the invention also provides a plant (or seed) of the species *Citrullus lanatus* wherein said plant is tetraploid and has a *bush* growth habit. The *bush* growth habit is due to the presence of the *b* allele, thus a tetraploid plant having a *bush* growth habit and comprising four copies of a recessive allele designated *bush* is provided, wherein a representative sample of seed containing said *b* allele has been deposited under accession number NCIMB 41905. Also any plant parts and progeny of a tetraploid *bush* plant, such as vegetative propagations, seed propagations (e.g. selfings) and also *in vitro* cell- or tissue cultures, as well as pollen, ovaries, etc. are encompassed herein. Thus, in one embodiment the tetraploid *bush* plant, or seeds from which the plant can be grown, or tissue or parts of the plant (pollen, anthers, ovules) comprises the *b* allele as found in NCIMB 41905.

[0079] Thus, in one aspect a plant of the species *Citrullus lanatus* is provided, wherein said plant is tetraploid and has a *bush* growth habit, and comprises four copies of a recessive allele designated *bush,* wherein the *bush* allele is obtainable by (can be obtained by) crossing a watermelon plant of which seeds were deposited under Accession number NCIMB41906 or NCIMB41905, or progeny of any of these plants (e.g. obtained by selfing and/or crossing), with another watermelon plant.

[0080] In another aspect a plant of the species *Citrullus lanatus* is provided, wherein said plant is tetraploid and has a *bush* growth habit, and comprises four copies of a recessive allele designated *bush,* wherein the plant is obtained by selfing a tetraploid plant of which a representative sample of seeds was deposited under Accession number NCIMB 41905.

[0081] A vegetatively propagated tetraploid watermelon plant having a *bush* growth habit is also an embodiment of the invention. In one aspect, the watermelon plant has the *bush* allele as found in seeds deposited under NCIMB41907, NCIMB41906 or NCIMB41905. In one aspect the vegetatively propagated watermelon plant is obtained from (obtainable from) plant cells or plant tissue of NCIMB 41905.

[0082] In one aspect a plant of the species *Citrullus lanatus* is provided, wherein said plant is tetraploid and has a *bush* growth habit, and comprises four copies of a recessive allele designated *bush,* wherein the plant is obtainable by (can be obtained by) vegetative propagation of plant cells or tissue of a watermelon plant of which seeds were deposited under Accession number NCIMB41905.

[0083] In another embodiment the tetraploid *bush* plant comprises a *b* allele identified from other diploid sources as described above or as found in seeds deposited under accession number NCIMB 41906.

[0084] A method for generating a tetraploid inbred plant having a *bush* growth type is provided, comprising the steps of:

a) providing a diploid plant comprising the *b* allele,
b) selfing said diploid plant for several generations to generate an inbred line having a *bush* growth type,
c) doubling the chromosomes of said inbred line to generate a tetraploid line,
d) selfing the tetraploid line for several generations.

[0085] Thus, in step a) the diploid plant may be a plant derived from seed deposited under NCIMB 41906 or progeny thereof, or may be a diploid plant into which the *b* allele from seed deposit NCIMB 41906 has been transferred by crossing and selection of the *bush* growth type. The diploid may also be new diploid plant in which the *b* allele has been identified e.g. by using an allelism test and/or by identifying a diploid which may comprise the *b* allele, selfing said plant for one or more generations and selecting a progeny plant phenotypically having the *bush* growth type. Alternatively the diploid may be a haploid plant generated from seed deposited under NCIMB 41905.

[0086] Also the use of the tetraploid *bush* plant according to the invention as male or female parent is provided, whereby the tetraploid *bush* plant is crossed with another watermelon plant or is allowed to self-fertilize to produce progeny. In one embodiment the tetraploid *bush* plant comprises a *bush* growth type, due to the presence of four copies of the *b* allele, wherein the *bush* plant (and/or the *b* allele) is obtainable from seeds deposited under NCIMB 41905, or progeny thereof.

[0087] Further the use of the tetraploid *bush* plant as female parent is provided, especially as a female parent in hybrid triploid watermelon seed production (i.e. F1 seed production). Thus, in one aspect the female flowers of the tetraploid *bush* plant are pollinated (or allowed to be pollinated) with pollen of another watermelon plant. The other watermelon plant may be any watermelon plant, e.g. a diploid or a tetraploid watermelon plant. In a specific embodiment the other

watermelon plant is a diploid plant, preferably a diploid plant comprising a *bush* growth type. The diploid watermelon plant comprising a *bush* growth type may be any diploid *bush* plant as described above, or a plant obtainable from seed deposited under NCIMB 41906, or progeny thereof.

[0088] Also described herein is a method for producing triploid hybrid watermelon seeds, wherein triploid plants grown from such seeds have a *bush* growth habit, said method comprising:

(a) providing a diploid watermelon plant having a *bush* growth habit and a tetraploid plant having a *bush* growth habit,
(b) allowing pollination of pistillate flowers of the tetraploid *bush* plant with pollen of the diploid *bush* plant, and
(c) harvesting seeds produced in the fruits of the tetraploid *bush* plant, and optionally
(d) drying the harvested seeds.

Optionally the dried and harvested F1 seeds are then packaged. They may also be treated prior to packaging. Thus packages or containers comprising or consisting of seeds obtained by the above method are an embodiment herein.

[0089] This method is also illustrated in Figure 1. The tetraploid *bush* plant and the diploid *bush* plant can be provided as described elsewhere herein. They may be interplanted to allow pollination to occur. In step a) seeds or seedlings of both plants are, therefore, planted and grown in proximity of each other. If the diploid *bush* plant and tetraploid *bush* plant do not flower at the same time, the plant which flowers later can be planted or sown earlier, so that flowering is at about the same time. As both the diploid plants and tetraploid plants have a *bush* growth habit, more plants per hectare can be seeded or planted compared to triploid hybrid seed production involving normal growth type tetraploids. Pollination may be by hand or by insects (e.g. bees) in isolation blocks. To ensure pollination of the tetraploid female flowers with pollen from the male diploid, different methods can be used, such as collecting male flowers by hand and hand-pollinating female flowers, followed by covering the pollinated flower. Alternatively, all male (staminate) flowers that develop on the tetraploid plants may be removed to ensure pollination of the pistillate flowers on the tertaploid *bush* plants with diploid pollen of the diploid *bush* plants. When the fruits on the tetraploid plants are mature, they are harvested and the triploid F1 hybrid seeds (resulting from cross-pollination) are collected. These may then be sorted (e.g. by size), dried, optionally treated, and packaged for sale. In one embodiment the tetraploid *bush* female parent (and/or the *b* allele) is obtainable from seeds deposited under NCIMB 41905 or progeny or vegetative propagations thereof. In another embodiment the diploid *bush* male parent (and/or the *b* allele) is obtainable from seeds deposited under NCIMB 41906 or progeny or vegetative propagations thereof.

[0090] Provided are, therefore, also seeds obtained by the above method, i.e. seeds of F1-hybrids which, when grown, produce triploid plants having a *bush* growth habit. Such seeds may be packaged in bags, containers and the like.

[0091] In one embodiment the F1 seeds are seeds of WH3451, a representative sample of seeds have been deposited under accession number NCIMB 41907. In another embodiment the triploid *bush* hybrid (and/or the *b* allele) is obtainable from seeds deposited under NCIMB 41907 or progeny thereof or vegetative propagations thereof.

[0092] The tetraploid *bush* plant used in the above method comprises four copies of the *bush* allele *(bbbb)* in its genome and has the following characteristics: a longest vine length of not more than 150 cm, preferably not more than 140 cm, 135 cm, or not more than 100 cm, an average internode length on the longest vine of 7 cm or less but at least 4.5 cm, and produces leaves of at least 11 cm long and/or at least 15 cm wide.

[0093] Also provided is a method for producing tetraploid *bush* watermelon seed is provided, comprising a) growing a tetraploid *bush* watermelon plant according to the present invention, b) allowing self-pollination of said tetraploid watermelon plant, c) obtaining a fruit from a plant of step b) and d) extracting tetraploid seed from said fruit. Preferably the method further comprises washing and drying said seed. In one embodiment the tetraploid watermelon plant of step a) is a plant comprising a *bush* growth type as described herein. The plant may in one embodiment comprise a *bush* allele obtainable from seed deposited under accession numbers NCIMB 41905, NCIMB 41906 or NCIMB 41907. The plant of step a) may be obtainable from a plant, or from a plant part, grown from deposit number NCIMB 41905.

[0094] As also described further above, it is an embodiment to provide a method for seedless triploid watermelon fruit production, said method comprising:

1. providing a triploid hybrid (F1) watermelon plant comprising a *bush* growth habit,
2. interplanting said triploid hybrid plants with diploid pollenizer plants,
3. harvesting the seedless watermelon fruits produced on the triploid plants of (a).

[0095] The triploid hybrid plant of step 1 is preferably not grafted onto a different rootstock. The method is preferably carried out in the open field.

[0096] The diploid pollenizer in step b) may be any diploid pollenizer, such as a normal growth type (*non-bush*) pollenizer, commercial pollenizers such as Jenny or Polimax may be used, or Super-pollenizers (SP-1, SP-2, SP-3, SP-4, SP-5), Sidekick, Escort-4, Companion or others. Optionally, the pollenizer may be a dual purpose pollenizer as described in WO2012/069539 A1. The diploid pollenizer should produce sufficient pollen at the right time of the day and

for an appropriate period of time to induce fruit set in triploid hybrids. The pollenizer plants may be hybrid diploids (F1 diploids) or open pollinated (OP) pollenizers.

[0097] In this method at least 1.5 times, preferably at least 2 times, 2.5 times or 3 times as many triploid *bush* plants may be grown per hectare than when a triploid hybrid plant comprising a normal (*non-bush*) growth habit, such as Boston F1, is used. At least 15%, preferably at least 20%, 30%, 40% or 50% more marketable triploid fruits are produced per hectare than when a triploid hybrid plant comprising a normal growth habit, such as Boston F1, is used. Total seedless fruit yield harvested from the triploid *bush* hybrid plants is preferably at least about 75 tonnes per hectare (t/ha), preferably at least 80 t/ha, more preferably at least 90 t/ha.

[0098] Interplanting in one field may be either done by seeding or transplants of the pollenizer and triploids. Various interplanting methods can be used, as known in the art and various ratios of pollenizer : triploid hybrid may be used. One row of pollenizer plants may for example be present at at least every 2, at least every 3 or at least every 4 rows of triploids, but other methods of interplanting may also be used.

[0099] Pollination is usually done by bees, and bee hives can be provided to the fields unless sufficient wild bees are naturally present. Pollination can also be performed by manual or mechanical means. Harvest at maturity may be done by hand or mechanized.

[0100] The harvested triploid fruits may be packaged for fresh markets or for processing. Fruits comprising three *b* alleles obtainable by the above method are encompassed herein. These fruits can be distinguished from fruits of normal triploid hybrids in that they have the capability to produce plants having a *bush* growth type according to the invention, i.e. they have the genetic determinants which are responsible for the *bush* growth type (the *b* allele). If molecular markers linked to the *b* allele are developed as described above, marker analysis can easily distinguish such fruits. Alternatively, cells or tissues from such fruits (or from other parts of the plant from which they are harvested) can be vegetatively cultured and regenerated into whole plants, which regenerated plants have the *bush* growth habit. Thus, in one embodiment, harvested triploid fruits *(bbb)* are provided, such as packaged whole fruits or fruit parts and/or processed fruits or fruit parts.

[0101] In another aspect of the invention a cell culture or a tissue culture of regenerable cells of a plant having a *bush* growth habit or comprising a *bush* allele, all as described above, is provided. A cell culture or a tissue culture comprises cells or protoplasts or plant tissue from a plant part of a plant comprising a *bush*-allele (such as a *bush* tetraploid, *bush* diploid or *bush* triploid plant, all as described herein) selected from the group consisting of: embryos, meristems, cotyledons, pollen, leaves, anthers, roots, root tips, pistils, flowers, seed, stalk. The plant part may be selected from a scion, fruit, pollen, ovule, stem, cotyledon, leaf, cell embryos, meristems, anthers, roots, root tips, pistils, flowers, seed. Also provided is a watermelon plant regenerated from such a cell culture or tissue culture, wherein the regenerated plant (or progeny thereof, e.g. obtained after selfing) comprises a *bush* growth habit. Therefore, in one aspect vegetatively propagated watermelon plants obtained from plant tissue of seeds or plants grown from seeds deposited under NCIMB 41907, NCIMB 41906 or NCIMB 41905 are encompassed herein.

[0102] It is understood that it is also an object of the invention to provide seeds from which the *bush* diploid, triploid or tetraploid plants described herein can be grown. Also seedlings, scions and rootstocks, as well as cells and tissues of the *bush* diploid, triploid or tetraploid plants are encompassed herein. Such plant parts comprise the genetic determinants for producing *bush* plants according to the invention. Thus whole plants obtained from seedlings, scions and rootstocks, as well as from cells and tissues of the *bush* triploid or tetraploid plants, retain all the physiological and morphological characteristics of the *bush* triploid or tetraploid plants according to the invention when grown under the same environmental conditions.

[0103] Also progeny of any of the plants according to the invention are provided herein, such as seeds obtainable by crossing a plant comprising the *bush* allele (and lacking the *B* allele) described herein with another watermelon plant and/or by selfing a plant according to the invention to produce F1 seeds, and further generation progeny (F2, F3, etc.). The presence of the *bush* allele in the progeny can be determined by the *bush* growth type (e.g. in inbred lines) and/or markers analysis.

[0104] In one embodiment a tetraploid watermelon plant (and seeds from which such a plant can be grown) having a *bush* growth habit is provided, wherein a representative sample of seeds containing the genetic elements for said *bush* growth habit (i.e. containing the *b* allele in four copies, and not containing the *B* allele) is provided, wherein a representative sample of seeds has been deposited under accession number NCIMB 41905.

[0105] In one embodiment a triploid watermelon plant (and seeds from which such a plant can be grown) having a *bush* growth habit is provided, wherein a representative sample of seeds containing the genetic elements for said *bush* growth habit (i.e. containing the *b* allele in three copies, and not containing the *B* allele) is provided, wherein a representative sample of seeds has been deposited under accession number NCIMB 41907.

[0106] In one embodiment a diploid watermelon plant (and seeds from which such a plant can be grown) having a *bush* growth habit is provided, wherein a representative sample of seeds containing the genetic elements for said *bush* growth habit (i.e. containing the *b* allele in two copies, and not containing the *B* allele) is provided, wherein a representative sample of seeds has been deposited under accession number NCIMB 41906.

[0107] Watermelon seeds containing the recessive allele designated "*bush*" is provided, wherein a representative sample of seeds containing said "*bush*" allele have been deposited under accession number NCIMB 41905, NCIMB 41906 and NCIMB 41907. In one embodiment the seeds have a pedigree which includes inbred line WHAAOX or inbred line WHAAPD as one of the parental lines. Also provided is a watermelon plant produced by growing said seeds. Also pollen and ovules of the plant produced by growing said seeds is provided.

[0108] Watermelon plants obtained (derived), or obtainable (derivable), from plants according to the invention (e.g. from plants comprising a *bush* growth habit and/or comprising the genetic determinants, the *b* allele, which confers the *bush* growth habit) include plants obtained by breeding methods, such as selfing, crossing, backcrossing, recurrent selection, double haploid production, marker assisted selection, clonal propagations, transformants, etc., whereby the derived plants comprise a *bush* growth habit and/or the genetic determinants (*b* allele) which confers the *bush* growth habit (when the *B* allele is absent) according to the invention.

[0109] In one aspect a watermelon plant is provided, of which a representative number of seeds has been deposited under accession number NCIMB 41905, NCIMB 41906 and NCIMB 41907, or progeny of any such plants, e.g. obtained by crossing and/or selfing. In one aspect a watermelon seed is provided, of which a representative number of seeds has been deposited under accession number NCIMB 41905, NCIMB 41906 and NCIMB 41907.

[0110] Also pollen, an ovule, cells, tissues, vegetative propagations obtained from these plants, or from the progeny thereof, are provided. In one aspect progeny retain the *bush* allele and the *bush* growth habit of the plants of which seeds were deposited under NCIMB 41905, NCIMB 41906 and NCIMB 41907.

[0111] Also fruit of a watermelon plant is provided, wherein the fruit is produced by self pollination of the plant. Also triploid seedless fruit is provided, wherein the fruit is obtained by pollination of a plant grown from a watermelon plant of which a representative number of seeds have been deposited under Accession number NCIMB 41907.

[0112] Also a triploid hybrid seed obtained by crossing a diploid watermelon plant, of which a representative number of seeds have been deposited under Accession number NCIMB 41906, with a tetraploid watermelon plant, of which a representative number of seeds have been deposited under Accession number NCIMB 41905.

[0113] Also a method for producing triploid, seedless watermelon fruit is provided, comprising interplanting seed of a triploid bush watermelon plant, representative seeds of which were deposited under Accession number NCIMB 41907 or another *bush* triploid according to the invention, with a diploid pollenizer plant, allowing pollination of said triploid watermelon plants by pollen of said diploid pollenizer plant to obtain triploid seedless fruits on the triploid plant.

[0114] Also a method of producing a triploid watermelon variety having a *bush* growth type is described herein, said method comprising a) providing a diploid *bush* inbred watermelon line, b) providing a tetraploid *bush* inbred watermelon line, and c) crossing the diploid and tetraploid *bush* lines, and collecting the triploid seeds from said cross. In one aspect, the diploid bush inbred watermelon line is the plant representative seeds of which were deposited under Accession number NCIMB41906, or progeny thereof, or vegetative propagations thereof. In another aspect, the tetraploid *bush* inbred watermelon line is the plant representative seeds of which were deposited under Accession number NCIMB41905, or progeny thereof, or vegetative propagations thereof.

FIGURE LEGENDS

Figure 1

[0115] Schematic diagram of the methods and plants / fruits according to the invention. A *bush* male (*bb*) and *bush* female (*bbbb*) are crossed to produce seeds of triploid *bush* hybrids (*bbb*). These F1 seeds can be interplanted (in-row or between-row) with any diploid pollenizer to produce triploid seedless fruit on the triploid hybrid *bush* plants.

[0116] The following non-limiting Examples describe the production of triploid *bush* hybrids according to the invention. Unless stated otherwise in the Examples, methods for conventional watermelon breeding are used, such as e.g. described in Maynard 2001, Watermelons - Characteristics, Production and Marketing, ASHS Press; Mohr H.C. Watermelon Breeding in Mark J. Bassett (editor) 1986 Breeding Vegetable Crops, AVI Publishing Company.

DEPOSIT INFORMATION

[0117] Applicant has deposited hybrid WH3451 at the December 1st, 2011 under at the NCIMB under Accession number NCIMB 41907. Seeds of WHAAPD and WHAAOX were deposited by Nunhems B.V. on December 1st, 2011 at the NCIMB under Accession numbers NCIMB 41905 and NCIMB 41906, respectively. Access to the deposits will be available during the pendency of this application to persons determined by the Commissioner of Patent and Trademarks to be entitled thereto upon request.

[0118] Subject to 37 C.F.R. § 1.808(b), all restrictions imposed by the depositor on the availability to the public of one or more deposits will be irrevocably removed upon the granting of the patent by affording access to a deposit of at least 2500 seeds with the NCIMB Ltd., Ferguson Building, Craibstone Estate, Bucksburn, Aberdeen AB21 9YA, UK. The

deposit will be maintained for a period of 30 years, or 5 years after the most recent request, or for the enforceable life of the patent whichever is longer, and will be replaced if it ever becomes nonviable during that period. Applicant does not waive any rights granted under this patent on this application or under the Plant Variety Protection Act (7 USC 2321 et seq.).

EXAMPLES

Example 1: Generation of triploid *bush* hybrids (b*bb*)

[0119] It was observed that a home-garden diploid watermelon had an interesting growth type. Starting from this observation a breeding program was developed in order to determine the heritability of this growth type and in order to fix the growth type, as to be able to generate triploid hybrids having this growth type. The growth type was found to be heritable as recessive trait, and was termed "*bush* allele" (*b*). It was found to be responsible for vine length, without however affecting leaf size or fruit size.

[0120] In order to generate a triploid *bush* hybrid, first an inbred diploid *bush* male parent line and an inbred tetraploid *bush* female parent line were generated (see Fig. 1).

[0121] Generation of the inbred *bush* male parent was done by selecting a diploid having the observed growth type, making a number of crosses with said diploid and proprietary lines and inbreeding the derived diploid *bush* line for nine generations to fix the *bush* characteristics in the diploid line.

[0122] Generation of the tetraploid female *bush* inbred line was carried out by selecting a diploid watermelon having the observed growth type, making a number of crosses with said diploid and proprietary lines and generating a diploid *bush* inbred line by selfing a derived line for more than nine generations to get a uniform (inbred) diploid *bush* line. The generated inbred diploid *bush* line was then treated with colchicine for chromosome doubling. After colchicine treatment a tetraploid line was selected and the line was selfed for several generations to fix the *bush* characteristics in the tetraploid line. In each generation of seed increase of the tetraploid line ploidy level was checked using flow cytometry.

[0123] The tetraploid inbred female *bush* (*bbbb*), designated WHAAPD, and diploid inbred male *bush* (*bb*), designated WHAAOX, were cross-pollinated to produce fruits with triploid seeds (*bbb*), designated WH3451. Seeds of the triploid hybrid WH3451 were harvested from the fruits and deposited by Nunhems B.V. on December 1st, 2011 under at the NICMB under Accession number NCIMB 41907. Seeds of WHAAPD and WHAAOX were deposited by Nunhems B.V. on December 1st, 2011 at the NICMB under Accession numbers NCIMB 41905 and NCIMB 41906, respectively.

[0124] The physiological and morphological characteristics of the triploid *bush* hybrid WH3451 were analyzed in the Examples below.

Example 2 - Comparison of triploid *bush* hybrids WH3451 to prior art hybrids

2.1 - Materials and Methods

[0125] A field trial was conducted in Italy (Sant'Agata Bolognese-BO). Seeds were sown on 7/04/2010 and transplanted into the field on 20/05/2010 (100 cm within the row, 250cm between the rows). The plot contained 10 plants per line.

[0126] Ploidy level was determined by flow cytometry.

[0127] Mean values were determined for the following characteristics:

- Leaf length and leaf widths was measured for 1 leaf of 3 plants per line.
- Number of staminate flowers was counted for 3 plants per line on the flowering date. The mean number of 3 plants was calculated.
- Mean stem diameter was measured on in the middle of the main stem for 3 plants and the mean was calculated.
- Maturity: the number of days from flowering to maturity was determined by recording the dates when the 50% of the plants of the plot showed at least 1 female flower and then when the 50% of the plants of the plot had fruits ready to harvest
- Stem: average number of internodes: the average number of internodes on the longest vine measured on 3 plants per line
- Stem: average internode length (cm): the measured average internode length (cm) on the longest vine on 3 plants per line
- Stem: average length of the longest vine (cm): average length of the longest vine (cm) measured 3 plants per line
- Average fruit weight (kg): mean of the weight of 3 fruits per line randomly harvested from 3 plants at maturity
- Average fruit length (cm): mean of the length of 3 fruits
- Average fruit diameter at mid section (cm): mean of the diameter of 3 fruits
- Fruit: rind thickness (cm) at the blossom end and rind thickness on the side of the fruit was measured for 3 fruit.

Rind thickness is measured from the outer edge of the fruit to the boundary between white mesocarp and colored endocarp.

- Fruit: degree Brix: value is the mean of 1 reading for 3 fruits, collected between the centre and the rind of the fruit; expressed in Degrees Brix (°) using the K71901 portable refractometer Mod. RLC ATC 0-18% (OPTECH).
- Sowing seed size length (mm) and widths (mm) mean of the measure of 5 seeds
- colour: evaluated using the Royal Horticultural Society mini colour chart (http://www.rhs.org.uk/Plants/RHS-Publications/RHS-colour-charts)

2.1 - Results

[0128]

Table 1

	WH3451 (triploid *bush* hybrid - invention)	cv Milady Diploid hybrid - normal growth type	cv Fashion F1 Triploid hybrid - normal growth type	cv Boston F1 Triploid hybrid - normal growth type
Ploidy	3n	2n	3n	3n
bush alleles	*bbb*	*BB*	*BBB*	*BBB*
Leaf lobes	lobed	lobed	lobed	lobed
Leaf length (cm)	17.50	12.17	17.13	15.67
Leaf width (cm)	19.50	15.50	17.97	16.30
Leaf colour (RHS color chart)	Dark green RHS 137a	Dark green RHS 137a	Dark green RHS 137c	Dark green RHS 137a
Number of staminate flowers	6.00	15.50	n.d.	n.d.
Stem diameter (mm)	**9.00**	7.00	6.25	5.50
Number of main stems at crown	2.00	2.50	2.00	2.50
Leaf: Degree of secondary leaf lobbing 1 = very weal 9 = very strong	4	4	4	5
Maturity: number of days from flowering to maturity	27.00	29.00	29.00	32.00
Stem: average number of internodes	**13.57**	31.36	25.95	36.53
Stem: average internode length (cm)	**7.00**	11.00	11.00	9.00
Stem: average vine length (cm)	**95.00**	345.00	279.00	321.00
Ratio: vine length / number of internodes	**7.00**	11.00	11.00	9.00
Average fruit weight (kg)	5.7	11.40	7.30	6.80
Fruit shape in longitudinal section	Broad elliptic (broad circular)	Elongate elliptic	circular	circular
Average fruit length (cm)	24.00	46.75	20.60	23.20

(continued)

	WH3451 (triploid *bush* hybrid - invention)	cv Milady Diploid hybrid - normal growth type	cv Fashion F1 Triploid hybrid - normal growth type	cv Boston F1 Triploid hybrid - normal growth type
Average fruit diameter at mid section (cm)	19.00	21.25	22.25	24.55
Fruit index: length / diameter ratio	1.26	2.20	0.93	0.95
Fruit rind pattern	striped	striped	striped	striped
Fruit: width of stripes 1 = very narrow 9 = very broad	5	6	2	2
Fruit: Ground color of skin (RHS color chart)	Medium green RHS 145b	Medium green RHS145c	Dark green RHS 136a	Light green RHS 2d
Fruit: stripe color (RHS color chart)	Dark green RHS 136a	Dark green RHS 137a	Dark green	Dark green RHS 137c
Fruit: rind thickness (cm) (blossom end)	1.50	1.00	1.00	1.30
Fruit: rind thickness (cm) (side)	2.00	2.00	1.50	1.50
Fruit: Flesh color (RHS color chart)	Dark Red RHS 44a	Dark Red RHS 45a	Dark Red RHS 44a	Dark Red RHS 47a
Fruit: degree Brix	12.00	11.00	12.00	11.75
Sowing seed size 1 = very small, 9 = very large	2	4	4	5
Sowing seed size length (mm)	5.00	8.00	7.00	8.00
Sowing seed size width (mm)	3.00	5.00	5.00	5.00

[0129] The male *(bb)* and female (*bbbb*) *bush* parents have essentially the same *bush* growth type characteristics as indicated for the triploid hybrid WH3451 in Table 1 above.

Example 3 - Reduced spacing for triploid *bush* hybrids

[0130] As the triploid *bush* hybrids are small plants, without however having reduced fruit size and fruit yield per hectare and without having reduced leaf sizes (i.e. photosynthetic tissue), these plants can be used to grow at least about 1.5 times, preferably at least about 2 times or 2.5 times, preferably even about 3 times as many triploid plants per hectare compared to normal-type triploid hybrids, such as Fashion F1 and Boston F1, thereby increasing marketable fruit yield per hectare. Thus, the triploid fruit yield per hectare can be increased significantly using the triploid *bush* plants according to the invention, i.e. fruit yield from triploid *bush* plants can be at least about 1.25 times or at least about 1.5 times the yield of a normal type triploid production field.

[0131] The following Table 2 shows the number of plants per hectare for the normal growth type triploid varieties Fashion F1 and Boston F1 compared to the triploid *bush* plants according to the invention, such as WH3451:

	Grafted greenhouse	Non-grafted greenhouse	Grafted open field	Non-grafted open field
cv Fashion F1 or Boston F1	2500 plants/ha	5000 plants/ha	3000 plants/ha	7000 plants/ha

(continued)

	Grafted greenhouse	Non-grafted greenhouse	Grafted open field	Non-grafted open field
Triploid *bush* hybrid	7500 plants/ha	15000 plants/ha	6000-8000 plants/ha	12000 - 150000 plants/ha

[0132] Fruit yields for Fashion F1 and Boston F1 are about 60 tonnes/hectare (t/ha) in the open field compared to about 75-90 t/ha for the triploid *bush* hybrid.

Example 3

[0133] In 2012 the vegetative growth type of the male (*bb*) and female (*bbbb) bush* parents was determined, the results of which are shown in Table 3.

Table 3

	NCIMB41905 (tetraploid *bush*)	NCIMB41906 (diploid *bush*)
Ploidy	4n	2n
bush alleles	*bbbb*	*bb*
Leaf lobes	lobed	lobed
Leaf length (cm)	13.00	14.00
Leaf width (cm)	15.00	10.00
Leaf colour (RHS color chart)	Dark green RHS 137c	Dark green RHS 137c
Stem: average internode length (cm)	6.00	6.00
Stem: average vine length (cm)	133.00	150.00
Ratio: vine length / number of internodes	6.00	6.00

Claims

1. A plant of the species *Citrullus lanatus*, wherein said plant is triploid and has a *bush* growth habit, comprising three copies of a recessive allele designated *bush,* wherein said *bush* allele is obtainable by crossing a watermelon plant of which seeds were deposited under accession number NCIMB41906 or NCIMB41905 with another watermelon plant.

2. The plant according to claim 1, wherein the plant is an F1 hybrid produced from a cross between a diploid inbred male parent line, which has a *bush* growth habit, and a tetraploid inbred parent line, which has a *bush* growth habit,

3. The plant according to any one of the preceding claims, wherein the plant has a longest vine length of not longer than 100 cm.

4. The plant according to any one of the preceding claims, wherein said plant has not more than 15 internodes on the longest vine.

5. The plant according to any one of the preceding claims, wherein said plant has an average internode length on the longest vine of 7 cm or less, but at least 4.7 cm.

6. The plant according to any one of the preceding claims, wherein the ratio of longest vine length: number of internodes on the longest vine is 7 or less.

7. The plant according to any one of the preceding claims, wherein said plant has a stem diameter of at least 8 mm.

8. The plant according to any one of the preceding claims, wherein said plant comprises leaves of at least 10 cm long and at least 15 cm wide.

9. The plant according to any one of the preceding claims, wherein said plant produces fruits with an average fruit weight of at least 5 kg after pollination with diploid pollen.

10. Seeds from which a plant according to claims 1 to 9 can be grown.

11. A plant or seed of the species *Citrullus lanatus* wherein said plant is tetraploid and has a *bush* growth habit, comprising four copies of a recessive allele designated *bush,* wherein said *bush* allele is obtainable by crossing a watermelon plant of which seeds were deposited under accession number NCIMB41906 or NCIMB41905 with another watermelon plant.

12. A tissue culture of regenerable cells of a plant of any one of the preceding claims.

13. A tissue culture according to claim 12, comprising cells or protoplasts or plant tissue from a plant part selected from the group consisting of: embryos, meristems, cotyledons, pollen, ovules, leaves, anthers, roots, root tips, pistils, flowers, seed, stem.

14. A plant part of the plant according to any one of claims 1 to 11, wherein said part is selected from a scion, fruit, pollen, ovule, stem, cotyledon, leaf, cell embryos, meristems, anthers, roots, root tips, pistils, flowers, seed.

15. A watermelon plant regenerated from the tissue culture of claim 12 or 13, wherein the regenerated plant is a triploid or tetraploid and comprises a *bush* growth habit.

16. The plant according to claim 11, wherein said tetraploid plant has the following characteristics: a longest vine length of not more than 100 cm, an average internode length on the longest vine of 7 cm or less but at least 4.7 cm, and produces leaves of at least 10 cm long and at least 15 cm wide.

17. A method for seedless triploid watermelon fruit production, said method comprising:

a) providing a triploid hybrid watermelon plant comprising a *bush* growth habit according to any one of claims 1 to 10;
b) interplanting said triploid hybrid plants with diploid pollenizer plants,
c) harvesting the seedless watermelon fruits produced on the triploid plants of (a).

18. The method according to claim 17, wherein at least 1.5 times more triploid *bush* plants are grown per hectare than when a triploid hybrid plant comprising a normal growth habit, such as Boston F1, is used.

19. The method according to claim 17 or 18, wherein at least 15% more triploid fruits are produced per hectare than when a triploid hybrid plant comprising a normal growth habit, such as Boston F1, is used.

Patentansprüche

1. Pflanze der Art *Citrullus lanatus,* wobei die Pflanze triploid ist und eine *bush*-Wuchsform aufweist, umfassend drei Kopien eines als *bush* bezeichneten rezessiven Allels, wobei das bush-Allel durch Kreuzen einer Wassermelonenpflanze, deren Samen unter der Zugangsnummer NCIMB41906 oder NCIMB41905 hinterlegt wurden, mit einer anderen Wassermelonenpflanze erhältlich ist.

2. Pflanze nach Anspruch 1, wobei es sich bei der Pflanze um ein F1-Hybrid handelt, erhalten durch Kreuzung einer diploiden männlichen Inzuchtelternlinie mit *bush*-Wuchsform und einer tetraploiden Inzuchtelternlinie mit *bush*-Wuchsform.

3. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze eine längste Rankenlänge von nicht mehr als 100 cm aufweist.

4. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze an der längsten Ranke nicht mehr als 15

Internodien aufweist.

5. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze eine durchschnittliche Internodienlänge an der längsten Ranke von 7 cm oder weniger, jedoch mindestens 4,7 cm, aufweist.

6. Pflanze nach einem der vorhergehenden Ansprüche, wobei das Verhältnis von Länge der längsten Ranke:Anzahl an Internodien an der längsten Ranke 7 oder weniger beträgt.

7. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze einen Stieldurchmesser von mindestens 8 mm aufweist.

8. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze Blätter mit einer Länge von mindestens 10 cm und einer Breite von mindestens 15 cm umfasst.

9. Pflanze nach einem der vorhergehenden Ansprüche, wobei die Pflanze Früchte mit einem durchschnittlichen Fruchtgewicht von mindestens 5 kg nach Bestäubung mit diploiden Pollen produziert.

10. Samen, aus denen eine Pflanze nach den Ansprüchen 1 bis 9 herangezogen werden kann.

11. Pflanze oder Samen der Art *Citrullus lanatus*, wobei die Pflanze tetraploid ist und eine *bush*-Wuchsform aufweist, umfassend vier Kopien eines als *bush* bezeichneten rezessiven Allels, wobei das *bush*-Allel durch Kreuzen einer Wassermelonenpflanze, deren Samen unter der Zugangsnummer NCIMB41906 oder NCIMB41905 hinterlegt wurden, mit einer anderen Wassermelonenpflanze erhältlich ist.

12. Gewebekultur regenerierbarer Zellen einer Pflanze nach einem der vorhergehenden Ansprüche.

13. Gewebekultur nach Anspruch 12, umfassend Zellen oder Protoplasten oder Pflanzengewebe von einem Pflanzenteil ausgewählt aus der Gruppe bestehend aus: Embryos, Meristemen, Kotyledonen, Pollen, Samenanlagen, Blättern, Staubbeuteln, Wurzeln, Wurzelspitzen, Blütenstempeln, Blüten, Samen, Stiel.

14. Pflanzenteil der Pflanze nach einem der Ansprüche 1 bis 11, wobei der Teil ausgewählt ist aus einem Ableger, einer Frucht, Pollen, einer Samenanlage, einem Stiel, einem Kotyledon, einem Blatt, Zellembryos, Meristemen, Staubbeuteln, Wurzeln, Wurzelspitzen, Blütenstempeln, Blüten, Samen.

15. Wassermelonenpflanze, regeneriert aus der Gewebekultur nach Anspruch 12 oder 13, wobei die regenerierte Pflanze triploid oder tetraploid ist und eine bush-Wuchsform umfasst.

16. Pflanze nach Anspruch 11, wobei die tetraploide Pflanze die folgenden Kennzeichen aufweist: eine längste Rankenlänge von nicht mehr als 100 cm, eine durchschnittliche Internodienlänge an der längsten Ranke von 7 cm oder weniger, jedoch mindestens 4,7 cm, und Blätter mit einer Länge von mindestens 10 cm und einer Breite von mindestens 15 cm produziert.

17. Verfahren zur Produktion samenloser triploider Wassermelonenfrüchte, wobei das Verfahren Folgendes umfasst:

    a) die Bereitstellung einer triploiden Hybrid-Wassermelonenpflanze mit einer *bush*-Wuchsform nach einem der Ansprüche 1 bis 10,
    b) der Zwischenanbau der triploiden Hybridpflanzen mit diploiden Bestäuberpflanzen,
    c) das Ernten der an den triploiden Pflanzen von (a) produzierten samenlosen Wassermelonenfrüchte.

18. Verfahren nach Anspruch 17, wobei mindestens 1,5-mal mehr triploide bush-Pflanzen pro Hektar herangezogen werden als bei Verwendung einer triploiden Hybridpflanze mit normaler Wuchsform wie Boston F1.

19. Verfahren nach Anspruch 17 oder 18, wobei mindestens 15% mehr triploide Früchte pro Hektar produziert werden als bei Verwendung einer triploiden Hybridpflanze mit normaler Wuchsform wie Boston F1.

Revendications

1. Plante appartenant à l'espèce *Citrullus lanatus,* ladite plante étant triploïde et possédant un port de type *buisson,* comprenant trois copies d'un allèle récessif désigné *buisson,* dans laquelle ledit allèle *buisson* peut être obtenu par le croisement d'une plante de pastèque dont les graines ont été déposées sous le numéro d'accès NCIMB 41906 ou NCIMB 41905, avec une autre plante de pastèque.

2. Plante selon la revendication 1, la plante étant un hybride F1 produit à partir d'un croisement entre une lignée parentale mâle consanguine diploïde, qui possède un port de type *buisson,* et une lignée parentale consanguine tétraploïde, qui possède un port de type *buisson.*

3. Plante selon l'une quelconque des revendications précédentes, la plante ayant une longueur la plus grande de tige qui n'est pas supérieure à 100 cm.

4. Plante selon l'une quelconque des revendications précédentes, ladite plante n'ayant pas plus de 15 entrenœuds sur la tige la plus longue.

5. Plante selon l'une quelconque des revendications précédentes, ladite plante ayant une longueur d'entrenœuds moyenne sur la tige la plus longue de 7 cm ou moins, mais d'au moins 4,7 cm.

6. Plante selon l'une quelconque des revendications précédentes, dans laquelle le rapport de la longueur la plus grande de tige au nombre d'entrenœuds sur la tige la plus longue est de 7 ou moins.

7. Plante selon l'une quelconque des revendications précédentes, ladite plante ayant un diamètre de tige d'au moins 8 mm.

8. Plante selon l'une quelconque des revendications précédentes, ladite plante comprenant des feuilles d'une longueur d'au moins 10 cm et d'une largeur d'au moins 15 cm.

9. Plante selon l'une quelconque des revendications précédentes, ladite plante produisant des fruits ayant un poids de fruit moyen d'au moins 5 kg après pollinisation par du pollen diploïde.

10. Graines à partir desquelles une plante selon les revendications 1 à 9 peut être cultivée.

11. Plante ou graine appartenant à l'espèce *Citrullus lanatus,* ladite plante étant tétraploïde et possédant un port de type *buisson,* comprenant quatre copies d'un allèle récessif désigné *buisson,* dans laquelle ledit allèle *buisson* peut être obtenu par le croisement d'une plante de pastèque dont les graines ont été déposées sous le numéro d'accès NCIMB 41906 ou NCIMB 41905, avec une autre plante de pastèque.

12. Culture tissulaire de cellules régénérables d'une plante selon l'une quelconque des revendications précédentes.

13. Culture tissulaire selon la revendication 12, comprenant des cellules ou des protoplastes ou un tissu végétal issus d'une partie de plante choisie dans le groupe constitué par : les embryons, les méristèmes, les cotylédons, le pollen, les ovules, les feuilles, les anthères, les racines, les extrémités des racines, les pistils, les fleurs, les graines, les tiges.

14. Partie de plante issue de la plante selon l'une quelconque des revendications 1 à 11, ladite partie étant choisie parmi : un scion, un fruit, un pollen, un ovule, une tige, un cotylédon, une feuille, des embryons cellulaires, des méristèmes, des anthères, des racines, des extrémités des racines, des pistils, des fleurs, des graines.

15. Plante de pastèque régénérée à partir de la culture tissulaire selon la revendication 12 ou 13, la plante régénérée étant triploïde ou tétraploïde et comprenant un port de type *buisson.*

16. Plante selon la revendication 11, ladite plante tétraploïde possédant les caractéristiques suivantes : une longueur la plus grande de tige non supérieure à 100 cm ; une longueur d'entrenœuds moyenne sur la tige la plus longue de 7 cm ou moins, mais d'au moins 4, 7 cm ; et produisant des feuilles d'une longueur d'au moins 10 cm et d'une largeur d'au moins 15 cm.

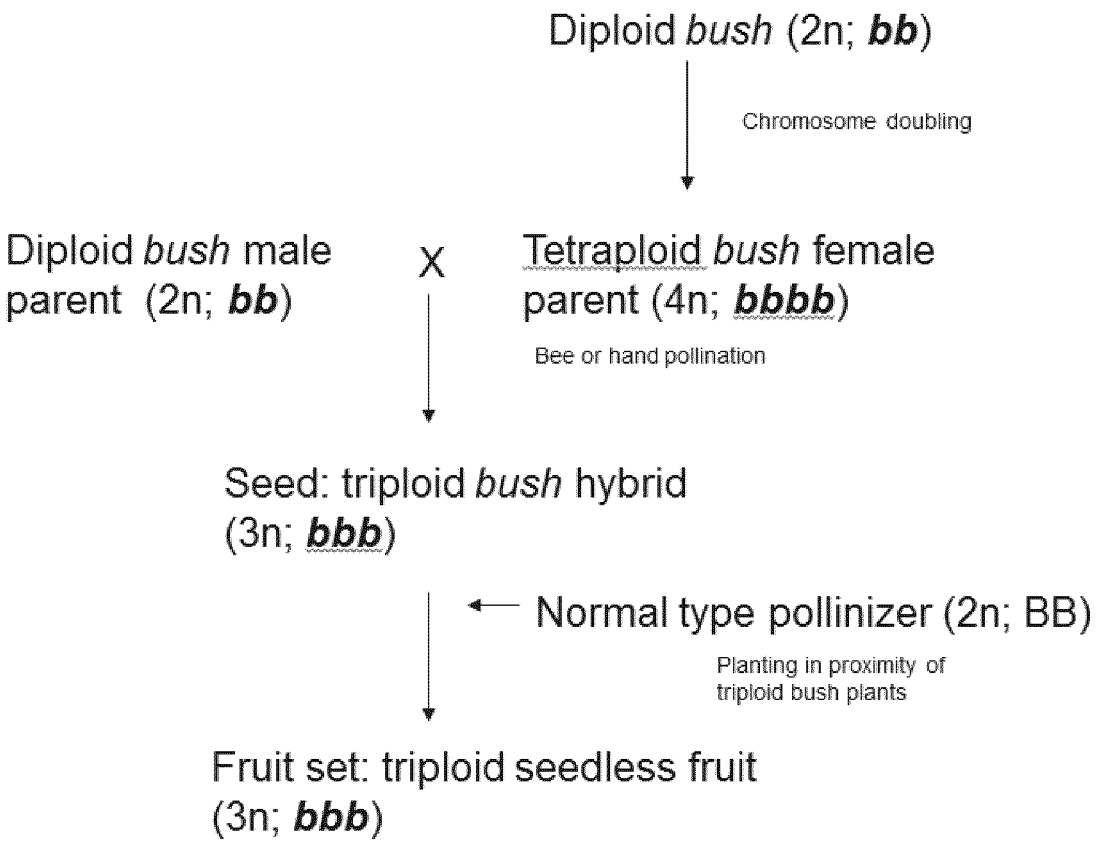
17. Méthode de production de fruits de pastèque triploïdes et sans pépins, ladite méthode comprenant :

a) la mise à disposition d'une plante de pastèque hybride triploïde comprenant un port de type *buisson* selon l'une quelconque des revendications 1 à 10 ;
b) la plantation intercalaire desdites plantes hybrides triploïdes avec des plantes pollinisatrices diploïdes ;
c) la récolte des fruits de pastèque sans pépins produits sur les plantes triploïdes de (a).

18. Méthode selon la revendication 17, dans laquelle au moins 1,5 fois plus de plantes triploïdes de type *buisson* sont cultivées par hectare, par rapport au cas où une plante hybride triploïde comprenant un port normal, telle que Boston F1, est utilisée.

19. Méthode selon la revendication 17 ou 18, dans laquelle au moins 15% de plus de fruits triploïdes sont produits par hectare, par rapport au cas où une plante hybride triploïde comprenant un port normal, telle que Boston F1, est utilisée.

Figure 1


Diploid *bush* (2n; ***bb***)
Chromosome doubling
Diploid *bush* male parent (2n; ***bb***)
X
Tetraploid *bush* female parent (4n; ***bbbb***)
Bee or hand pollination
Seed: triploid *bush* hybrid (3n; ***bbb***)
Normal type pollinizer (2n; BB)
Planting in proximity of triploid bush plants
Fruit set: triploid seedless fruit (3n; ***bbb***)

REFERENCES CITED IN THE DESCRIPTION

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