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Electroculture

» **ElectroCulture** : CHAPIN : Interstellar Light Collector ** BOEHM : DNA Resonant Frequencies ** CHRISTOFLEAU : ElectroCulture ** CORSON & ZADEREJ : Electrogenics ** DARRAGH : Vi-Aqua ** DeLAND : Frost Guard ** DUDGEON : Electroculture ** EBNER : Primeval Code ** Electrolyzed Water ** RF Heating vs Pests ** GUASCO : Theta Amplifier ** GUILLEMETTE : Perpetual ES Battery ** GUASCO : Theta Amplifier ** GUILLEMETTE : Perpetual ES Battery ** STERNHEIMER : Plant Protein Music ** ElectroCulture ** ElectroCulture Patents ** ElectroCulture Patents #2 ** ElectroCulture Patents #3 ** Electroculture Patents #4 ** FANTUZZI : Energy Accumulator ** JOHNSON (J.) : Dipole Resonance Mutation ** LAEMSTROM : Electroculture ** MagnaCulture ** LEVENGOOD : Electroculture ** PARRY : ElectroCulture ** Radiesthesia Patents ** Rainmaker : Water Treatment ** Tourmaline Electrogeneration ** WADLE : Tree Electricity ** Electro-Culture #1 (PDF) ** Electro-Culture #2 ** Electro-Culture #3 **

EP0218538
Device for electroculture

Inventor(s): HANGARTER JEAN-MARIE +
Also published as: FR2586892

1. Device for electroculture with minimum two metal grates or plates (2, 3) arranged in parallel in the cultivated soil (4), in a north-south direction, and with a voltage source (6) with an antenna (7) and that supplies the metal grates (2, 3) with an electric current of natural origin, device for electroculture characterized in that the aforesaid voltage source (6) consists, on one hand, of the antenna (7) for collecting atmospheric electricity and, on the other hand, of one or several photocells (8).

The invention relates to a device comprising at least electroculture two grids or panels arranged in parallel in the culture ground using a North-South direction, and a voltage source providing an electric current naturally occurring metal grilles.

Several devices are known for the use of the beneficial effect of electricity on the vegetation which is long known.

Indeed, it was found that electricity could have a powerful influence on the rise of the sap in plants, and therefore, the rapid and dramatic development thereof.

Many devices have been proposed for post planting the influence of electricity, primarily in the roots. The purpose of these known devices consists in collecting electricity from natural preferably such that atmospheric electricity and to channel it to the roots in the form of electric current. Thus, according to one of these known devices, an antenna of seven to eight meters high is placed vertically in the soil and topped, on the one hand, by a wire rods assembly of galvanized iron and on the other hand, of a set of copper or brass tubing. Each of these sets of elements made of galvanized iron or copper is separately connected to a lead wire which runs down the vertical antenna. Either son is then buried in the soil to a depth of about fifty centimeters, and this spiral-shaped lap, so as to define a couple copper-iron.

Thus, the spiral is obtained trap to force lines of magnetic field, and it establishes a direct current on the spiral, which enables the growth of plants located above the spiral tablecloth.

This device has the disadvantage of being relatively expensive, and further requests a particularly careful implementation with many insulation and welds. Moreover, it requires a particularly large unsightly antenna height above all, the results obtained at the plantations are of great irregularity, and are mainly dependent on the distribution of electrical voltages in the basement.

There is also known another device for electroculture based on the collection of air currents, and a compound antenna provided with metallic copper strands in its upper part. This antenna is isolated from earth by means of an insulator, but is connected to a galvanized iron grid placed vertically in the soil. Next to this grid of galvanized iron, arranged in a north-south direction, is placed a second, identical grid but only connected to ground. In this way, air currents collected by the antenna are transmitted to the first-mentioned gate, and it is established between the two gates an electric field resulting in the circulation of a current in the low part of the floor between the two grids, this current beneficial to the growth of plants placed in its path.

However, this device is characterized by inefficiency, resulting in part of the low levels of current and voltage observed, as well as variations thereof.

While the aforementioned electroculture devices are based on the use of atmospheric electricity, which is free, other devices are to directly power grids placed in the ground by means of electric generators such as batteries or other , which considerably increases the cost of using these devices.

Finally, some embodiments are based on a juxtaposition of acidic and basic compost strips arranged alternately in the ground, so as to generate electrical currents through the flower beds. It is clear that this is an electric energy use more expensive and must be periodically renewed.

The present invention aims to remedy these drawbacks. The invention, as characterized in the claims, solves the problem of creating a electroculture device comprising at least two grids or panels arranged in parallel culture of the ground according to a North-South direction and a source of ten sion providing an electric current naturally occurring metal grids and the voltage source which consists on the one hand, a sensing antenna of atmospheric electricity and, secondly, of one or more photovoltaic cells.

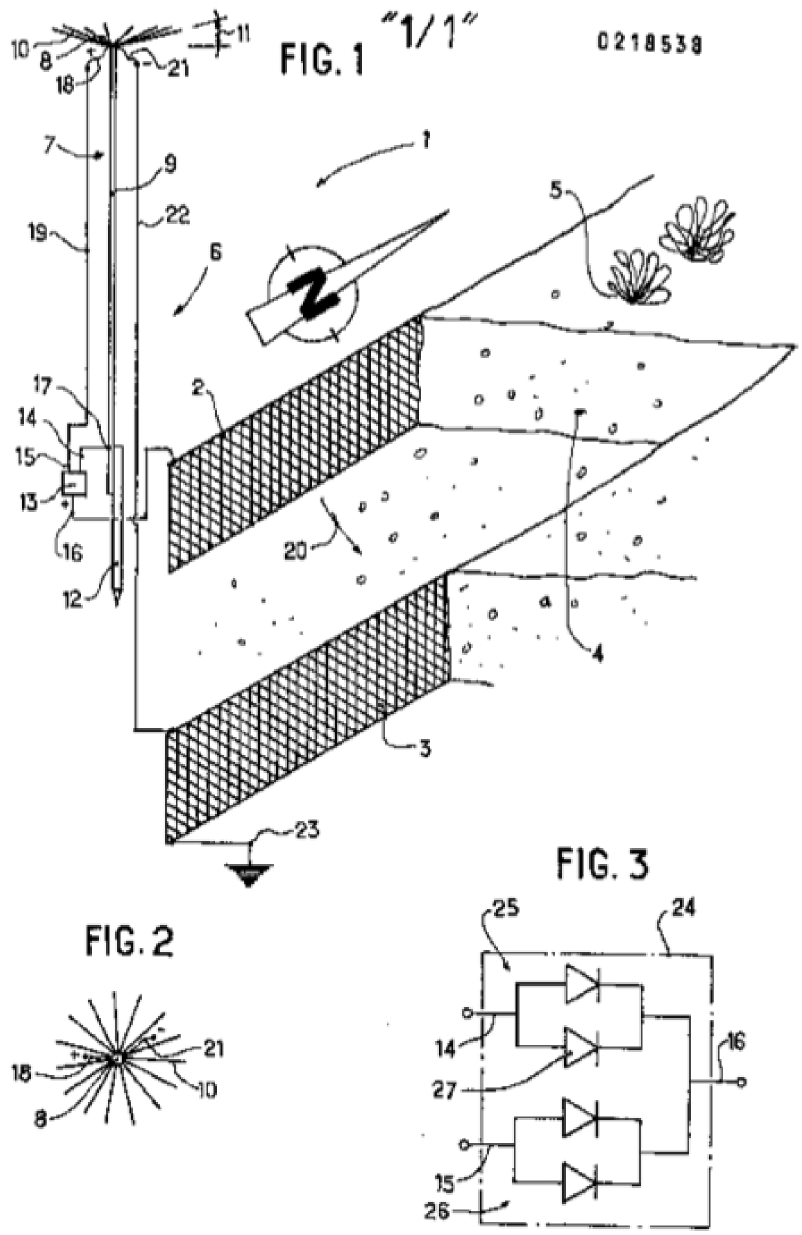
The advantages obtained through this invention consist primarily in that as a result of the presence of photovoltaic cells and a controller, the electroculture device allows for the same night electrical voltage available at the positive gate metal, which increases profitability of the device.

Another object of the present invention is to provide a practical embodiment, simple and effective electroculture of devices, all based on a source of completely free electrical energy.

Another object of the present invention is to provide a very economical electroculture device and which is used to circulate in the culture beds flat, a DC relatively large compared with those obtained by the devices known in the state Current art.

The invention is described below in more detail using drawings representing only one embodiment. 1 shows a perspective view of the entire electroculture device according to the invention. Figure 2 is a plan view of the antenna of the device as shown in Figure 1. Figure 3 is a block diagram of the controller shown in the device of Figure 1.

Referring to FIG 1.



The electroculture device 1 according to the invention mainly consists of two metal grids 2 and 3 having a height of thirty to fifty centimeters arranged parallel in the cultivation soil, so as to laterally delimit a culture 4 flowerbed for planting and cultivation of any plant 5.

The metal grids 2 and 3, preferably made of galvanized iron, are intended in known manner to be brought to a relative electric potential so as to move with one another an electric current limited by the earth resistance of the lintel 4 . Of course, the metal grids 2 and 3 may be replaced by solid metal panels that perform the same function.

It is important to note that the metal grids 2 and 3, in the ground, are oriented in a north-south direction to benefit the moving electric charges between the two gates, the influence of the earth's magnetic field.

The electroculture device 1 according to the invention further comprises a voltage source 6 electrically connected to the gates 2 and 3, the first acting as a positive pole, the second acting as a negative pole.

For this purpose, the voltage source 6, which supplies an electric current naturally occurring metal grids 2 and 3, is composed, on the one hand, an antenna 7 for sensing atmospheric electricity and, hand, of one or more photovoltaic cell 8 as shown in FIG 2.

The antenna 7 is intended to capture the electricity present in the atmosphere as ions, especially in stormy weather. For this purpose, it consists of a conducting tube 9 made of aluminum or another good electrical conductor, surmounted by strands of copper or equivalent, arranged in "umbrella" as shown schematically in Figures 1 and 2. These copper strands of wire 10, necessarily an odd number are set on top of the conductive tube 9 by any connection providing good electrical continuity and are distributed in a cone so as to be inclined upwardly 11 fifteen to thirty degrees.

In addition, the conductive tube 9 of the antenna 7 is fixed on an isola tor constituted for example by a wooden post 12 driven into the soil, the whole of the antenna 7 is installed near metal grids 2 and 3 order to shorten the necessary electrical connections.

Please note that the sizing point of view of this antenna, several achievements in the scope of Armed Men are possible. It nevertheless appears that antenna 7 made of a conductive tube 9 meters high and two copper strands thirty centimeters long and with a diameter of 2.5 to 3 millimeters is optimal.

It is clear that the antenna 7 captures atmospheric electricity is in itself a source of voltage, said voltage can be tapped at any point of the tube 9. However, this voltage is essentially variable and fluctuating the rate of changes in atmospheric conditions, and its application to a metal grids 2 or 3 does not give good results as regards the growth of plants 5.

Also, according to the invention, the voltage source 6 is further comprised of one or more photovoltaic cells 8 producing a DC voltage from the light energy received by the sun, the respective voltages from the antenna 7 and photovoltaic cell 8 is fed onto the metallic grille 2 serving as a positive terminal, via a controller 13.

The controller 13 has two inputs 14 and 15 and an outlet 16. To ensure the operation of such electroculture device described above, the inlet 14 of the controller 13 samples the voltage produced by the antenna 7 at any point 17 of the tube 9 thereof. Furthermore, the positive voltage produced by the photovoltaic cell 8 is imposed at the positive terminal 18 of the latter and is fed on the input 15 of the regulator via an insulated electrical wire 19.

Of course, for a current to flow in the direction 20 shown in Figure 1, it is necessary that the output 16 of regulator 13 is connected to the metallic grille 2 serving as a positive pole, and furthermore the negative terminal 21 of the photovoltaic cell 8 is connected by an insulated electrical wire 22 to the metal gate 3 serving as a negative pole of the device. Thus, the metal mesh 2 being raised to a positive electrical potential relative to earth, and the metal gate 3 being intimately connected to ground via a ground rod 23, an electric current can be established between the two gates 2 and 3 in the direction 20 shown.

According to the invention the best results are obtained when the electroculture metal gate 2 is supplied with a DC voltage of the order of 0.2 to 0.4 volts. The controller 13 according to the invention allows to obtain such a voltage from individual voltage sources formed by the antenna 7 on the one hand, and by the photovoltaic cell 8 on the other.

For this purpose, the controller 13 shown schematically FIG 3 comprises a rectifier stage 24 with low losses for fabricating a DC voltage of 0.2 to 0.4 volts from, on the one hand, of the fluctuating voltage supplied by the antenna 7, and secondly, of the substantially DC voltage delivered by the photovoltaic cell 8. Therefore, the rectifier stage 24 is constituted by two groups 25 and 26 of diodes 27 arranged in parallel, and located respectively between each inlet 14 and 15 and the output 16 of controller 13.

It should be noted that the voltages delivered by the antenna 7 and 8 by the photovoltaic cells are of relatively low values, and therefore, it is necessary to limit the voltage drops inside the controller 13 to their simplest expression. Also, the diodes 27 are they preferably consist of diodes "signal" germanium low loss. It is also noteworthy that the provision of two or more diodes 27 in parallel between an input 14 or 15 and the output 16 of the regulator 13 allows to limit the equivalent resistance of each set of diodes in parallel, and therefore to limit drops voltage.

In order to make the whole as compact voltage source 6 as possible, the solar cell 8 can be suitably placed on top of the tube 9 of the antenna 7 as shown in Figures 1 and 2.

Of course, the spacing of the metal grids 2 and 3 depends on the resistance of the soil in the region of cultivation, and the number and size of the metal grids 2 and 3, and the number of photovoltaic cells 8 and antenna 7 needed by growing area are fully accessible to Skilled Professionals.

Among the advantages of electroculture device described above, it may be noted that the presence of photovoltaic cells 8 and 13 allow the regulator to always have a voltage available on the positive metal grid 2, even if for one reason or another one of the two voltage sources is silent, which is the case each night for the photovoltaic cell 8.

Moreover, the electroculture device according to the invention is very simple and compact while giving spectacular results, and allows to put a cost effective and efficient service to electroculture any gardener, who can, therefore, do without chemical fertilizers.

US5806294
Weed electrifier

Inventor(s): STRIEBER LOUIS CHARLES

A portable, hand held tool for trimming and electrifying vegetation. The portable, hand swingable, weed trimmer passes electricity through its cutting or trimming element so as to pass electricity into the weeds to kill the roots of the weeds. The tool includes a power unit for rotation of a cutter drive. A pancake generator generates electricity via rotation of the cutter drive. Brushes between the pancake generator and the cutter blade conduct current to the cutter blade, which in turn permits the current to pass into the vegetation as the cutter blade trims the vegetation.

FIELD OF THE INVENTION

The present invention relates to hand held portable trimmers for the maintenance worker and landscaper and, more specifically, to such trimmers with means to deliver electricity to the weeds of the plants which it cuts.

SUMMARY OF THE INVENTION

A general object of the present invention is to provide a unique hand tool for trimming and electrifying vegetation.

Another object of the present invention is to provide in such a hand tool a unique arrangement for generating electricity in a trimmer. Specifically, the hand tool includes a generator in or adjacent to the trimmer head which generates electricity from the rotating drive shaft used to turn the blade or cutter that cuts the weeds.

Another object of the invention is to provide a unique add-on kit for a conventional weed eater. This add on and removable kit enables an individual to convert his or her conventional weed eater into a weed electrifier. Electrical treatment decreases the number of times an individual needs to trim weeds or poison them, saving fuel, money, and time, and reducing air pollution and the environmental impact of property upkeep. The present add on kit works even on a low powered weed eater. Most fueled motors have more than enough power to both cut the weeds and power the add on pancake generator.

One advantage of the present invention is that it enables one or more individuals to clear brush, including large trees, by a method that does not require poisons. The dead weeds remain in place until decomposed. The clearing of the brush, weeds, or vegetation is accomplished by electrocuting the weeds or other vegetation, which is relatively easy because weeds, which generally grow faster than the plants generally used as crops, are taller than the desired vegetation. Otherwise, the modified weed eater is manipulated with minimal touching of the plants grown as crops. The cutting apparatus is electrified and thus transfers electricity to the weeds and, more importantly, through the fluids of the plant to the roots of the weeds.

Even large trees such as weed trees, weesatch or mesquite, prickly ash, and stump sprouts may be electrified. Such is accomplished by trimming through the bark and into the cambium as close to the ground level as possible to reduce the chances of sprouts forming along the trunk.

It is preferred to treat the vegetation with electricity after a good rain, to enable the electricity to flow at least partially into the ground after it has flowed through the roots of the plant. In other words, current is carried from the generator, to the brushes, to the cutting tool, to the plant, to the plant's roots, and then further into the ground about the roots of the plant.

It is preferred that the vegetation is treated more than once. Seeds grown and perhaps even spread before treatment will sprout, producing weeds which then may be electrified before new seeds are generated. The larger weeds may be somewhat resistant and may have portions that grow back. However, two or more electrical treatments are preferable to regularly using a nonelectrified weed cutter or a poison.

It is preferable that the operator be safety conscious. For example, in addition to eye and ear protection, it is preferable to wear protective gear such as rubber gloves, rubber boots or chaps to protect from shock. Another example of a safety conscious operator is one who inspects the cutter for wear and tear, such as inspecting the cutting head, the cutting piece, the hub, the brushes, the teeth of the cutting piece, and balance of the cutting piece.

These and further objects and advantages of the present invention will become clearer in light of the following detailed description of the illustrative embodiments of this invention described in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The illustrative embodiments may be best described by reference to the accompanying drawings where:

FIG. 1 shows a perspective view of a hand held trimmer and weed electrifier and further shows a weed and the roots of a weed.

FIG. 2 shows an exploded view of one embodiment of the trimmer and electrifying unit.

FIGS. 3-5 show perspective views of different types of electrically conducting trimmers or cutting tools or elements.

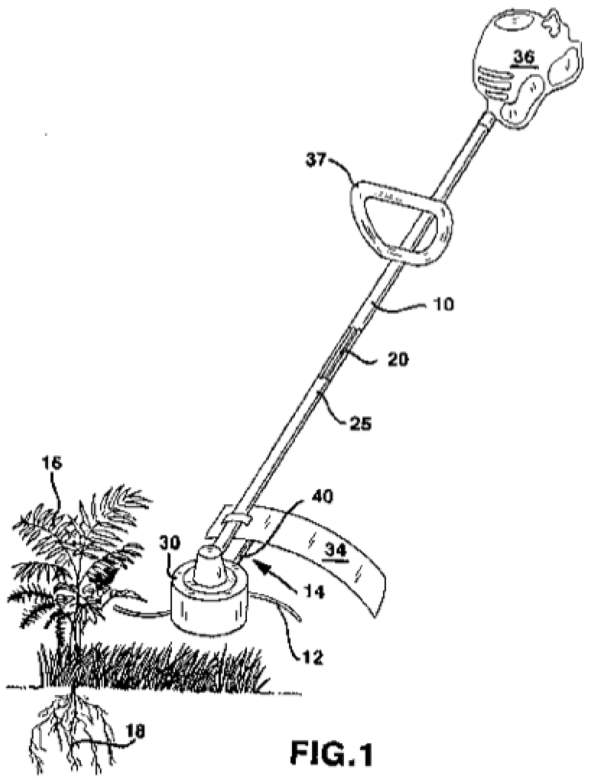


FIG.1

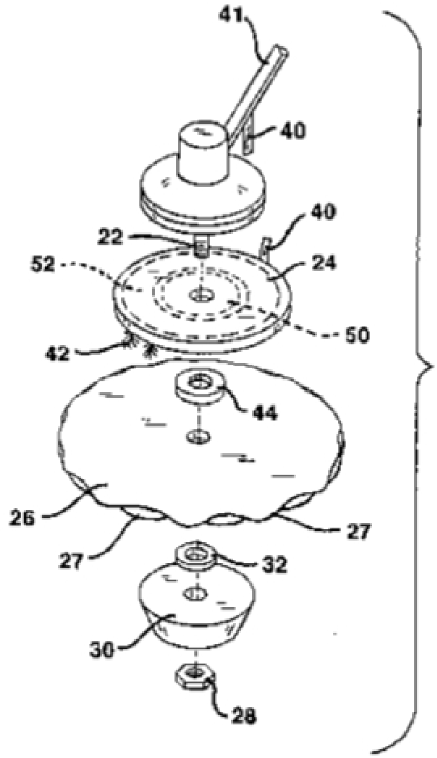


FIG.2

FIG.3

FIG.4

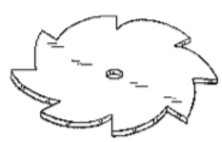


FIG.5

All Figures are drawn for ease of explanation of the basic teachings of the present invention only; the extensions of the Figures with respect to number, position, relationship, and dimensions of the parts to form the preferred embodiment will be explained or will be within the skill of the art after the following description has been read and understood. Further, the exact dimensions and dimensional proportions to conform to specific force, weight, strength, and similar requirements will likewise be within the skill of the art after the following description has been read and understood.

Where used in the various Figures of the drawings, the same numerals designate the same or similar parts. Furthermore, when the terms "inner," "outer," "side," "end," "upper", "lower" and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawings as it would appear to a person viewing the drawings and are utilized only to facilitate describing the preferred embodiments.

DETAILED DESCRIPTION

The invention in general is a weed electrifier 10 which passes electricity through the rotating cutting flexible electrically conductive cable 12 at the distal end of a weed trimmer unit 14 to in turn pass electricity through the weeds 16 being trimmed to kill the roots 18 of the weed 16 or at least stunt the growth of the roots 18 or weed 16 at the same time that the weed 16 is cut.

As shown in FIG. 2, the rotating drive 20 includes a drive portion 22 to drive the pancake-like generator 24 to generate electricity. The drive 20 is mounted in a shaft or housing 25. The electricity is passed to the cutting tool 26 via a contact such as a brush or brushes 42 and/or via electrical lead lines. The cutting tool 26, formed of an electrical conducting material, passes the electricity into the weeds 18 at the same time that the cutting tool 26 trims the weeds 16. It should be noted that the disk like cutting tool 26 has one or more cutting edges 27 or double serrations 27.

The trimmer unit 14 includes the mounting nut 28, rider 30, thrust washer 32 and deflector 34. The drive means or power unit 36 for the weed trimmer 10 may be a gas engine. The tool 10 further includes a handle 37 affixed to the shaft 25.

The housing 38 for the pancake generator may be fixed via a strap 40 or other means to a stationary portion 41 of the distal end 14 of the weed electrifier 10 so as to keep such from spinning.

The cutting tools 26 may take a variety of shapes and structures. See FIGS. 3, 4, and 5. The entire perimeter of such tools may be sharpened for cutting, if desired.

This invention is an enhancement of the more familiar weed trimmer in that it not only trims the weed 16 but electrocutes it to kill the weed roots 18. It is possible to kill the weeds 16 and not the grass due to the fact that weeds 16 generally grow taller and faster than grass, thus permitting the electrocution of the weed 16 while not contacting the grass. This eliminates the weekly trimming process after all of the weed seeds have sprouted and been electrocuted. This enhanced trimmer will reduce the use of herbicides and their pollution.

The present invention is a traditional weed trimmer with the addition of a D.C. pancake motor/generator 24 and a contact 42 on the pancake motor/generator 24 utilized to provide electricity to the trimmer cutting instrument 26, to thereby put electrical energy into the plant 16, such as through the sap of the plant or tree and into the roots 18. This effectively electrocutes the plant 16.

Mounting is accomplished by lengthening the mounting stud or drive shaft portion 22 for the cutting or trimming head or housing 30 in order to accommodate the axial thickness of the pancake motor/generator assembly 24, including spacers 44 and bearings. The electrical output or the generator 24 is delivered to a contact or brush 42 which is induced to contact the cutting instrument 26 such as with a spring.

The pancake generator 24 includes a relatively flat or wide magnetic wheel or rotor 50 which is fixed to the drive shaft portion 22. The pancake generator 24 further includes a relatively flat or wide armature winding or stator 52. A housing 54 encompasses the rotor 50 and stator 52. The brushes 42 are electrically connected to the windings of the stator 52. It can be appreciated that, if desired, the stator may rotate and the rotor may be stationary.

This in effect makes the addition of electrocuting the taller weeds an add on feature to practically all weed eater trimmers.

The addition of a strap 40 or other means like a bolt to keep the motor/generator 26 or its housing 30 from spinning to allow it to produce electricity is one of only a few of the add on features of this invention.

The contact brush 42 is easily replaceable.

The generator 24 may require addition bearings on its shaft 22 to allow for the spinning trimmer cutting tool 26 to spin without rubbing the motor/generator 24.

The addition of capacitors may reduce the arcing on the generator brushes 42 and provide greater amperage to electrocute plants with a smaller generator. Mounting the capacitors on the trimmer head shield may provide a cooling means. This arrangement may enable electrifying large weeds whose size is on the order of trees.

Electrical treatment may be simultaneous with the step of trimming the bark and cambium all around the trunk base. Electrical treatment by the tool 10 is then applied to the resulting exposed portion.

It should further be noted that the outer elongate hollow shaft or sheath 25, encompassing the drive shaft 20, is formed of a nonconducting material. Also, the drive shaft 20 may be nonconductive, with the drive shaft portion 22 also being nonconductive. Further, diodes may be included in the circuitry in the head 30 to restrict electrical flow to chiefly one direction.

It should also be noted that the rotating cutter 24 may be a metal disk with cutting edges, a metal chain, or a metal cable.

An add-on kit for a conventional weed eater generally includes a generator, and a contact for feeding electricity to the cutter. Further, such an add-on kit may include:
1) a conductive cutter;
2) attachment means for the generator, such as a bolt longer than the bolt or shaft which is conventionally found on a weed eater which affixes the cutter to the weed eater. Such a longer bolt accommodates the added width of the generator.
3) a contact for running up through a protective shield placed over the generator and cutter and then running down past the perimeter of the cutter to the underside of the cutter where the contact engages the cutter.
4) means for holding the contact or conductor in place (spring holding brush or bolt for holding contacts).
5) means for accommodating wear of the contact or conductor (spring loaded contacts or brushes).
6) means for permitting electrical contact regardless-of the direction of spin of the cutter (oval springs, arcuate springs, U-shaped springs, each of which with a contact on a bottommost arcuate tangential portion of the spring).
7) means for stabilizing the generator housing on the weed eater (strap or bolt connected to the weed trimmer and generator casing).
8) means for boosting the power of the conventional engine or motor on the conventional weed eater (capacitors, the inclusion of which may lead to a slower walking motion to enable the capacitors to have time to charge up).
9) means for controlling the time of discharge of the capacitors (trigger switch or automatic discharge upon reaching full charge).
10) means for checking the functioning of the generator and/or capacitors (LED light indicating electrical flow).
11) means for determining the amount of current being generated by the generator (volt meter or amp meter).
12) a switch on the handle 37 for turning the generator on and off and electrical leads between such switch and the generator.

As to a cutter blade for the present invention, the entirety of the Hayhurst, Jr. U.S. Pat. No. 4,627,322 is hereby incorporated by reference. Such patent shows a circular saw blade assembly.

As to a pancake generator, the entirety of the Boyer U.S. Pat. No. 4,539,497 is hereby incorporated by reference. This patent shows a pancake armature or, in other words, a pancake generator.

It should be noted that conventional weed eaters include a deflector or protective device or cover over a portion of the cutter blade. The protective device typically extends rearwardly to provide space between the cutter and the operator. If desired, the contact for the cutter may run upwardly from the generator to and through the protective device and then downwardly past the perimeter of the cutter to the underside of the cutter, where it makes electrical engagement therewith. Or, if desired, the contact may run to the upperside of the cutter. Or, if desired, contacts may run to both the underside and upperside of the cutter, whether or not the contacts first run upwardly through the protective device. Running the contact or contacts up through the protective device provides the advantage of visual inspection of the contact being made with the cutter.

It can be appreciated that the present invention permits an individual to selectively eradicate weeds of all sizes in any terrain that the device can traverse. It may take several passes in order to eradicate the sprouts from seedlings and stumps.

Further, if in the form of an add on and removable kit, the trimmer can also be used in conventional fashion (without electricity) to maintain ground cover.

The invention may also be used on trimmers having wheels.

It should be noted that it is preferable to locate the contact 42 or contact point, whether on the lower or upper face of the cutter blade, as close to the central axis of the rotating cutter blade as possible. Such minimizes the wear of the contact against the cutter blade per revolution of the cutter blade.

WO2007052007
METHOD OF CONTROLLING VEGETATION

Inventor(s): HOLLAND ROBERT ERIC BRADWELL, et al.

A method of controlling vegetation having persistent roots or rhizomes comprising the steps of applying electricity to said vegetation to effect current flow through said roots or rhizomes so as to traumatise said roots or rhizomes and thereby stimulate recovery growth; and after a period of recovery growth, performing a second destructive treatment upon said vegetation.

Background of the Invention

The present invention relates to a method of controlling vegetation having persistent roots or rhizomes, where rhizomes are underground shoots.

Invasive weeds cause many problems, including penetrating concrete structures, roadways and housing developments, as well as preventing other more desirable species from flourishing. Many of these weeds are very difficult to control, given that they have persistent roots or rhizomes. One specific problem caused by persistent roots or rhizomes is that the weeds are able to regenerate from a small portion of the roots or rhizomes. If, during attempts to control the weed, these persistent roots or rhizomes are damaged in any way, this damage actually encourages recovery growth, given that this is one of the weed's methods of reproduction. Japanese Knotweed is one such invasive weed. It grows very densely and is extremely destructive. It grows to around 3 metres tall above ground and has a rhizome system underground that extends out up to 7 metres from the plant and up to 4 metres downward into the ground. It also has a dense mass of root-like material which sits at the surface of the soil called the crown. Japanese Knotweed is a particular problem near watercourses where dense clumps can block drainage channels and inhibit the growth of native species. It is estimated that the cost of control for Japanese Knotweed in the UK runs into several billion pounds. The weed is resistant to conventional weedkillers and control by chemical means requires repeated applications over many years. The most effective chemical treatments are not suitable to be used near water or trees, because of their toxicity.

The form of control which is currently most widely used is the chemical glyphosate. Glyphosate can only be used when the plant is in full leaf, and therefore can only be used once or twice per season. It generally takes five to ten years of treatment to fully kill the weed, although the weed can go into a dormant state more quickly than this. It can then remain dormant for anything up to 25 years. In the dormant state the knotweed will reappear if the ground is disturbed in any way. A further problem with glyphosate is that its use often results in the knotweed growing back looking like a miniature version of its former self, with much smaller stems and leaves. This means that the general public often mistake this miniature version for a different plant, and therefore do not re-treat the weed. The knotweed then quickly grows back to its original size and its treatment has to start again from scratch. Some formulations based on glyphosate can be used near watercourses but controls on residual chemicals allowed in drinking water supplies prevent these being used in many of the areas where the weed grows.

Another known approach to the knotweed problem is mechanical destruction of the plant. This could be the cutting down of the plant or covering it with an impenetrable membrane. There are two major problems with this method. The first is that because the weed keeps large reserves of energy below ground, it takes approximately 10 to 15 years to eradicate the weed.

Given the persistent nature of knotweed rhizomes this is highly undesirable because the plant is able to propagate from tiny fragments. This means if a field full of knotweed is cut down and the rhizomes pulled up, every last fragment must be removed and the soil removed or replaced to prevent re- infestation. This is clearly a huge drain on resources.

A further known method of control is biological control. This involves introducing an organism, for example an insect or a virus, which is known to be destructive towards Japanese Knotweed. Use of biological methods is not yet effective enough to control knotweed without also using other methods.

Brief Summary of the Invention

According to an aspect of the present invention, there is provided a method of controlling vegetation having persistent roots or rhizomes comprising the steps of: applying electricity to said vegetation to effect current flow through said roots or rhizomes so as to traumatise said roots or rhizomes and thereby stimulate recovery growth; and after a period of recovery growth, performing a second destructive treatment upon said vegetation.

Brief Description of the Several Views of the Drawings

Figure 1 shows a site infested with Japanese Knotweed, ready to be treated according to the present invention;

Figure 2 shows components contained in trailer 102 and applicator 103 as shown in Figure 1;

Figure 3 shows an operator treating Japanese Knotweed according to the present invention; Figure 4 shows a schematic cross-section through a Japanese Knotweed plant;

Figure 5 shows a damaged rhizome;

Figure 6 shows the rhizome shown in Figure 5, with some recovery growth; Figure 7 shows a second treatment being applied to the Japanese Knotweed; and

Figure 8 shows removal of the crown.

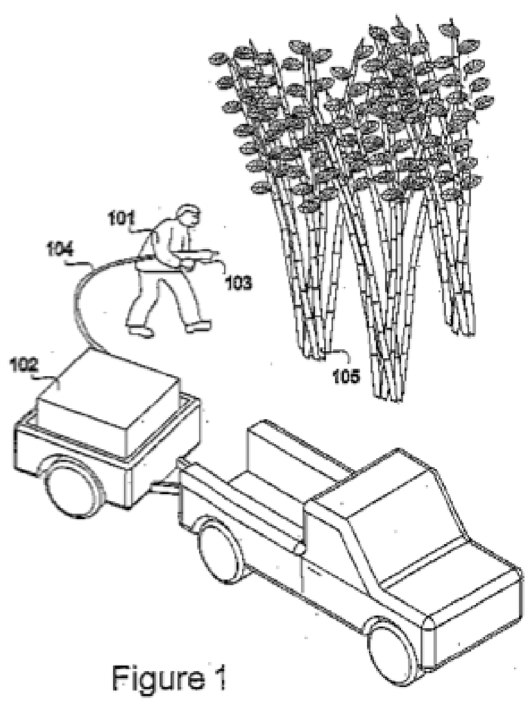


Figure 1

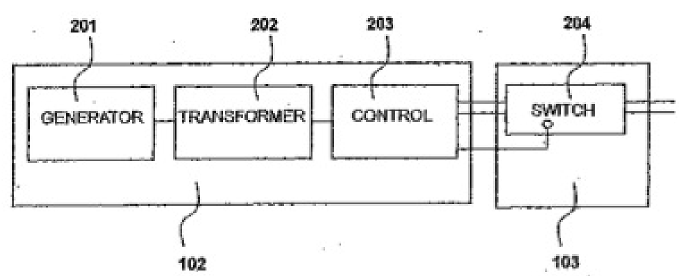


Figure 2

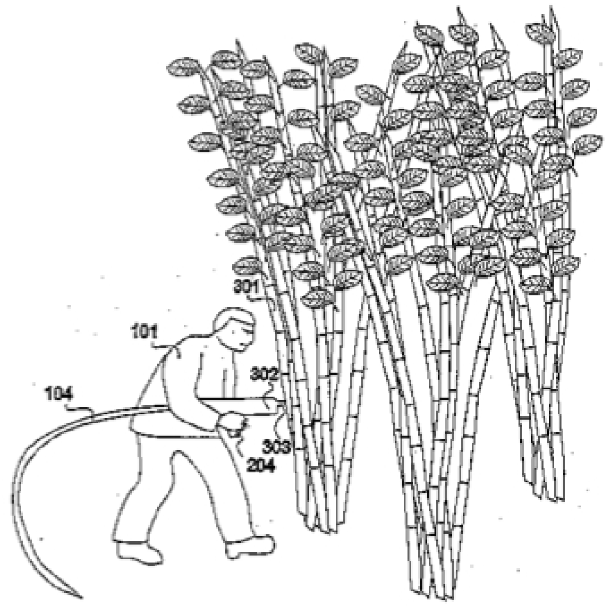


Figure 3

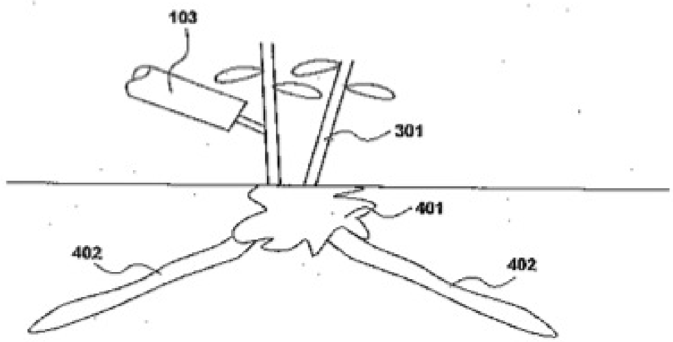


Figure 4

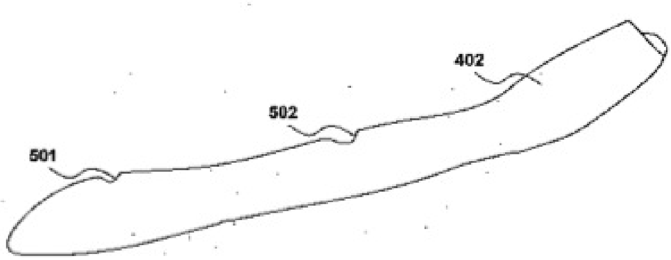


Figure 5

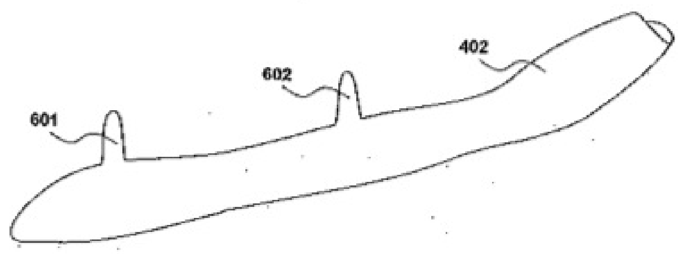


Figure 6

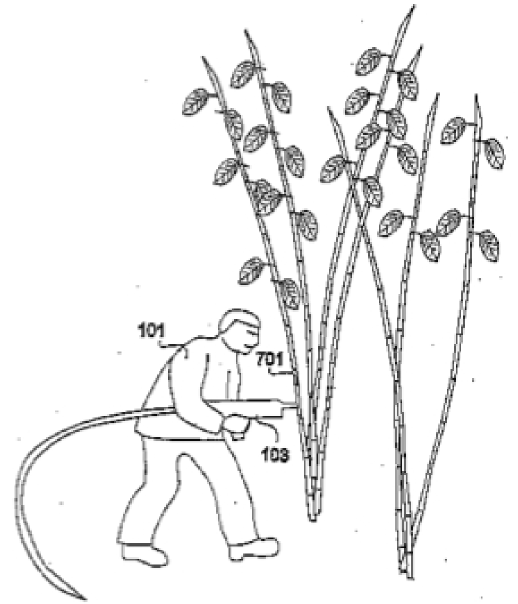


Figure 7

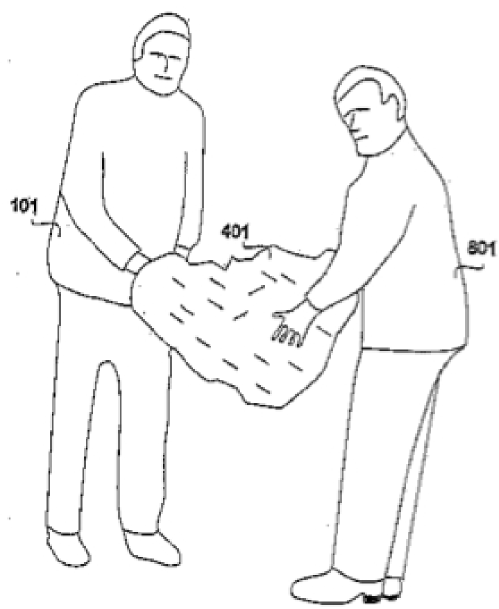


Figure 8

Written Description of the Best Mode for Carrying out the Invention

Figure 1

Figure 1 shows a site infested with Japanese Knotweed, which is to be treated using a method according to an embodiment of the present invention. Depending upon the time of year and the level of infestation, a pre-treatment step involving the use of chemical or mechanical control may be included before the electrical treatment is conducted.

Operator 101 arrives at the scene with trailer 102. Trailer 102 contains electrical equipment which is detailed in Figure 2. Operator 101 is holding an applicator 103 which is linked to trailer 102 by cable 104. Operator 101 is preparing to treat the Japanese Knotweed shown at 105 with applicator 103, as explained in the description of Figure 4 below.

Figure 2

Components contained in trailer 102 and applicator 103 are illustrated in Figure 2. A generator 201 generates electricity which is passed to transformer 202 which is in turn linked to control unit 203. In the present embodiment components 201 to 203 are contained in trailer 102, although in alternative embodiments one or more of these components are contained in a unit which can be carried by the operator, such as a backpack type device, or incorporated into the applicator 103 itself. In a further alternative embodiment, the equipment is scaled up such that applicator 103 is incorporated in a vehicle, such as a tractor. Switch 204 connects to control unit 203, and serves to switch the current flow on and off. In this embodiment switch 204 is contained in applicator 103.

Figure 3

Figure 3 shows operator 101 applying electricity to a Japanese Knotweed stem 301, according to the present invention. Applicator 103 is positioned so that its conductive treatment portion 303 is in contact with stem 301. Applicator 103 is manufactured to be of a suitable length to ensure both ease of use and operator safety. When switch 204 is in the "on" position, electricity is supplied from generator 201 , along cable 104 to applicator 103. In a preferred embodiment operator 101 checks the area before treatment for metal debris which might accidentally be contacted in the ground nearby. Depending upon the configuration of the equipment, it may be necessary to undertake a calibration process of determining the correct voltage level for a specific plant before treatment can begin. This may be in the form of trial and error applications, or may be automated in some way. In the present embodiment, the experience of the operator is relied upon in selecting the correct voltage level. If the voltage level is too high there is danger of the current arcing back to earth (either straight from applicator 103 or from part way down stem 301). This means that the current hasn't been transmitted down into the roots or rhizomes and therefore recovery growth will not be stimulated. Alternatively, if the voltage is too low the current will not be passed down into the roots or rhizomes.

The voltage required to initiate damage to the stem when the applicator is first applied is often much higher than that required to continue the process. When cells in the stem burst, and cell electrolytes are released, the plant stem impedance decreases. Because of this effect, in an embodiment of the present invention the voltage applied is varied to achieve a controlled current as the plant becomes gradually more damaged. Control unit 203, in this embodiment, measures the degree of damage as it takes place and controls the current through a feedback loop. Use of a controlled current also assists in avoiding generator overload.

In an alternative embodiment, it is desirable to begin with a relatively low voltage and build up the current flow gradually. This approach is particularly useful if the plant stems are wet, or if weed control is being carried out in an area where there may be metal debris in the ground nearby. In a further alternative embodiment, a combination current waveform is used. An example of this is that one or more high voltage pulses are output to initiate the stem damage, with application of controlled current inbetween. This serves to maximise the damage to the plant without putting undue strain on the generator.

Cable 104 enters applicator 103 at the end of its insulating handle 302. Electricity is passed from cable 104 to conductive treatment portion 303, which passes through a bore of insulating handle 302. In alternative embodiments there is an insulated portion which does not form a handle, for example if applicator 103 is mounted onto a tractor.

A potential is applied to the stem 301 to effect current flow down through the root or rhizome system below the ground, which therefore forms part of the electrical circuit back to the generator. In this embodiment, a potential of approximately 2 kilovolts is applied, although in alternative embodiments a potential of any magnitude greater than 100V would be applied. In the present embodiment this current is an alternating current with a frequency of 50 Hertz. The frequency used in alternative embodiments would vary according to the generator used. In alternative embodiments a direct current is used instead.

Figure 4

Figure 4 shows a schematic cross-section through a Japanese Knotweed plant. Applicator 103 is placed into contact with stem 301, and in this embodiment operator 101 would then operate switch 304 in order to apply electricity to stem 301. The electricity passes down stem 301 (below the site where applicator 103 touches stem 301) and into crown 401. Crown 401 is a large mass of root-like material, which sits at the surface of the soil. From crown 401 the electricity passes into the rhizome system 402. An enlargement of a rhizome that is part of system 402 is shown in Figure 5. Electricity is applied through applicator 103 to stem 301 to effect visible damage to the stem. In a preferred embodiment, the water in parts of these upper parts of the plant becomes superheated and therefore vaporised, causing stem 301 to collapse. In an alternative emboidment, treatment continues until all visible parts of the plant which are above ground appear to be dead. However, in further alternative embodiments, the damaged stems are left to dry out, or removed by other means such as mechanical cutting. All parts of the plant above ground need to be destroyed because the weed would otherwise re-grow from even the smallest remnant, due to its .infectious nature.

Figure 5

Figure 5 shows a rhizome which has been damaged by the passing through of an electric current in accordance with the present invention. Damage has occurred at points 501 and 502. The result of this damage is shown in Figure 6.

Figure 6

Figure 6 shows the rhizome illustrated in Figure 5, after recovery growth has begun.

Because knotweed has persistent rhizomes, wherever damage occurs, the rhizomes will bud and recovery growth will begin. Therefore, at each of the points 501 and 502 where damage had occurred, new growth is now emerging as shown by shoots 601 and 602.

The growth of shoots 601 and 602 uses up some of the energy stored in crown 401 and rhizome system 402. Given that the parts of the plant which were above ground were destroyed by the application of electricity, the plant now has no means for generating further energy, as it cannot photosynthesise without its leaves. This means that by inducing recovery growth and killing the parts of the plant which are above the ground, the method is forcing the knotweed to use its reserves of energy and therefore eventually "burn out". Although the presence of recovery growth means that the knotweed is not destroyed immediately, after repeated treatments the knotweed gradually runs out of energy reserves and will eventually die. This is achieved significantly sooner than eradication would be achieved by purely chemical means. As Japanese Knotweed grows very rapidly, within a timeframe of approximately two weeks to a month the shoots 601 and 602 will be sufficiently strong to be treated again. This is shown in Figure 7.

Figure 7

Figure 7 shows one option for a second treatment of the knotweed.

As is shown in Figure 7, when the recovery growth (as illustrated in Figure 6) emerges from the ground it is much weaker and more spindly than the original knotweed plants. This weaker regrowth is treated, either by re-application of electricity as described above, or, depending upon the location of the infestation, it can be treated with a chemical such as glyphosate, or by mechanical treatment such as cutting.

In Figure 7, operator 101 can be seen to be treating regrowth stem 701 with applicator 103. In a preferred embodiment, the application of electricity is repeated several times, each time the regrowth becoming weaker as the reserves of energy held in the crown are depleted.

Figure 8

Figure 8 is an embodiment of the invention showing removal of the crown 401. After repeated treatments as described in Figures 1 to 7, possibly including some treatments with glyphosate or a similar chemical, the crown 401 or rhizomes 402 will have no remaining reserves of energy with which to effect recovery growth. At this point the crown 401 and/or rhizomes 402 can be removed from the ground by operators 101 and 801 and taken away from the site. In alternative embodiments, crown 401 is be removed by other means, such as earth moving equipment.

Because the present invention involves causing recovery growth and therefore uses up the reserves of energy, the crown is unable to go into a dormant state as it can with other methods of control. In a preferred embodiment the crown is incinerated after removal.

FR2492631

Destruction of weeds using high-tension electricity source - uses long conductive bar from which series of

metal conducting wires extend

Inventor(s): DORVAL EDMOND DANQUECHIN

The device for destroying vegetation comprises a horizontal, electrically conducting bar (1) which extends transversely to the direction of motion of the device. An array of metal wires (2,3,4) are in electrical contact with the upper bar and depend from it. The parallel wires may be in the form of a rake and may be bent or curved at their distal ends. The wires are inclined to the direction of motion and are pref. spaced apart by between 5 and 20 cm and pref. by between 8 and 10 cm. The device is connected to a high tension electricity source.

The invention relates to the electrical destruction of the plants.

In known manner, this technique consists of contacting the plant with a conductive member electrically.

This member is connected to one terminal of a high voltage electric source whose other terminal is electrically connected to ground, for example by a kind of small plow.

The main problem in this technique is the quality of the mechanical contact and therefore power, between the plants and the electric organ. It is clear that the quality of the destruction is better as the contact is prolonged in time and is done over a large area.

The object of the invention is therefore to improve the contact between the plants and the conductive member electrically.

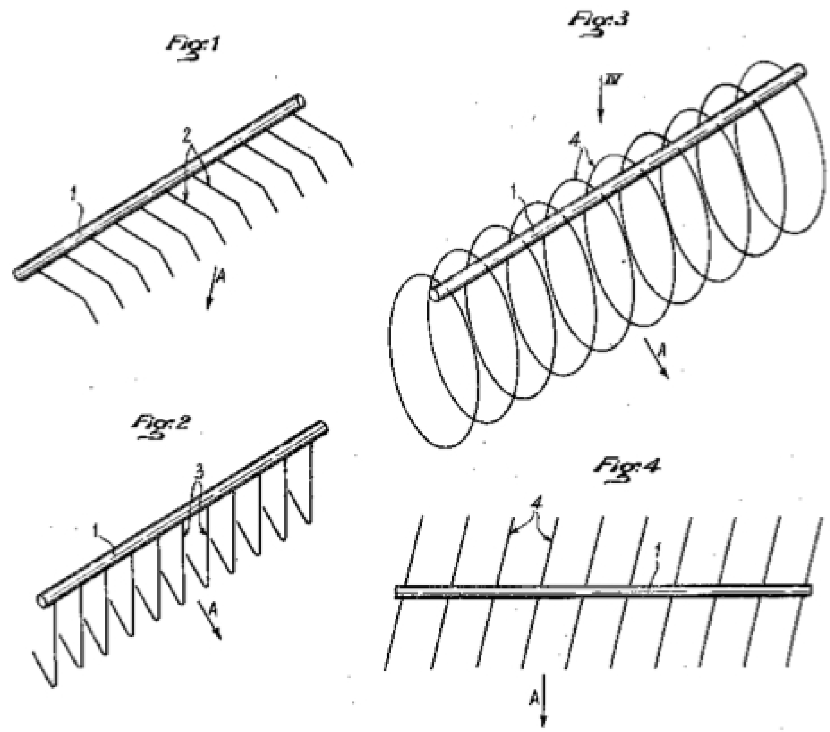
For this purpose, the device according to the invention is characterized in that the conductive member is constituted by a horizontal bar, extending transversely to the displacement direction of the device and carrying a large number of metal lic son, drivers electricity, electrically connected to the bar and extending downward with respect thereto.

Preferably, the son present on at least part of their extent, a direction in plan view, has a transverse component relative to the feed direction.

More preferably, the son are flexible.

The electrical contact of the son with the plant may be either dry or with a liquid supply promoting electrical connection, for example water.

The transverse spacing is about 5 cm to 20 cm, preferably 8 cm to 10 cm.



Although the invention will be understood on reading the following description and with reference to the accompanying drawings in which Fig. <RTI> 1 </ RTI> is a perspective view of a device according to one embodiment of <RTI> invention </ RTI> Fig. 2 is a perspective view of a device according to a variant Fig. 3 is a perspective view of a device according to another embodiment; and Fig. 4 is a plan view according to IV of the device of FIG. 3.

In FIGS. <RTI> 1 </ RTI> to 4, 1 denotes a bar, electrically conductive, which extends transversely to the feeding direction A with respect to the plant (not shown). The rod 1 is supported by a common device or towed by a tractor and is electrically connected to a terminal of a high voltage power source whose other terminal is connected to ground by a kind of small plow. This <RTI> Layout </ RTI> is known luimême and described in the French patent application <RTI> NO </ RTI> 80 00477 filed on <RTI> 10 </ RTI> in January 1980 by the applicant.

According to the invention, to provide mechanical and intimate and lasting electrical contact with the plants to be destroyed, we do bring to the bar 1, in electrical connection with it, a large number of metal son, electrically conductive, which < RTI> s'retendent downward from celleci. </ RTI>

In the embodiment of FIG. 1, 2 the son have generally the form of rake teeth. They are mutually parallel. One of their <RTI> extremities </ RTI> is subject to <RTI> 1 bar </ RTI> while the other end is free. The son can be either straight or bent, curved or angled.

They extend in the 1 bar and slightly behind celleci each being in a vertical plane containing the feed direction A; if any, each wire 2 can at least with - tie be in a vertical plane inclined to the direction A or in an oblique plane.

In the variant of FIG. 2, the son 3 are the same type as the son of Figure 2. 1 <RTI> 7 </ RTI> however they differ in that, from the bar 1, they first have a rectilinear vertical portion and a lower end portion bent at <RTI> 90 "</ RTI> backward, parallel to the direction A.

In the variant of fig. 3 and 4, the son 4 are shaped identical rings, each in a vertical plane, both ends of which are subject to the bar 1. On each ring plan can be either parallel to the direction A or, as shown, inclined to that direction. According to -variante, each ring may be in an oblique plane.

According to another variant, not shown, the son can be formed by successive turns of a continuous wire arranged in a helix that is linked to a rod 1 along a generatrix.
In all embodiments, the son are preferably flexible.

The electrical contact between the plants and the son can be either dry or, if appropriate, with addition of a liquid promoting the electrical connection, for example water.

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http://www.sciencedirect.com/science/article/pii/0022474X9290005B
Journal of Stored Products Research, Volume 28, Issue 4, October 1992, Pages 251-256

Effect of microwave heating on quality and mycoflora of sorghum grain

Hari G. More, Naresh Magan, Brian C. Stenning

Abstract

Sorghum (cv. Maldandi M35-1) was modified to 12, 14 and 16% moisture content (m.c.) and heat-treated with microwave energy at 3 levels, for 30 sec (=4.5, 9 and 18 kJ), and 60 sec (=9, 18 and 36 kJ). The effect of microwave heating on rise and subsequent fall in grain temperature, reduction in m.c. and quality characteristics including germination, seedling dry matter, free fatty acids (FFA) and contaminant fungi was determined. The temperature attained and the moisture loss in the sorghum grain was affected by grain m.c. and the time of exposure. At the lowest and highest microwave treatment level grain temperatures reached 30–40°C and 90–101°C, respectively. However, a 60-sec treatment at the highest energy level was lethal for the grain, particularly at 14 and 16% m.c. The FFA values were unaffected by microwave treatment. Statistical analyses showed that the microwave power level and time individually, and power level × time interactions were significant for most quality characteristics. The fungi present most abundantly on the sorghum grain were Eurotium spp., Aspergillus candidus, A. niger and Penicillium spp. Increasing m.c. and microwave heating resulted in elimination of most fungi after a 30-sec exposure time. With a 60-sec exposure period, practically all fungi were eliminated from the grain.

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A New Approach of Electric Field Adoption for Germination Improvement

Waman Ziblaji Gandhare, Mamta Samir Patwardhan

1Government College of Engineering, Amravati, Maharashtra state, India
2Department of FSRE, Dr. A. S. College of Agricultural Engineering, MPKV, Ahmednagar, Maharashtra state, India
Email: wz_gandhare@yahoo.com, patmam@sify.com

Abstract

Enhancement of tomato seed germination is one of the most important factors for developing a supply chain of increased demand. Tomato is one of the important cash crops in the world. To fulfill increased requirement, electric field adoption is the best alternative. The study was undertaken at MPKV, Rahuri for improvement in tomato seed germination. Three different approaches were utilized as electrostatic field, microwave and corona discharge method to treat tomato seeds. The comparative analysis revealed that adoption of electrostatic field application was simple as well as powerful method with significantly positive results. In electrostatic field, the optimal dosage was 2 kV/mm for 20 second interval to improve germination, root shoot length and seed vigor.

1. Introduction

Experimental study of the effects of electricity on plant growth began in 1746. Early researchers discovered the application of electricity in agriculture for different purposes such as for seed treatment, seedling growth, plant growth, insect control and so on. Although their research aims were good, their apparatus, experimental designs and methods, process, dosage, amplitude of voltage, and the treatment time were not scientific so that they often got contradictory results [1].

The application of electricity, magnetism, monochrome light and sound can stimulate the growth of plants to a great extent. The energies are applied to the seeds, plants, soil or the water and nutrients. This technology termed as electro-culture, can protect plants from diseases, insects and frost. These methods can also reduce the requirements for fertilizer or pesticides [2].

It is well known that currents of electricity exist in the atmosphere. Clouds are charged and discharged. There is constant change of electricity from earth to air and from air to earth. The earth is the reservoir for all electrici- ty. The electricity is the potent factor in the economy of nature and has more to do with the growth and devel- opments of plants. Plant food is carried throughout the plant by means of the flow of sap, these currents circulates through all rootlets and centre as it were, in the stalk, carrying their tiny burdens of various elements and depositing them in the proper places. This phenomenon of sap circulation can be doubled due to electricity [3].

The several approaches of electricity were reviewed [4]. Morar [5] experimented with electrostatic field ranging 2 to 6 kV/cm with exposure time of 1 to 30 sec. for bean seeds. Huang [6] treated cucumber seeds with field strength of 1 kV to 7 kV/cm. Efe [7] conducted experiments with corona shocking instrument for cotton seeds. Pozeliene [8] processed rapeseeds with corona discharge field in the conveyer type electric separator. Zhou [9] designed new atmospheric plasma device, to explore approximate voltage of plasma treatment for tomato seeds. Aladjadjiyan [10] treated lentil seeds by using microwave of 2 - 45 GHz. frequency. More [11] utilized microwaves for sorghum.

Out of these all possibilities, it was felt that electrostatic field, microwave field and corona discharge methods were prominent. Hence a comparative study was undertaken to verify the effects of high voltage application for tomato seed treatment. Based on these pretreatments of seed before sowing, the study was planned.

2. Experimental Procedure

As described above, three methodologies were adopted for tomato seed treatment. Seeds of tomato cv. Dhansh- ree developed by MPKV, Rahuri were used for trials. Germination tests were conducted as per ISTA standards.

2.1. Electrostatic Field Treatment

The test cell consisted of two horizontal electrodes, connected to a fully adjustable ac high voltage supply of 0 to 5 kV, 50 Hz. The disks were covered with thin insulating films to avoid contact between the seeds and elec- trodes. Several laboratory tests were conducted to determine high-intensity electric field exposure causes any change in germination. The voltage gradient of 1 kV, 2 kV, 3 kV/mm with time duration of 10, 20, 30 seconds were finalized.

2.2. Microwave Energy Treatment

The influence of microwave irradiation on Tomato seeds has been investigated. A magnetron with frequency of radiation 2.45 GHz and maximum output power 900 w according to supplier data has been used as microwave source. Several laboratory tests were carried out and power levels as well as duration of irradiations were fixed as 90%, 70%, 60% of power and 10, 20, 30 seconds for time.

2.3. Corona Discharge Method

Plasma has been used for seed mutation. Atmospheric plasma discharge equipment was used. It had two parallel high voltage electrodes. Seeds were put under atmospheric pressure plasma, the plasma would bring a mass electron, ion and ozone, and the mass electrons were faster. The ozone was the main component to react on to- mato seed for mutation. Various trials were carried out and operating voltage levels as 2 kV, 4 kV and 6 kV were fixed with time interval 15, 10, 5 second at high frequency of 15 kHz.

For these all methods, germination tests were carried out. For each method nine variable combinations of vol- tage and time were considered. One untreated seed lot was used as control. Each seed lot was of 50 seeds. Three replications were utilized for statistical analysis. Germination trials were carried out in seed germinator where temperature and humidity was maintained at 25℃ at 80% relative humidity. Similarly same seeds were also sown in the plugs filled with soil having sufficient moisture well suited as open field conditions. Germination percen- tage was calculated as per standards. Additionally, root shoot length and seed vigor study was also completed.

3. Results and Discussion

After seeds were treated, germination trials were started immediately. The germination percentage were counted as first day count and final count on fourth and fourteenth day as per ISTA norms. Tables 1-3 show the changes in seed germination percentage due to adoption of different methods of electric field exposure.

3.1. Germination Improvement Based on Electrostatic Field Exposure

Table 1. Results of germination improvement due to electrostatic field application.

Table 1. Results of germination improvement due to electrostatic field application.

Treatment		Germination (%)		
		R_1	R_2	R_3
V_1T_1	1 kV, 10 Sec	98	100	98
V_1T_2	1 kV, 20 Sec	98	98	100
V_1T_3	1 kV, 30 Sec	98	98	98
V_2T_1	2 kV, 10 Sec	100	98	98
V_2T_2	2 kV, 20 Sec	100	100	100
V_2T_3	2 kV, 30 Sec	100	98	98
V_3T_1	3 kV, 10 Sec	98	98	98
V_3T_2	3 kV, 20 Sec	98	100	98
V_3T_3	3 kV, 30 Sec	100	100	99
Control		92	92	92

Table 2. Results of germination improvement due to microwave field application.

Treatment		Germination (%)		
		R_1	R_2	R_3
P1T1	90%,10 sec.	100	98	98
P1T2	90%, 20 sec.	100	100	98
P1T3	90%, 30 sec.	100	98	98
P2T1	70%, 10 sec.	98	98	98
P2T2	70%, 20 sec.	100	100	99
P2T3	70%, 30 sec.	98	98	98
P3T1	60%, 10 sec.	96	98	98
P3T2	60%, 20 sec.	98	98	98
P3T3	60%, 30 sec.	98	94	98
Control		92	92	92

Table 2. Results of germination improvement due to microwave field application.

Table 3. Results of germination improvement due to corona field application.

Treatment		Germination (%)		
		R_1	R_2	R_3
V1f1	2 kV, 15 Sec	100	100	98
V1f2	2 kV, 10 Sec	98	100	98
V1f3	2 kV, 5 Sec	98	98	96
V2f1	4 kV, 15 Sec	96	96	94
V2f2	4 kV, 10 Sec	100	100	100
V2f3	4 kV, 5 Sec	96	96	96
V3f1	6 kV, 15 Sec	96	96	96
V3f2	6 kV, 10 Sec	96	98	96
V3f3	6 kV, 5 Sec	96	98	94
Control		92	92	92

Treatment

As per standards, the perti dishes were used for each lot with three replications. The electrostatic field exposure apparatus was designed and developed for demonstration purpose. With reference to so many trials, treatment parameters were finalized. On fourteenth day, germination count was noted. Table 1 revealed that the treatment V2T2 was significantly good. Basically all treated seeds showed better results.

3.2. Germination Improvement based on Microwave Field Exposure

Similar to electrostatic field exposure, another set up was arranged for microwave field treatment. For further large scale set up, different unit of industrial microwave set up was proposed for installation in process of seed treatment unit. The results were encouraging in comparison with untreated one. Table 2 recommended P2T2 treatment of 70% power level with 20 second time of application for enhancement.

3.3. Germination Improvement based on Corona Discharge Field Exposure

Alternative method of corona discharge field exposure was also tested for seed treatment before sowing in petri dishes. Based on prior trials, working high voltage level and speed based time setting combination were finalized. Table 3 represented results confirmed that there was positive effect on corona discharge field on seed germination process. The moderate voltage and speed was the best option for optimum results.

The development of root shoot for electrically treated tomato seeds was faster as in Figures 1-3.

This germination process was related to basic mechanism which explains stimulating effects of electric field exposure. Ozone generation by partial discharges between seeds and the activation of OH radicals under the action of the high-intensity electric field was assumed to be responsible for the intensification of the biological processes. The processes had been reported to be time dependent. The above described seed exposure processes were employed at three different high voltage levels. Laboratory tests showed that the germination energy of the treated seed samples increased as compared to untreated ones (Figure 1) for electrostatic field exposure.

3.4. Some Common

• Quotation marks are used, instead of a bold or italic

Figure 1. Graphical presentation for effect of elec- trostatic field on root shoot length.

Figure 2. Graphical presentation for effect of micro- wave field on root shoot length.

Figure 3. Graphical presentation for effect of corona field on root shoot length.

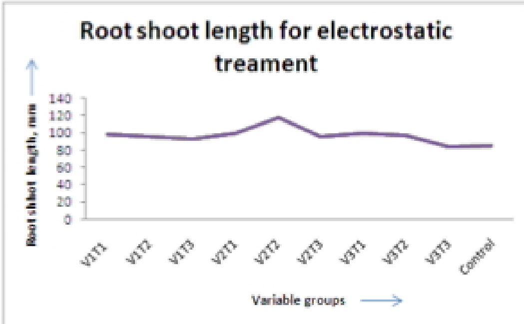

Figure 1. Graphical presentation for effect of electrostatic field on root shoot length.

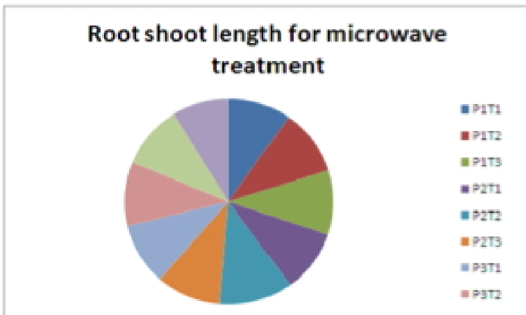

Figure 2. Graphical presentation for effect of microwave field on root shoot length.

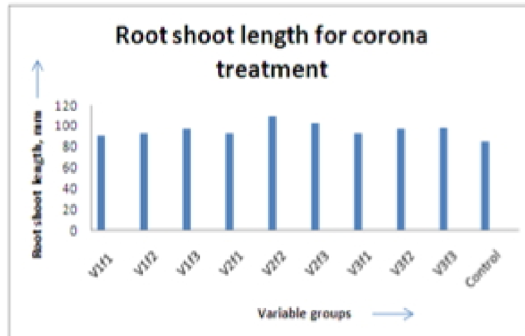

Figure 3. Graphical presentation for effect of corona field on root shoot length.

Ozone generation by partial discharges between seeds seems to be the main effective parameter to enhance the growth. Thus with adoption of electric field for seed treatment, the germination and seed vigor can be im- proved. Ultimately it results in maximum yield. The food production may be increased. As per review [3], this technique results in reduced fertilizer and pesticide requirement that will be the added advantage.

Comparative study reflects that the method of electrostatic field exposure was the best.
It was found easy for adoption too. A simple circuit incorporated in this treatment may give advantage of cost effectiveness for com- mercial approach.

This will help rural development and create tremendous wealth in these areas. But still technology needs to go a long way in the process of research and development so that it can be made available at economical rates and the feasibility can be increased.

4. Conclusions

• The application of electrostatic field, microwave irradiation and corona discharge methods had a prominent impact on seed germination.

• The adoption of electrostatic field is most superior method for seed enhancement. Due to simplicity, this technique is suitable for commercialization.

• The voltage gradient of 2 kV/mm, 20-second interval is the optimal value for best results.

• Better results are observed for older seed lots for improving germination count and seed vigor.

• In Indian scenario, there is a need to apply these methods to improve growth, yield and minimize the fertilizer/pesticides requirements.

Acknowledgements

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Electrostatic treatment of bean seeds

Morar, R. ; Dept. of Electr. Eng., Tech. Univ. of Cluj-Napoca, Romania ; Munteanu, R. ; Simion, E. ; Munteanu, I.

The classical methods of seed treatment make use of chemical substances which are either expensive or harmful to the soil. This paper demonstrates that exposure to the action of a high-intensity electric field can be an effective substitute for the chemical agents. The experiments were carried out on bean seeds (Phaseolus vulgare), naturally infected with Colletotrichum lindemuthianum. Under normal conditions (no treatment), only about 30% of a reference sample of such seeds germinated. Other samples were subjected to 50 Hz electric fields ranging from 2 to 16 kV/cm with exposure time ranging from 1 to 30 s. In the optimum laboratory test, more than 99% of the seeds germinated. The weight of the resulting bean plants was significantly greater than those grown from nontreated seeds.

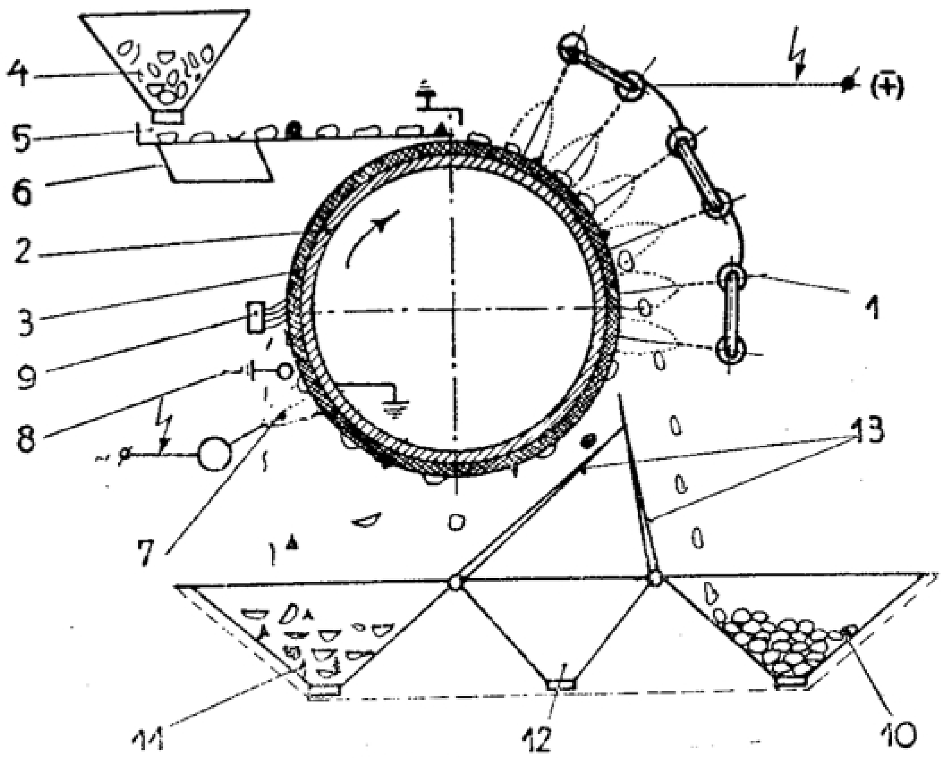
The field tests proved the efficiency of this method, which could be successfully employed for the prevention or treatment of various seed-transmitted diseases of plants. Ozone generation by partial discharges between seeds

seems to be the main sterilizing agent, while the activation of OH radicals under the action of the high-intensity electric field may explain the intensification of the biological processes. The automated seed treatment installation proposed in this paper consists of a plate-type capacitor, supplied from a 75 kV 50 Hz generator. Special devices ensure the rapid transfer of the material to and from the seed treatment cell. The method and the apparatus for seed treatment have been patented. [RO96493 : INSTALLATION FOR CLEANING AND SEPARATING LEGUMINOUS SEEDS]

RO96493
INSTALLATION FOR CLEANING AND SEPARATING LEGUMINOUS SEEDS

ABSTRACT

The invention relates to a plant for cleaning and separating impurities and cranny of bean seeds for sowing and consumption. The seeds for election are inserted in the plant of the invention in an intense electric field generated by some active electrodes Corona-powered pulse voltage, all mixed particles uploading is electrically charged, seeds, whole pulses moving along paths determined by centrifugal forces and gravity, the compartment seeds useful and broken grains legumes, seeds of weeds, loose soil and stone crop residues is fixed to an electrode under the action of electrical image and then drawn through an electrode Corona neutralizing a scraper and brush. I; Nventa the following advantages: reduce the number of cars required conditioning seeds, reduces power consumption, ensure high biological quality seeds bright.



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A Novel Atmospheric Pressure Plasma Fluidized Bed and Its Application in Mutation of Plant Seeds

Chen Guang-Liang, Fan Song-Hua, Li Chun-Ling, Gu Wei-Chao, Feng Wen-Ran, Zhang Gu-Ling, Wang Jiu-Li, Latif K., Zhang Shu-Gen, Wang Zhen-Quan

Abstract

An atmospheric pressure plasma fluidized bed (APPFB) is designed to generate plasma using a dielectric barrier discharge (DBD) with one liquid electrode. In the APPFB system, the physical properties of DBD discharge and its application in plant-seed mutating are studied fundamentally. The results show that the generated plasma is a typical glow discharge free from filament and arc plasma, and the macro-temperature of the plasma fluidized bed is nearly at room temperature. There are no obvious changes in the pimientos when their seeds are treated by APPFB, but great changes are found for coxcombs.

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Introduction of a new atmospheric pressure plasma device and application on tomato seeds*

Zhuwen Zhou, Yanfen Huang, SizeYang, Wei Chen

ABSTRACT

We designed new atmospheric pressure plasma device, to explore appropriate voltage of plasma treatment that promote traits and yield of to- mato, tomato seeds were treated by plasma at 4760 to 6800 V, and traits and yield of tomato were observed. The results showed that the ef- fects of different voltage plasma treatments on seed germination were not the same. The bloom times, the height, the caulis, the extent of the plants and the average weight, length,diameter of each fruit in the seven treatment groups from 4760 to 6800 V were increased distinctly. The tomato yields of seven different plasma voltage treated groups were increased than the untreated (CK). In most indexes of our tests, ef- fects of (5440 ~ 6120 V) plasma voltage treat- ments were better than of other voltages, the best was 6120 V plasma voltage treatment. So the tomato yield increase and the most the botany properties of the tomato are improved. The discharges were not uniform and the pow- ers were lower in low voltages (4760 ~ 5100V), and the discharge powers were higher in high voltages (6460 ~ 6800V). There was a step un- altered violet blue light from 5440V to 6120V, it was nearly uniform discharges, it maybe due to the energy of the electron and the active air particles in the plasma increasing with atmospheric plasma voltage adding, more electric charges are produced per unit time and cannot be neutralized at once, which can strengthen the reaction between the active air particles and seeds. The active air particles and ultraviolet radiation can penetrate into the capsule of the seeds,accelerate to decompose the inner nu- triment of the seeds, reduce relative penetrability of cell velum, improve the activities of the root of the tomato seedling. Test data of fruit yield of the tomato are consistent with the statistical regressive line.

1. INTRODUCTION

Applications of physical technology in agriculture are more and more popular, but most of them are radiations and irradiations with γ-ray, 60Co-ray, laser, electric and magnetic field,[1-13] cells of plant seeds are damaged by radiations.

Plasma has been used in industry for applications; few experimental studies have been carried out for seed mu- tation induced by atmospheric plasma. We used a atmospheric plasma discharge equipment [14,15] to study the mutations of plant seeds. The device is atmospheric dielectric barrier discharge (DBD) with two parallel high voltage electrodes. A mass of electrons bomb plant seeds and bring much ozone, because seeds were put under atmospherical pressure plasma, the plasma would bring a mass electron,ion and ozone, the mass electron were faster and bomb seeds,the ozone can kill bacterium and virus, and also plant seeds are radiated by ultraviolet-ray, plant seeds are mutated by the many factors. We tested with tomato seeds (No.10 Hongza), to study the effects of atmospheric pressure plasma on the seeds germination, seedling growth, fruit yield and quality of tomato, in order to find the methods of improving the plant growth and increasing fruit yield of tomato.

The test device is shown in Figure 1, it is two parallel containers made of quartz, the thickness of quartz is 1mm, the length is 15 cm, the width is 5cm, the space of dielectrics is 10mm. there are some liquid of potassium chloride in two containers, two inner copper rings dipped in the liquid are two electrodes connected to AC high voltage power supply 30 kV with frequency 8 ~ 30 kHz. Different plant seeds were treated with different plasma voltages, for example, tomato seed for 4760 ~ 6800V, eggplant seed for 4420 ~ 6800V [16], cucumber seed for 5610 ~ 7310V [15].

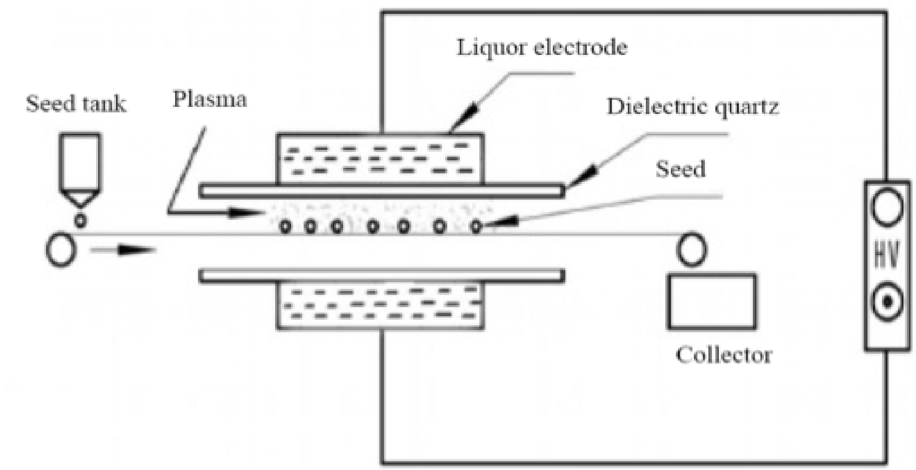


Figure 1. Schematic diagram of the atmospheric plasma dielectric barrier discharge (DBD).

As compact joined between the liquid of potassium chloride and dielectrics, both cool quartz dielectrics and uniform plasma were discharged. In our experiment, the tomato seeds were uniformly put on a transmission belt at constant speed, turned on high voltage power supply to discharge, the seeds passed through the plasma, treatment time were controlled by the speed of the belt. There were seven different voltage (4760, 5100, 5440, 5780, 6120, 6460 and 6800 V) treatments with the same treatment time 6 seconds, the different voltages were produced between two parallel high voltage electrodes and the plasma charges occurred in atmospheric pressure environment, therefore the experiment is called atmospheric dielectric barrier discharge (DBD). The process of treating the seeds by plasma device is shown in Figure 2.

Figure 2. Process of treating seeds by plasma device.

3. RESULTS AND DISCUSSION

We designed an atmospheric pressure plasma device. The tomato seeds were treated by different voltage from 4760 to 6800 V. The results showed that the effects of different voltages plasma treatments on seed germination and growth were not the same. The height (90 ~ 100cm), the caulis (> 14cm), the extent(> 55×60cm)of the plant and the single fruit weigh(t > 80g), the length(≥ 5.2cm), the diameter(≥ 5.5cm) of the tomato of seven treatments from 4760 to 6800 V were increased distinctly in Table1.

Table 1. Change of botany properties of the Tomato treated by different plasma voltage.

treat group	Treat voltage (V)	Plant height (cm)	Extent (cm×cm)	Caulis height (cm)	Root length (cm)	Incidence of virus (cm)	Bloom time (day)	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield (kg/667m^2)	Increased yield (%)
CK	0	90-100	55×60	14	17.3	4.17	16	5.0	5.5	80	2797	
1	4760	95-105	60×65	15	19.3	2.08	17	5.2	5.5	85	2921	4.43
2	5100	100-110	58×63	15	18.7	2.08	17	5.1	5.6	85	2997	7.15
3	5440	100-110	57×60	17	19.4	2.08	17	5.0	5.7	90	3260	16.55
4	5780	105-115	55×68	17	18.9	2.08	17	5.3	5.7	100	3365	20.31
5	6120	105-115	60×70	17	19.4	2.08	17	5.2	5.8	95	3540	26.56
6	6460	100-110	53×64	16	20.2	4.17	17	5.0	5.6	85	3142	12.33
7	6800	95-100	56×62	16	19.9	4.17	17	5.1	5.6	90	3172	13.41

In addition, anti-virus of seven treatments (incidence 2.08%) were better than the untreated except sixth and seventh treatment (incidence were as same as the un- treated 4.17%). The bloom times of all the treated seeds were longer and earlier than the untreated (CK), as well as the maturity time (Figure 3). The tomato yields of seven different voltage plasma treatments were increased, the fifth, the fourth and the third treatments were better than the untreated (CK), the yields of the three treat- ments increased 26.56%, 20.31%, 16.55% than CK. In Figure 4 there were obviously increasing yields of the tomato under the proper plasma treatment voltages ranges (5440 ~ 6800V), the figure showed that some experimental data compared with Gaussian distribution curve of the fruit yields of the tomato by using a regres- sion line estimate statistical method, the Gaussian distribution curve was regression equation:

$$y = a\,exp\left[-b(x-c)^2\right] + d\,,$$

The Gaussian distribution curve was comparatively convinced since the F-value was calculated: F =5675 > F 0.05(1, 5)=6.61, remain standard error: s = 0.02, it showed that the error was very small between real fruit yields and estimated. In 5440 ~ 6120 V voltage ranges, the fruit yields were better than other voltages. In most indexes of our tests, the effects of 5440 ~ 6120 V plasma treatments were better than of other voltages, the best was 6120 V plasma treatment, real test data of the fruit yields were consistent with the regressive line (estimated yield of forecasting).

Different voltage(4760 ~ 6800 V) plasma treating the tomato seeds were all better than the untreated (CK) in our experiments, the reasons might be that the treated seeds had been in different physical conditions, the atmospheric pressure plasma device was a dielectric barrier discharge (DBD),it created a typical glow discharge free from filament and arc plasma,[17] the macro-temperature of the plasma was nearly at room temperature, and plasma discharge gas pressure was atmospheric pressure. Because the seeds were passed through the plasma on the transmission belt, the seeds were treated with uniform plasma discharge and were not burned.

Figure 3. Growth of the tomato plants in the test farmland. The tomato seeds treated by plasma had more fruits than CK, and the treated were premature.

Figure 3. Growth of the tomato plants in the test farmland. The tomato seeds treated by plasma had more fruits than CK, and the treated were premature.

In Figure 5 there were seven different discharge proc- esses with seven different voltages, intensity of violet blue light (350nm ~ 500nm) gradually increased with voltage adding (see Figure 6), x axis denoted voltage, and y axis denoted the intensity of violet blue light on Figure 6. The discharges were not uniform using the lower powers in low voltages (4760 ~ 5100V), and the higher powers in high voltages (6460 ~ 6800V). There was a step unaltered violet blue light from 5440V to 6120V, it was nearly uniform discharges, it due to the energy of the electron and the active air particles in the plasma increasing with atmospheric plasma voltage adding, more electric charges are produced per unit time and cannot be neutralized at once, which can strengthen the reaction between the active air particles and seeds. The active air particles and ultraviolet radiation can penetrate into the capsule of the seeds,accelerate to decompose the inner nutriment of the seeds, reduce relative penetrability of cell velum, improve the activities of the root of the tomato seedling. Lower voltages (< 5440V) cannot penetrate into the seeds capsule and higher volt- ages (> 6120 V) can burnt the inner cells of the seeds

Figure 4. Regression line analysis of fruit yields of tomato. ‘o’ represents real yield, ‘—’ represents regression line (estimated yield of forecasting).

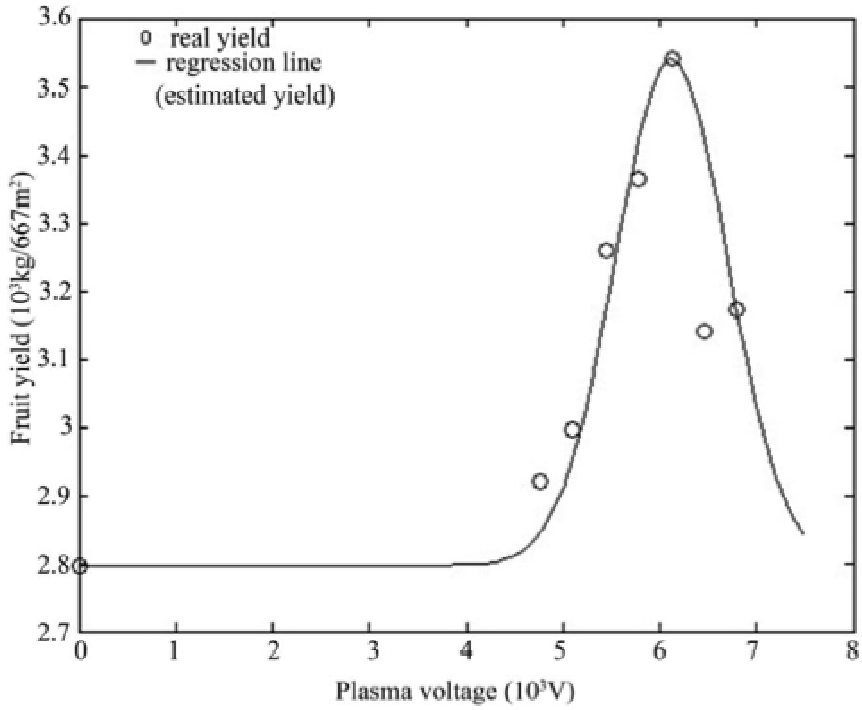
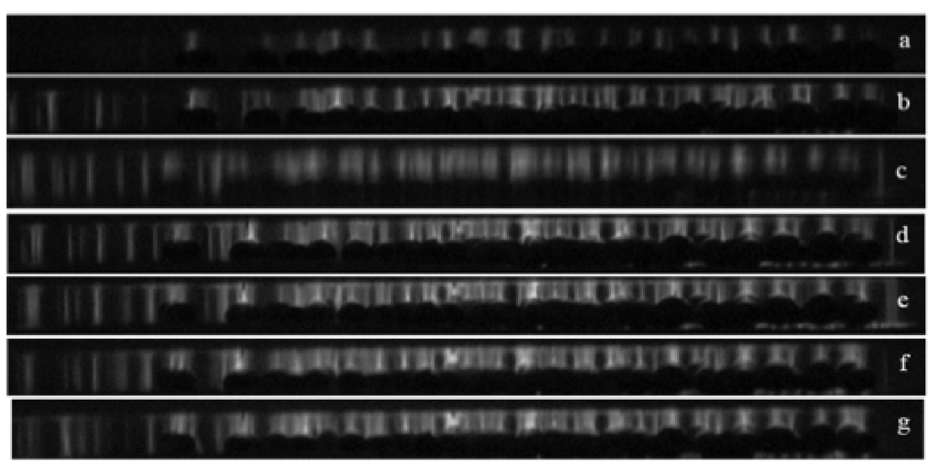


Figure 4. Regression line analysis of fruit yields of tomato. 'o' represents real yield, '—' represents regression line (estimated yield of forecasting).

Figure 5. Seven different discharge processes with seven dif- ferent voltages, intensity of violet blue light gradually in- creased with adding voltage. In figures a ~ b the discharges were not uniform and the powers were lower with low voltages 4760~5100V, and the discharge powers were higher with high voltages 6460V~6800V in figure f ~ g. There were uniform discharges under the middle plasma voltages 5440, 5780, and 6120V in figures c, d, e. of the tomato botany properties were improved.



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4. CONCLUSION

The tomato yields of seven different plasma voltage treated groups were increased than the untreated (CK). In most indexes of our tests, effects of (5440 ~ 6120 V) plasma voltage treatments were better than of other voltages, the best was 6120 V plasma voltage treatment. There was a step unaltered violet blue light from 5440V to 6120V, it was nearly uniform discharges, So the to- mato yields increased and the most of the botany proper- ties of the tomato were improved, it due to the energy of the electron and the active air particles in the plasma increasing with atmospheric plasma voltage adding, more electric charges are produced per unit time and cannot be neutralized at once, which can strengthen the reaction between the active air particles and seeds. The active air particles and ultraviolet radiation can penetrate into the capsule of the seeds,accelerate to decompose the inner nutriment of the seeds, reduce relative penetra- bility of cell velum, improve the activities of the root of the tomato seedling. Test data of fruit yield of the tomato were consistent with the statistical regressive line. In recent research, eggplant seeds were treated by the same method, there were the same conclusion in some as- pects.[16, 18,19]

Figure 6. The violet blue light intensity versus different plasma voltage.

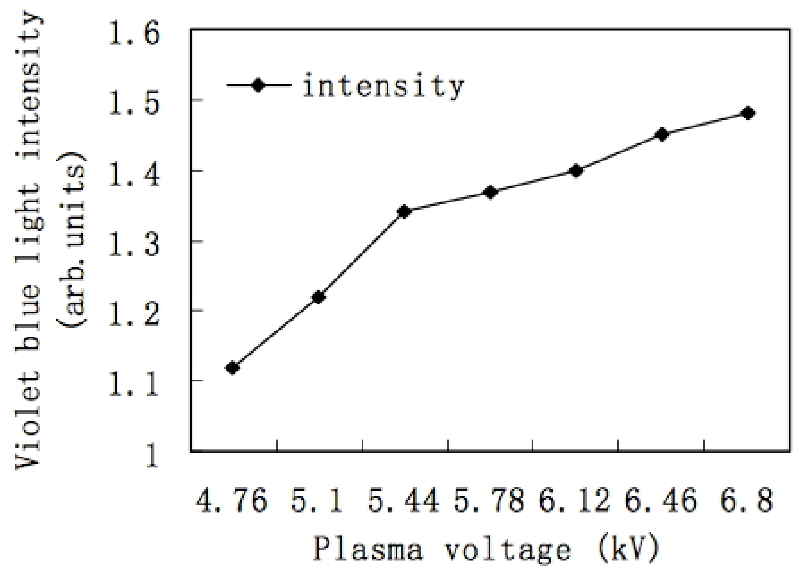

Figure 6. The violet blue light intensity versus different plasma voltage.

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