

(11)

PATENT SPECIFICATION

(11) 1 535 854

1 535 854

- (21) Application No. 8497/76 (22) Filed 3 March 1976
(31) Convention Application No. 800/75
(32) Filed 5 March 1975 in
(33) Australia (AU)
(44) Complete Specification published 13 Dec. 1978
(51) INT CL⁷ C05G 3/00
(52) Index at acceptance C1B 4



(54) SOIL NUTRIENT PACK

(71) We, DAVID BARNES, a citizen of the United States of America, of 40 Sam Ratulangi, Jakarta, Indonesia; WRIGHT-CEL LIMITED, a Company incorporated under the Laws of the State of Victoria, Australia, of Cato Street, Auburn, Victoria, Australia; ANDERSONS PLANTATION PTY. LTD., a Company incorporated under the Laws of Papua New Guinea, of Kokopo via Rabaul, Papua New Guinea; and BURNS PHILP NEW GUINEA LTD., a Company incorporated under the Laws of Papua New Guinea, of Rabaul, Papua New Guinea, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved means of dispensing solid fertilizers to plants and especially perennial crops in tropical areas.

With the increasing cost of fertilizers attention is now being focussed on ways of avoiding fertilizer loss. This loss usually arises from gaseous losses such as in urea containing fertilizers; fertilizer take-up by weeds infesting the crop area, dispersion of fertilizer from the soil surface by rain run-off and by leaching of the soil where the fertilizer solutes are washed below the root system of the crop plant.

The latter two causes of loss are especially prevalent in tropical high rainfall areas where hillside slopes in particular can be difficult and expensive to cultivate. Under dry conditions urea and liquid ammonia fertilizers are subject to evaporation losses which may be 40% or more. The other loss referred to is "take up" by weed growth in the immediate vicinity of commercial plants caused by an over abundance of fertilizer available in the soil surrounding the plants.

The traditional means of applying solid fertilizers which are usually in crystalline, granular or pellet form is to disperse the fertilizer in loose form onto the ground

surface. This means of application is readily susceptible to the four types of loss discussed above. Also application rates are difficult to control and a considerable quantity of fertilizer is applied away from of feeding roots and is of no effect in promoting growth in the commercial plants.

It is an object of this invention to provide means which allow the fertilizer to be dispersed to the soil at a rate which is close to the rate at which the plant can absorb it and which also reduces the amount of fertilizer required to be applied, by avoiding loss of fertilizer.

Thus, according to the present invention a soil nutrient pack adapted for use by burying in the soil in the environs of the roots of plants to which it is wished to supply the nutrients contained in the bag comprises non liquid soil nutrient composition contained within a package composed of a perforated bio-degradable non phytotoxic material, the perforation size being not greater than 1 mm, and the perforation size, perforation density, and total surface area of pack being selected to obtain a predetermind diffusion rate of the nutrients into the soil.

As a result of this invention losses of fertilizer due to faulty control of application rates is avoided because application is directly to the soil adjacent the plant base. The controlled slow rate of diffusion of fertilizer or nutrients from the pack to the soil ensures less take up of fertilizer by weeds. Also the pack itself hinders loss of fertilizer due to rain run off or leaching. Another advantage of the present invention is that it enables fertilizer and nutrients to be applied to maturing plants according to variations in plant demand. Traditional methods of application are not able to adequately meet a maturing plant's varying demand for quantity and type of fertilizer or nutrient.

The material of which the package is composed is preferably a normally water impermeable or near impermeable material which is perforated. Although the

50

55

60

65

70

75

80

85

90

95

permeability of the pack depends on the material as well as the perforations, the perforations are no larger than 1.0 mm as larger perforations allow free flow of water which is undesirable. Prevention of free flow of water means that is perforated material of the package should be such that if the package is filled with water no leakage will occur through the perforations.

Plastic materials have been found to be the most suitable to provide these requisite properties. These materials are selected for their biodegradability or treated to become biodegradable. A particularly suitable material is cellulose film which is of course biodegradable. Polyethylene or polypropylene films can also be used but due consideration must be given to the degradability of these films when deposited in the soil. Some applications will require longer degradation periods for the packs and the fertilizer and such synthetic polymer films are quite useful. All films used to make the packs are non-phytotoxic, and harmless to all living organisms.

In preparing a fertilizer pack for application several factors must be taken into consideration. These are the surface area of the pack, the amount of fertilizer in the pack, the number of perforations per unit area in the pack, and the biodegradability of the pack material.

Once the type of fertilizer has been selected, the amount of fertilizer to be used is selected based on the estimated take up rate of the plant and the likely period that the pack will remain intact from biodegradation. It is preferred that the fertilizer be substantially fully dispersed before the pack disintegrates to ensure controlled dispersal of the fertilizer, but the advantages of the invention are still obtained even if there is some fertilizer remaining within the confines of the pack when it disintegrates.

The surface area of the pack and the density of perforations are two of the variables which are adjusted to give a controlled dispersion rate.

Obviously the dispersion rate of any particular fertilizer in a particular pack will also vary according to the soil and climatic conditions of the area in which it is deposited. Preliminary field trials are needed to determine the likely dispersal rate for a given area and the pack design and fertilizer quantities can then be selected.

The non liquid fertilizer may comprise a liquid fertilizer carried on a solid absorbant such as peat. Pellets of compound fertilizers or granulated or crystalline fertilizers can each be used in the packs. A problem encountered with crystalline or pelleted fertilizers has been a tendency of the fertilizer to agglomerate within the pack

subsequent to deposition. This agglomeration inhibits dispersal of the fertilizer. By increasing the size of the pack so that it is only half filled this particular problem can be avoided. Another problem has been encountered with urea containing fertilizers when cellulose film packages are used as the urea which is a plasticizer for cellulose tends to interfere with the structure of the film.

This invention has been found to be particularly effective in tropical regions on perennial crops such as cocoa, tea or coffee. It could be used in respect of annual crops but generally this could prove to be uneconomic. One particular application is in forestry. In re-afforestation projects the deposition of a fertilizer pack of this invention adjacent each seedbag would ensure good growth results in the early years of the plant's life. In this particular application quite large bags of a slowly biodegradable material such as polypropylene could be used to supply fertilizer to the seedling over a long period such as three or four years.

In use the fertilizer pack is deposited under the soil surface at the base of the plant. It is usual to find that the root system of the plant tends to mass about the spot where the pack has been positioned. When a fresh pack is required to replace an expended pack it is desirable to place it in the same location as the previous pack. Usually the period chosen for replacement of the pack is sufficient to allow for the disintegration of the pack as well as the dispersal of the fertilizer.

EXAMPLE.

In one particular application of the method of this invention established cocoa trees were given applications of fertilizers in packs 7ins. x 3½ins. in size, made from a perforated cellulose material marketed under the trade name paniphane. This paniphane material included 0.5 mm perforations at 6 mm centres in one direction and 3 mm centres in the other direction, i.e. the perforations occupy about 1.1% of the surface area of the pack.

If the perforations are 1 mm in diameter, with the same spacing, then they occupy 4.4% of the surface area of the pack. If the perforations are 0.2 mms in diameter then with the same spacing the perforations occupy 0.17% of the area of the pack.

The spacing of the perforations in the above Example is such that there are about 5 perforations per sq cm.

Thus more broadly we prefer to use a pack having 1 to 20 e.g. 2 to 15 or 3 to 10 perforations per sq cm the perforations having a size such that they occupy between 0.1% and 10% e.g. 0.2% to 8% or 1% to 5% of the surface area of the pack.

70

75

80

85

90

95

100

105

110

115

120

125

(13)

5 The packs used for these established trees contained 6 to 8 ounces of fertilizer. The packs were replaced after deposition periods of three to four months. Filed tests indicated that the fertilizer was dispersed from the packs within about 7 weeks and that the packs themselves were disintegrated within 9—10 weeks.

10 Additional trials on a smaller scale have been carried out on such plants as mango seedlings, shrubs and ornamentals, tomatoes, maize and a variety of vegetable plants. Results in all cases indicated that growth rates were maintained or improved with half the quantity of fertilizer required in conventional methods of applying fertilizer.

15 On the basis of trial results it is evident that fertilizer packs may also find wide application in home gardens, the market gardens, the market garden industry, 20 orchards and vineyards, on field crops such as tobacco and in reafforestation projects. In tropical areas, these fertilizer packs will have particular application in the seedling stages of such crops as cocoa, tea, coffee, 25 rubber, coconuts and Oil Palm.

30 roots of plants to which it is wished to supply the nutrients contained in the bag, the pack comprising a non liquid soil nutrient composition contained within a package composed of a perforated biodegradable non phytotoxic material, the 35 perforation size being not greater than 1 mm, and the perforation size, perforation density, and total surface area of pack being selected to obtain a predetermined diffusion rate of the nutrients into the soil. 40

2. A pack as claimed in Claim 1 in which the material is a cellulose film.

3. A method of improving the health and growth rate of a plant comprising inserting in the soil in the vicinity of the plants root system, a pack as defined in Claim 1 or Claim 2. 45

4. A method of treating a crop which is prone to nutrient loss in the soil which comprises inserting a pack as defined in Claim 1 or Claim 2 into the soil in, the vicinity of the root system of the individual plants of the crop and repeating the operation at predetermined intervals. 50

WHAT WE CLAIM IS:—

1. A soil nutrient pack adapted for use by burying in the soil in the environs of the

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

3
The packs used for these established trees
contained 6 to 8 ounces of fertilizer. The
packs were replaced after deposition
periods of three to four months. Filed tests
5 indicated that the fertilizer was dispersed
from the packs within about 7 weeks and
that the packs themselves were disinte-
grated within 9—10 weeks.
10 Additional trials on a smaller scale have
been carried out on such plants as mango
seedlings, shrubs and ornamentals,
tomatoes, maize and a variety of vegetable
plants. Results in all cases indicated that
15 growth rates were maintained or improved
with half the quantity of fertilizer required in
conventional methods of applying fertilizer.
On the basis of trial results it is evident
that fertilizer packs may also find wide
20 application in home gardens, the market
gardens, the market garden industry,
orchards and vineyards, on field crops such
as tobacco and in reafforestation projects. In
tropical areas, these fertilizer packs will
25 have particular application in the seedling
stages of such crops as cocoa, tea, coffee,
rubber, coconuts and Oil Palm.

30 roots of plants to which it is wished to
supply the nutrients contained in the bag,
the pack comprising a non liquid soil
nutrient composition contained within a
35 package composed of a perforated
biodegradable non phytotoxic material, the
perforation size being not greater than 1
mm, and the perforation size, perforation
density, and total surface area of pack being
40 selected to obtain a predetermined diffusion
rate of the nutrients into the soil.
2. A pack as claimed in Claim 1 in which
the material is a cellulose film.
3. A method of improving the health and
45 growth rate of a plant comprising inserting
in the soil in the vicinity of the plants root
system, a pack as defined in Claim 1 or
Claim 2.
4. A method of treating a crop which is
50 prone to nutrient loss in the soil which
comprises inserting a pack as defined in
Claim 1 or Claim 2 into the soil in, the
vicinity of the root system of the individual
plants of the crop and repeating the
operation at predetermined intervals.

WHAT WE CLAIM IS:—

1. A soil nutrient pack adapted for use by
burying in the soil in the environs of the

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1978.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.

