MINI REVIEW

Future Perspective of Seed Ball Technology For Creating New Ecosystem

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Abstract

Seed balls as a low-cost technology is unique, scattered in a controlled manner, and give life to new plants from vegetation deficient area, deforestation area, desert area, grassland area, agriculture and horticulture cultivable land area throughout the world. Seed balls became an important aspect of natural farming and conservation enterprises all over the world. This scheme in view of different funding given to government and private sectors is for improving ecosystems and getting a healthy environment with low-cost seed ball technology. Seed ball technology is useful for foundation of woods or remain of trees in a space where there was no past tree cover. Using seed ball technology many agricultural and horticultural crops may be grown in problematic soil without land preparation such as the plowing, weeding, and irrigation and protect from birds, ants, and unfavorable stress (abiotic and biotic).

Keywords: Agriculture, Clay, Crops, Germination, Horticulture, Vermicompost.

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Introduction

The grain ball, also known as the earth ball or *Nendo Dango*, consists of a variety of seeds located inside a mud pack. Ideally, volcanic red pyroclastic mud with various supplements can be incorporated, such as mulch or manure and surrounding coated the seed, in the center of the ball, to create a probiotic. Cotton fiber or paper concentrate is sometimes mixed with soil to enhance firmness, or melted squash is coated to ensure additional soil shine when grown by throwing, or in particularly arid natural environments. Seed bombs are preparative different organic substrates to protect against predators and enhance the seed ball dormancy breaking when a favorable abiotic and biotic environment is available surrounding the seed ball until the seed ball lives in the soil system. This technology highly supports ecosystem conservation in the forest because mostly trees with the help of human crops are not possible for planting forest in a difficult area. In this technology easily and viable seed balls spread problematic soil through aircraft/helicopter. The best and most useful seeding method for guerrilla guards as well as those with back pain and one of the least demanding and manageable cultivation methods to win favorably for a longer period until the growth window arrives. Essentially, the seeds are covered with soil and then dried with a soil substance which is usually a combination of soil and manure.

It is possible to disperse plants and trees from seeds without having to open the dust with cultivation tools such as tillers. Masanobu Fukuoka was a Japanese farmer, breeder, thinker, microbiologist, and expert in plant growth. He was rediscovered seed ball technique and extensively advocated in the mid-20th century. Standardized seed strategy in seeds of Subabul (*Leucaena leucocephala*) to study the introduction of trees into forest areas as a review paper on seed science and innovation.[2] Information technology and Sports Minister Tusharkanti Behera opened the seed dissemination event at Yatri Niwas in Konark to help restore forest cover.

Most farmers spend more energy, labor consumption, high expenditure, and more land area to damage the soil profile system, wastage groundwater, and natural breeding. Humans through cultivation do not support the ecosystem conservation.[13] Successfully achieved through seed ball technology in the table crops, millets, Solanaceae, Cucurbitaceae family, and fruits crops. This is an efficient way to cultivate without plow/drilling and labor involvement. Urban land areas most will follow this technology because of less availability of farm machinery equipment. Seeds have been used to establish perennial pastures on degraded marginal lands where seeders and tillers cannot be used due to steep slopes, existing forests, exposed shallow/bedrock, and general rock of the area. When subabul seeds are used in the diet, iron supplements and a mineral mixture containing iodine should be added. Subabul as green fodder should not be used more than 33% of the total ratio. Subabul granules can be safely used at 10% and 30% in concentrates for lactating and growing animals, respectively. They can be used up to 30% of the adult cow's diet,[2] Seed coating technology has been developed on most plant and plant species, and to a lesser extent on grasses, grasslands, and flower seeds.

Historical Roots of Seeds Balls

The seed ball was rediscovered and popularized in the early 20th century by different developed countries and different

contributors towards to development of agriculture. For example, the technique is also used in ancient Egypt to repair farms after the annual spring flood of the Nile. In modern times, during the Second World War, a scientist from the Japanese government on the Island of Shikoku, focus on enhancing food productivity. In the low expensive and eco-friendly technology, this point of view allotment of land from volcanic regions to Japan farmers for cultivation of traditional rice productivity enhancement,[12] and in the 1970s, they were incorporated into guerrilla gardening tactics, a movement that sought to renovate abandoned or abandoned urban land through direct action, and in New York City, seed bombs were used during the 1973 Bowery neighborhood revival and the development of the city's first community garden.[3,4]

This efficient technology to make healthy ecosystems from arid or barren land through spread the seed ball surface soil system, actively practice of afforestation from guerrilla gardening adapted to make green revolution. Similarly reported 2016 in Kenya, through experimentally make aerial seeding to improve higher yield by seed bombardment. A special type of technology for direct seed sowing without any making land preparation, without expenditure, directly delivers the seed to critical fields through aircraft, through aerial reforestation achieved less expensive, more percentage of merits and less

Fig. 1: List of seeds used for seed ball preparation

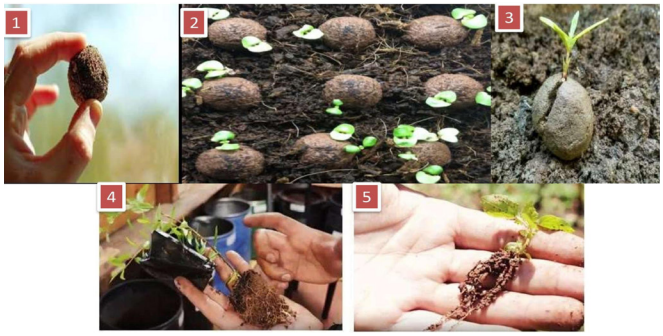

Fig. 2: Growth performance stages
1. Seed ball before showing, 2. Germinated seed ball (10 days old), 3. 26 days old seedling, 4. Healthy shoot growth, 5. Higher root branches

percentage of demerits natural available on the barren land.[7] Reported chardust Pvt. Ltd, 7 million seed purchased and prepared seed ball distributed through aerial seeding.[8]

Haitian Aerial Reforestation Project (HARP) was proposed by Lynn Garrison, 1987, this project scheme is the main motto for producing a huge number of seed balls, spread specifically altered planes, tons of seed balls coated with substrate like water retention material (Coir pith powder), nutrient-rich vermicomposts, predator control agent like neem oil and vegetable seeds through aerial seed sowing. Similarly, another project proposed,[5] using aerial seeds with enclosed special material in sturdy, biodegradable containers which can act like balls and penetrate the land at high speed, this type of seed ball technology can be highly scientifically authenticated for better yields compared to the previous seed ball process. Another project was started in 1999 by Aerial Reforestation Inc, Newton, Massachusetts by Pilot Jack Walters, and used the C130 aircraft for laying mines on battlefields (9 and 5). Aerial saplings used reforestation at a higher rate, studying highly efficient process saplings to enhance the aerodynamics and better soil penetration.[10] A variety of studies require to obtain the accuracy result towards afforestation technique, drone seed used to prepare to bomb, this process patented against can prevent animals eating seed bombs and more yields.

In the Carolinas in the 1700s, West African slaves, mostly women, were brought in to cultivate rice using seed techniques already used in Africa. The grains of rice are coated with clay, dried, and pressed with the heel of the foot into the mud. This serves two purposes, to protect the seeds from birds and also to prevent the seeds from drifting when the fields are flooded. More recently, Japanese agricultural reformer Masanobu Fukuoka began exploring the use of seeds (*Nendo dango* in Japanese) to help improve food production in post-war Japan. Seed ball techniques literature and information not available and public awareness also poor, research and outreach effort have brought the seed ball back into the public eye. Today, seed balls are fun for green-minded kids and adults and are also an important tool of the guerrilla gardening movement illustrate Fig. 1.

Growth Performance in the Field

The chances of a seed taking root and growing into a tree are much higher than saplings, due to the root structure and size. The images demonstrate this difference very clearly. Saplings are typically grown in small plastic bags or pots or similar containers that restrict the growth of the roots. While seeds that are planted in the ground (such as with the help of seed balls) have much stronger roots – as seen in the attached photo. Also, trees grown from seeds are believed to be stronger than a planted sapling – the reason could be the difference in the roots at germination (Fig. 2).

With seeds, you can propagate plants and plants from seeds without opening up the soil with cultivation tools like plows. The establishment of perennial pastures from degraded land, slopes in deep land and rocks area, where no vegetation area and another part to find disappear the native plants, can reintroduce the same plant species through seed ball technology. For improvement of pollination, developed wildflower-based seed

ball preparation and introduced forest land to support increased fertilization through the butterfly. In the Carolinas in the 1700s, West African female slaves were able to grow rice using seed techniques they had practiced in Africa. The rice grain is coated with clay, dried, and pressed into the mudflat with the heel. In addition to protecting the seeds from birds, the orb also keeps the seeds from flying away when the field is moisture high. This is a suitable time for the distribution of seed balls or during their early stages of germination by natural enemies against ball germination. Improvement of biodiversity can grow vegetation in the roadside area and wherever no vegetation area from the human interference field, this will provide a healthy atmosphere by seed ball technology, making greenish and healthy oxygen level.

Common Protocol for Seed Ball Making

1. Materials Required

(i) Seeds (3-4 packets), (ii) Compost or garden soil, (iii) packet air-dry clay/1 packet air-dry red soil, (iv) Greaseproof/baking paper or any smooth surface, (v) Mixing vessels, (vi) Water, (vii) Hand gloves(if required).

2. Two Way of Seed Ball Making

Making ball seeds is relatively simple, but like any craft, it does take some getting used to. The following ingredient ratios (by weight) were taken from Fukuoka's suggestion (Fig. 3):

(i) 5 parts dry powdered clay (ii) 3 parts fine compost (iii)1 part seed mix

There are two ways to make seeds by hand.

a. One is to roll each ball by hand.

b. And the other method is to roll the ingredients in a flat-bottomed saucepan until they "lighten" and start to form a ball, like:

(i) 2 parts potting soil (ii) 5 parts mixed ceramic clay at the door of your local art store (iii) 12 parts water (iv) 12 parts seeds of your choice (v)Large reservoir for mixing ingredients

Common Procedure

- Take 5 kg of dry clay soil, remove unwanted debris, and transfer it to a large vessel. Thoroughly mix the soil, clay, and 1 part water. There should not be any lumps. Slowly add the water until the mixture is the same consistency as the toy store play clay that comes in the box.
- Add seeds. Continue kneading the dough until the granules are evenly combined. Add more water if needed.
- Take small pieces of the clay mixture and roll them into a ball about 1 inch in diameter. The balls should be easy to hold together. If they are crumbly, add more water.
- Dry the seeds for 24-48 hours in a shady place before sowing or storing them. They are best kept in cardboard boxes. Do not use plastic bags (14). (Fig. 4).

Germination Data

Recorded germination rate 87-98 % at 5 days incubation sugar beet seed ball by physical and chemical factors in the maternal tissue observed that soaking seed balls of different varieties prior to germination may be beneficial, may have no effect, or may even be detrimental to germination of seeds. It appears that soaking may be beneficial only when seed balls contain an abundance of inhibitory substances that must be diluted to a concentration that permits germination (FW.Synder 1959).

Tamilarasn 2020 et al, observed a higher germination percentage for seed balls prepared with a combination of red soil and vermicompost at various ratios were evaluated for seedling parameters under shade net condition. The results obtained were significantly different from control. The maximum speed of emergence (81% to 97% germination and root length 9.9 cm) was noticed in red soil with vermicompost used in different ratios 2:1 to 4:2 compared to control.

Mechanism of Seed Ball Function in the Fields

Seed ball preparation, way of spread and storage process illustrate the Fig. 5.

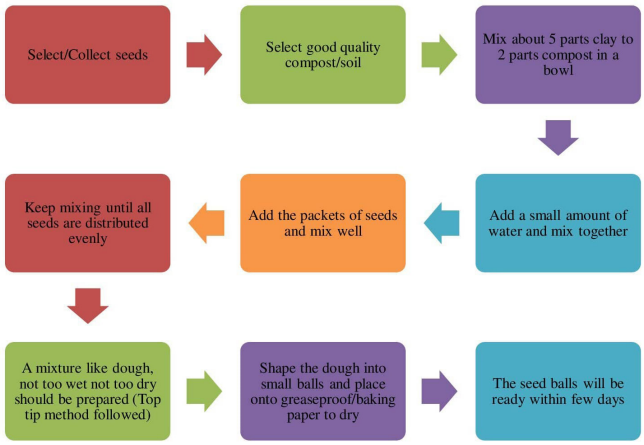

Fig. 3: Flow chart for seed ball preparation protocol

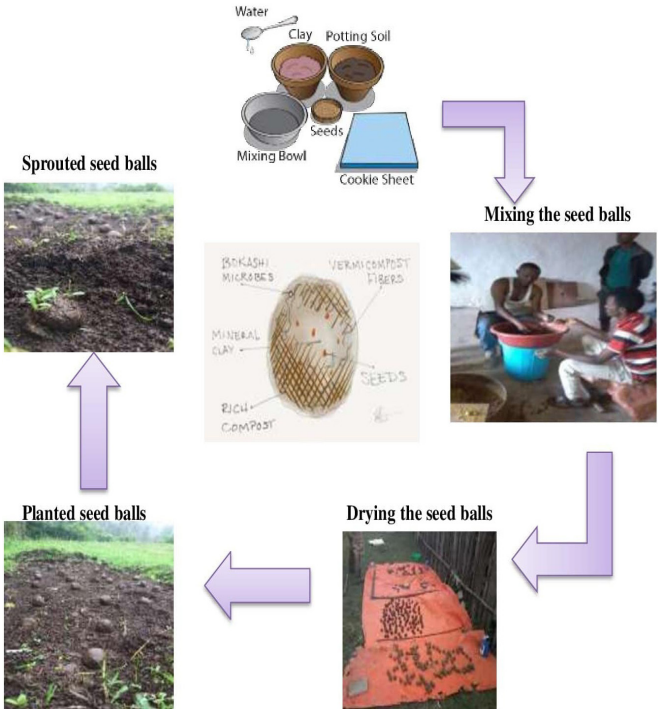

Fig. 4: Stepwise seed ball preparation and transfer to the field

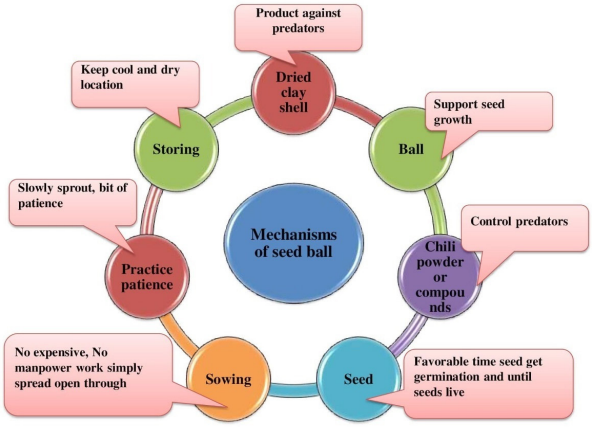

Fig. 5: Seed ball mode of action

Fig. 6: Quality seed ball preparation

Storage

You do not need to spread them out as soon as they are dry. If placed in a cool, dry location, the seeds can be stored and can be planted for several years (13).

Feasibility

(i) Less time and more land area cover through helicopter/ airplane; (ii) Seed balls spread anywhere in the world such as lithosphere, biosphere, hydrosphere (shore area); (iii) Not require skilled labor and cultivation process; (iv) Seed ball preparation use any variety of agriculture and horticulture crops; (v) Problematic soil areas such as infertile soil, barren land, sodic soil, saline soil and acetic soil, slope area, watershed, and hillside also can spread the seed ball.

Weaknesses

(i)Poor germination of seed ball and not uniform germination; Lesser yield is obtained from seed ball germination plants; (ii) Before spread, the seed ball find the rainfall percentage (weather forecast); Only favorable factors support seed ball germination (Fig. 6).

Properties of Seed Balls

Single seed balls consist of 1 to 4 seeds and a way to sow the seed balls in the field.

Advantages of Seed Balls

(i) Easy to make. (ii) Have existed for a very long time. (iii) Versatile. (iv) Diverse. (v) People involved in collection seed ball preparation. (vi) Stored for a long time (years).

Disadvantages of seed balls

(i) More seed in a single seed ball
(ii) Not uniform size of seed ball

Conclusion

Seed balls have proven to be very effective in growing forestry, legumes, oil seeds, flower crops, vegetables, and fruit crops in any type of lithosphere or biosphere around the planet. They are a low-cost, effective approach to establish plants without the need for ploughing or drilling. Seed balls are useful for increasing green space in waste land areas, but they can also be used anywhere with a wet season. Furthermore, this review will support the establishment of a seed ball with organic fertilizers substate industry in every district in India, which will, in the future, meet the oxygen needs of living organisms, increase biosphere land area from waste land, and create more jobs for local poverty people.

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