

MANUAL ON SEED BALL PROPAGATION TECHNOLOGY



AUTHORED BY

Seema Mishra, Saurabh S. Bhogale & Saurabh D. Wadye

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SIES-Indian Institute of Environment Management

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INTRODUCTION

The afforestation and reforestation play significant role in the management of green cover by conservation of degraded forest, grasslands and barren hillocks. The seed ball propagation have been found to be very effective in upscaling the regeneration at degraded sites because it is economical, saves seeds from predation and provides suitable environment for seed proliferation into a healthy seedling. For optimizing the benefits of seed ball propagation for greening of degraded sites, selection of suitable native tree species, substrate quality and site-specific climatic conditions play very important role. A scientific approach in the standardization of seed ball preparation and propagation technique is desirable for developing an effective toolkit for its application in the conservation and greening of degraded sites. Bharat Petroleum Corporation Limited (BPCL) has taken initiative to increase the green cover by seed ball propagation in Maharashtra with SIES Indian Institute of Environment Management (SIES IIEEM), Nerul. The manual is prepared after thorough research and field observations, it will support researchers, foresters, environment management professionals, policy planners, industries and voluntary organizations in adopting best strategy in seed ball propagation for greening of degraded sites and supporting in sustainable environment management.



ABOUT Seed Balls

The propagation of seed balls, also known as seed bombs, is an easy and sustainable way to propagate a native species by providing suitable conditions and prolong duration for the germination of seeds and proliferation of seedlings.

Seed balls are one of the easiest and sustainable way of cultivating native plants, flowers and grasses.

It is an affordable and effective conservation tool for establishing green cover at degraded sites.

The layers of soil and organic fertilizers on seed protects it from drying out in sun, getting eaten by birds, animals or from blowing away with wind.

The ploughing, pit digging, and fertilization are not required in this method.

The preparation and propagation of seed balls is a very simple technique; however, it requires appropriate knowledge for maximizing the benefits.

By identifying the ideal environment and inputs required in propagation of native species, the site-specific seed balls and methods for their propagation can be developed



The quality seeds with good viability and germination percentage are normally used in seed balls that improves the success of seed ball propagation.



SITE SELECTION for Seed Ball Propagation

- 1 Seed ball propagation is best suited to sites whose remoteness, ruggedness, inaccessibility, or sparse population, make seedling planting difficult.
- 2 Very dry sites without previous vegetation should be properly characterized before site selection.
- 3 A sunny abandoned field or any sunny area that won't be mowed can be chosen for seed ball propagation.
- 4 If site is having high density of native weed than site should be cleared before the seed ball propagation.
- 5 On steep slopes, seed ball propagation may not be effective because seed balls will not remain at specific site.
- 6 The site should have proper slope and drainage for easy removal of excess rainwater. Waterlogged soil may increase chances of diseases and pest infestation in seeds.

SUITABLE TIME for Seed Ball Preparation and Propagation

The preparation of seed balls should start in late April and completed by May end in monsoon areas, however, in winter planting areas the seed balls should be ready by October.

The site selection, transportation of dried seed balls at specific sites should be done in advance.

The propagation of seed balls may be started before the onset of monsoon at sites where soil moisture is good, grazing can be controlled, and anthropogenic activities are less.

In drier regions, the seed ball propagation should be conducted after two three days of rainfall.

In coastal areas, the seed ball propagation should be done at the onset of monsoon. Late propagation may not yield good results.

In winter planting areas October- December months are suitable for seed ball propagation

SELECTION & PRETREATMENT of Seeds

- ✦ Conduct site survey before selection of plant species for making seed balls. In coastal areas neem seed may not germinate and grow easily.
- ✦ Select seeds of native species from same climatic conditions for making seed balls. This improves the chances of germination.
- ✦ Native trees species should be selected for propagation along highways, avenue plantation etc. Along railway tracks tree sps. are not advised, as during cyclone or monsoon it may fall on it. Deep rooted, non-palatable, nature ornamental shrubs are most suitable for these areas.
- ✦ In forest area the selection of plant species for plantation should be conducted after proper survey of area. Some of the tree species may have allelopathic effects on other species.
- ✦ The fruit bearing trees and shrubs are more suitable for propagation in forest area that provides food to native wildlife and chances of human wildlife conflicts can be reduced.
- ✦ In annual grass or legume species, seed should not be older than one year.
- ✦ In tree sps. viz. Neem, Ficus sps. seeds may be collected, shade dried and propagated in same year.
- ✦ The seeds should be collected from local vendors or from forest areas.
- ✦ The viability and germination percentage of seeds should be assessed before making a seed ball.
- ✦ Some seeds remain dormant in soil after propagation due to the immature embryo, chemicals on seed coat or hard seed coat. These types of seeds require pretreatment.
- ✦ Annual grass and herbaceous legume seeds do not require pretreatment.
- ✦ In leguminous trees, mechanical scarification, hot water scarification, soaking in cold water and acid scarification improves the seed germination.
- ✦ After scarification seeds should be shade dried to remove the traces of moisture. It reduces the chances of pre germination of seeds in seed ball.





PREPARATION of Seed Balls

Collect well drained native soil. Sieve it from 0.075 mm (200 no.) sieve to get clay particles.

Mix clay, organic fertilizer of your choice and perlite / vermiculite in the ratio of 1:0.5:0.25.

Add culture of beneficial microorganisms viz. N fixers, P solubilizers and mobilizers for improving the germination of seeds and growth of seedling even in adverse conditions.

By adding *Trichoderma sp.*, the occurrence and infestation of root zone pests and diseases can be reduced.

Add water in the seed ball substrate to prepare dough. If dough is very sticky, cocopeat may be mixed.

1 kg substrate can make 90-100 balls of 0.5 to 1 inch that may accommodate 2-4 seeds depending on the size of seed.

In 5000 kg of substrate 5,00,000 seed balls can be prepared in advance before propagation.

Air dry seed balls for 24-48 hours in a shade before sowing or storing.



PROPAGATION of Seed Balls

Seed ball propagation must be started during pre-monsoon rainfall or from October – December in winter planting areas.

For propagation along highway or in forest area the seed balls are required in comparatively less number.

The number of seed balls required for propagation depends on the site conditions, size of seed balls and objective of plantation. Normally 500 – 750 seed balls are required per hectare.

For regenerating grasslands, the requirement of seed ball / hectare will be more.



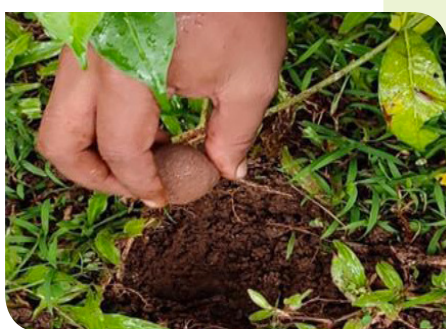
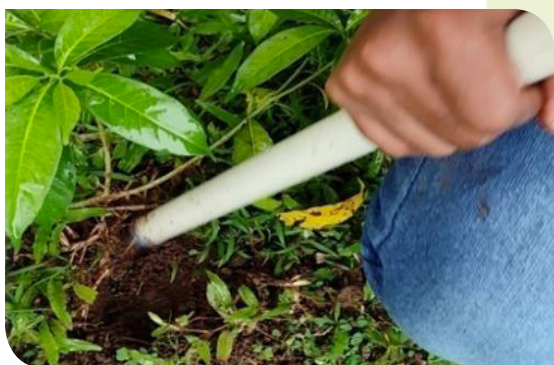
As per the site condition aerial or dibbling methods can be selected for the propagation of seed balls.

Note GPS coordinates of propagated seed balls for effective monitoring.



Broadcasting /Aerial Throwing

- ♦ Aerial throwing of balls is recommended on hillocks or harsh habitats that is inaccessible or fragmented to develop maximum green cover.
- ♦ Broadcasting of seed balls can be done by throwing with hands or dropping from helicopter or drones.
- ♦ The ploughing or pit digging is not required.
- ♦ It covers large area in least time.
- ♦ It requires specific atmospheric conditions for good germination and survival of seedlings.
- ♦ The aerial broadcasting along steep slopes is not recommended the seed balls may wash off.
- ♦ Monitoring of germinated seeds and their survival of seedlings is bit difficult in this method.



DIBBLING Method

- ✦ In this method seed balls are placed in a hole or cavity at predetermined spacing by a dibbler, metal rod or a bamboo stick.
- ✦ Deep burring of seed balls is not advisable.
- ✦ Select plain landscape or any flat region. eg. roadside, backyard, ground, etc.
- ✦ Place one seed ball in one hole.
- ✦ Cover seedballs with loose soil.
- ✦ Depending on the kind of plantation required and number of tiers or rows of propagation, the seedballs can be propagated in different designs e.g., triangular, square, single hedge, double hedge, etc.

IMPORTANT POINTS TO KNOW While Propagating Seedballs Using Dibbling Method

Depending on type of soil certain precautions must be taken



1

In loose soil
depth of ball
dibbling should
be less.

2

In lateritic soil
depth of seed
ball propagation
can be little
more.

3

In black soil
seedball
dibbling should
be done after
two days of
rainfall.

4

In wastelands
seed rate should
be high and
leguminous sp.
should be more

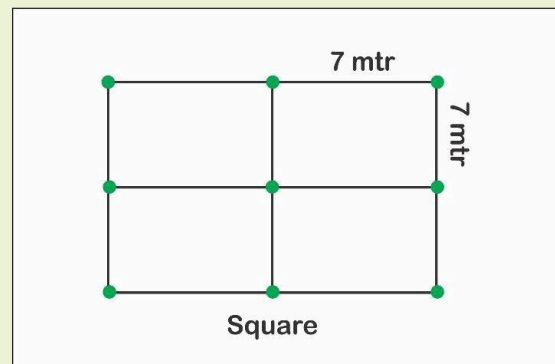
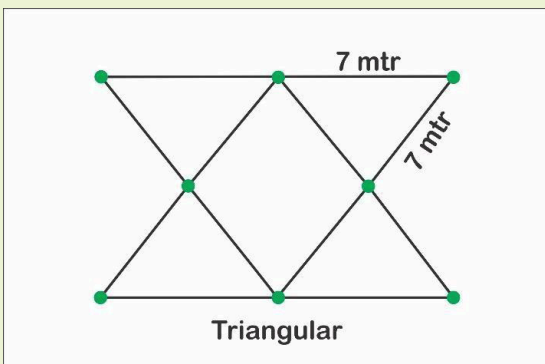
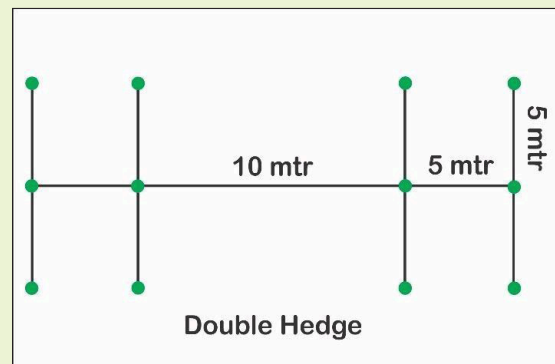
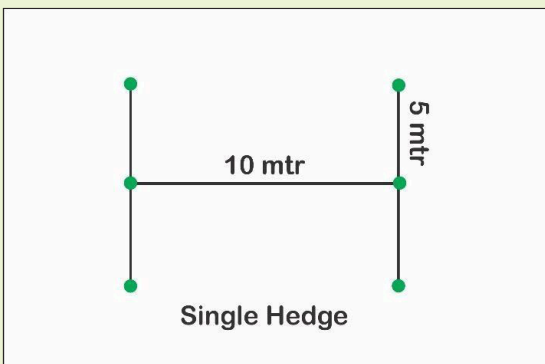


DISTANCE TO MAINTAIN in Seed Ball Propagation

Depending on size and canopy of tree, seedballs must be propagated at specific distance.

Sr. No.	Height of Plant	Preferable Position for Plantation	Distance to maintain
1.	Tall	On Boundary	10m x 10m
2.	Medium	Roadside	7m x 7m
3.	Short	Block Plantation	5m x 5m

DIFFERENT PATTERNS for Seedball Propagation by Dibbling Method





PRECAUTIONARY MEASURES Taken After Propagation

Grazing should be controlled to get better survival ratio of germinated seedlings.

In waterlogged land, small bunds can be prepared near germinated seedlings to prevent deterioration of seed.

In case of long break in rain fall, light irrigation should be done.

COUNTING & MONITORING of Germinated Saplings

After 45 days of propagation 1st monitoring should be done to check the germination and calculate germination ratio.

For counting of germinated saplings quadrat method is used.

Germination percentage can be calculated by,

$$\text{Germination \%} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds propagated}} \times 100$$

Along with this, information of rainfall, nature of area, slope, mode of propagation etc. can be recorded.



QUADRAT Method of Sampling

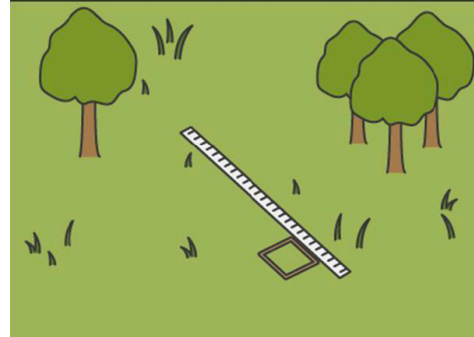
Quadrat method is suitable for monitoring seed germination in areas where seedball propagation is done in large number.

Quadrat sampling is a classic tool for the study of ecology, especially biodiversity.

Quadrat sampling is a method by which plants in a certain proportion (sample) of the habitat is counted directly.

It is used to estimate population abundance (number), density, frequency, and distribution in a large area.

sampling along a transect



The quadrat positions are chosen randomly, or they are placed along a transect.

Quadrat can be placed randomly as per the size and shape of the field.

QUADRAT Method

If the number of plants in the plot is large, the plot can be divided into quadrats.

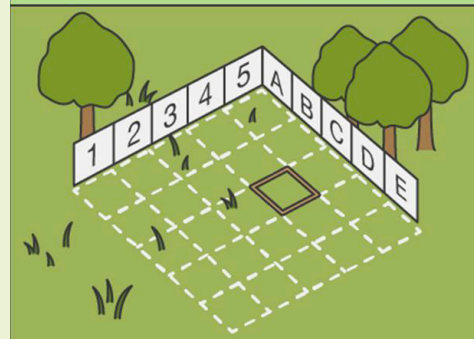
Fix four nails to make a square plot.

Tie each end of the nails using a thread, to make 1m x 1m plot.

Count the number of individuals of a species "A" present in the first quadrat and record the data in the observation table.

Similarly count the individuals of the species "A" in other quadrats respectively and record the data in the observation table.

random sampling



Count the number of individuals of a species "B" present in all quadrats and record the data in the observation table.



Do's

Fresh seeds of native tree species of earlier season should be collected.

Pretreatment of hard coated seeds must be done for proper and successful germination.

Composition mixture of seedball substrate must be in proper proportion.

Seed balls should be air dried in shady place.

Seedballs should be prepared and dispersed before monsoon season.

Grazing and land fire must be controlled after saplings are germinated.

Light irrigation can be done in case of less rainfall.

Time to time monitoring of germinated saplings should be done.

Don'ts

Avoid invasive seeds and collected seeds should not be more than 6 months old.

Avoid pretreatment of soft coated seeds.

Avoid higher clay content.

Avoid direct sun drying of seedballs.

Don't prepare and propagate seedballs in mid monsoon season.

CONCLUSION



Seedball propagation is low-cost method for greening of fragmented and degraded sites.

Seedballs are best to cover large area in short time period.

It's an affordable, sustainable and effective conservation tool for establishing vegetation in difficult area.

Seedball intervention has high potential in areas where protection from grazing is assured.

Seedballs are suggested to propagate in wildlife areas, protected barren areas, etc. with village panchayat and land-owning agencies is recommended.



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