



Gene Pyramiding Into a Single Genotype & Seed Treatment Techniques in Different Crops

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Abstract

The development of molecular genetics and associated technology like marker assisted selection has led to the emergence of a new field in plant breeding-Gene pyramiding. Pyramiding entails stacking multiple genes leading to the simultaneous expression of more than one gene in a variety to develop durable resistance expression. Gene pyramiding is gaining considerable importance as it would improve the efficiency of plant breeding leading to the development of genetic stocks and precise development of broadspectrum resistance capabilities.

Introduction

Watson and Singh (1953) first introduced the concept called gene pyramiding. Gene pyramiding is defined as a method aimed at assembling multiple desirable genes from multiple parents into a single genotype. The end product of a gene pyramiding program is a genotype with all of the target genes. Gene pyramiding is a breeding method aimed at assembling multiple genes with known effects on target traits. It is mainly used in improving existing elite cultivars for a few unsatisfactory traits, for which genes with large positive effects are identified. Traditionally, the identification of the sources of useful gene is very slow and breeder's capability to trace the presence or absence of the target genes is limited. This limits the number of genes to be incorporated into elite cultivars at any times (Joshi et al., 2010).

Advantages Gene Pyramiding

1. Widely used for combining multiple disease resistance genes for specific races of a pathogen
1. Pyramiding is extremely difficult to achieve using conventional methods.
2. Consider - phenotyping a single plant for multiple forms of seedling resistance-almost impossible.
3. Important to develop 'durable' disease resistance against different races.
4. Main used to improve existing elite cultivar.
5. Eliminates extensive phenotyping.
6. Control linkage drag.

Limitations of Gene Pyramiding

1. Lots of efforts have to made to incorporate several major gene into single cultivar.
2. Pyramiding is extremely difficult to achieve using conventional methods.

1. It is very difficult to integrate one gene from one cultivar or one species to another one by conventional method.
3. Stability of all desired gene in one plant is another issue which limited the gene pyramiding.

Seed Treatment

It is the process of treating the seeds with organic materials to augment the germination, to make it free from pest and diseases; to harden the seeds to withstand drought. Seed borne infestation of insects and diseases pose devastating consequences to crop production. The concept of seed treatment is the use and application of biological agents that basically can control or contain primary soil and seed borne infestation. This helps to improve crop safety, which in turn leads to good establishment of healthy and vigorous plants thus results in better yield. Treating seeds with microorganisms also enhances the nutrient availability in soil by fixing or solubilizing in various crops. The benefit of seed treatment leads to increased germination and ensures uniform seedling emergence. Seed treatment break seed dormancy, induce drought tolerance and augment germination. Seed treatment also gives protection to the emerged seedlings from sucking insect pests.

Seed Treatment Techniques

Smear all types of seeds with a paste of ash and water and dry it under the sun before sowing. This will control the seed borne diseases and enhance seed vigour and germination percentage. Treat the seeds with butter milk (125 ml / kg of seeds) to prevent fungal diseases in crops. Mix the seeds of cereals, legumes and cotton in cactus (*Euphorbia neriifolia*) milk solution (100 ml in 1 litre of water) and dry in darkness for 8 hours before sowing. This will enhance the protection from stem borer larvae, termites and other pests.

Seed Treatment Techniques in Paddy

Seed treatment with bio fertilizers: Five packets (1kg/ha) each of Azospirillum and Phosphobacteria or five packets (1kg/ha) of Azophos bioinoculants are mixed with sufficient water wherein the seeds are soaked overnight before sowing in the nursery bed. The bacterial suspension after decanting may be poured over the nursery area itself.

Seed treatment for improved germination and healthy seedlings: Dry seeds in bright sun light (between 12.00 p.m. to 1.00 p.m.) for half an hour before sowing to improve the germination and seedling vigour. Soak the paddy seeds along with a gunny bag in water for 12 hours and then soak in biogas slurry for 12 hours before sowing. Soak paddy seeds in Panchagavya (35 ml per litre of water) for 30 hours before sowing.

Seed treatment for the prevention of pest and disease attack: Soak seeds in water for 12 hours and then mix it with 10% cow's urine (10 ml cow's urine + 90 ml water) or 5% prosopis kashaayam (5 ml kashaayam + 95 ml water) and dry it for 30 minutes. Use the seeds for sowing within 24 hours. This will enhance the resistance of the paddy against bacterial leaf blight disease. Soak paddy seeds tied into small bundles using kada cloth in cow's urine solution (500 ml of cow's urine with 2.5 litres of water) for 30 minutes and shade dry before sowing. This method of seed treatment prevents the crop from seed borne fungal and bacterial diseases.

Seed treatment techniques for Pulses: Treat the seeds with talc formulation of *Trichoderma viride* @ 4g/kg of seed (or) *Pseudomonas fluorescens* @ 10 g/kg seed. Bio control agents treated seeds should be again treated with bacterial culture after 24 hours. Treat the seeds required for sowing 1 ha with Rhizobial culture CRR 6 / CPR 9, phosphobacteria (*Bacillus megaterium*) and PGPR (*Pseudomonas* sp.) developed at TNAU, with one packet each (200g). For red lateritic soil, Rhizobial culture VPR 1 is effective.

Chickpea: Soak seeds in water before sowing to enhance the germination percentage of the seeds. Smear seeds (1 kg) with a mixture of turmeric and sweet flag powder (50 gms turmeric powder and 15 gms sweet flag powder with 10 ml of water) and sow after 10 minutes. This will enhance the disease resistance of the crop. Bengalgram Mix seeds with well fermented (sour) butter milk and shade dry before sowing. The acidic nature of the butter milk reduces the incidence of wilt and dry root rot diseases.

Greengram: Take the seeds in a plastic tray and add a small quantity of adhesive (10% maida solution) to the seeds. Shake this gently to enable the seeds to spread evenly on all parts of each of the seed. Add Arappu powder (*Albizia amara*) as filler material evenly over the seeds and continue shaking until the uniform coating is ensured. Remove the seed clumps manually and also the excess filler material by sieving. Shade dries it before sowing. This process helps to handle small and irregular shape seeds. It also enables precision sowing of seeds and physiological characters of seeds are strengthened.

Millets: Treat the seeds with three packets (600g) of the Azospirillum inoculant and 3 packets (600g) of phosphobacteria or 6 packets (1200g) of Azophos.

Maize/ Pearl Millet / Finger Millet: Soak seeds in 2% Panchagavya (20 ml of Panchagavya in 980 ml of water) for 2 hours before sowing for the production of healthy seedlings.

Sorghum (Jowar): Treat the seeds with asafetida solution (75 - 100 gms in 1 litre of water) and shade dry before sowing. This seed treatment method prevents ergot disease in sorghum. Mix the seeds with the extract of Ashwagandha and Datura (for 1 kg seeds, pound 250 gms of Ashwagandha / Amukura (*Withania somnifera*) roots and 50 gms of Datura / Oomathai (*Datura metel*) leaves by adding water and shade dry before sowing. This will help in the production of healthy and disease-free seedlings.

Seed Treatment Techniques for Oilseeds: Treat the seeds with *Trichoderma viride* (4 gms/kg of seeds) or *Pseudomonas fluorescens* (10 gms/kg of seeds) and sow after 24 hours. In ground nut treat the seeds with 3 packets (600 g)/ha of Rhizobial culture TNAU14 + 3 packets of Azospirillum (600 g/ha) and 3 packets (600 g/ha) of Phosphobacteria or 6 packets of Azophos (1200 g/ha) developed at TNAU using rice kanji as binder. If the seed treatment is not carried out apply 10 packets of Rhizobium (2000g/ha) + 10 packets of Azospirillum (2000 g/ha) and 10 packets (2000 g) of Phosphobacteria with 25 kg of FYM and 25 kg of soil before sowing.

Groundnut: In Groundnut, the pre germinated seeds are used for sowing to get good yield by maintaining optimum plant population in the field. Soak the seeds tied in a gunny bag in water for 4 - 6 hours. Then untie the gunny bag and cover it with another wet gunny bag for 12 - 14 hours. Shade dries the germinated seeds for 3 - 4 hours and treat with Rhizobium (@ 600 gms / 110 - 120 kg of seeds) and sow within 1 or 2 days. Soak the seeds in Jeevamirtham / Amirthakaraisal / Panchagavya for 4-6 hours and shade dry before sowing.

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