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SEED PRIMING - IMPROVE GERMINATION IN PAPAYA

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Papaya has been recognized as highly remunerative fruit crop, but its successful cultivation for high yield potential and quality of fruits is plagued with several limiting factors.Papaya seeds are classified as recalcitrant since a loss of moisture through drying has an effect on their viability. Removal of the gelatinous material around freshly harvested seeds through washing also removes the sarcotesta which causes secondary dormancy. In addition, the seeds have a hard coat and an internal germination inhibitor which hinders water absorption thus preventing germination. The production of pure and viable seeds with better germination percentage, healthy growth and vigour, induction of more percentage of sex-ratio, fruit set and better quality of fruits have been worked out with use of certain growth regulators, balanced use of fertilizers and improved cultural practices. In tropical and subtropical countries, deterioration of stored seed is a serious problem and seed priming enhanced the seed quality of deteriorated seed lot. Priming of fresh and aged seed with GA3 and KNO3 significantly improved all the parameters like standared germination, viability percentage, seedling length, vigoour index, dehydrogenase activity and decrease the permeability of cell membrane by repairing process results in to lower electrical conductivity, priming boost the repair mechanism of seed.

Introduction

The papaya (*Carica papaya* L.) belongs to the family Caricaceae and is one of the most important fruit of tropical and subtropical regions of the world. In India, it was introduced in the 16th century and now has widespread throughout the country. Being a highly remunerative and short duration fruit crop, it has tremendous impact on economic and nutritional propitiations. Papaya fruit is known as wholesome fruit which has nutritional, medicinal and nourishment properties. It has got utility from unripe to ripe stages. The ripened fruits are of the richest source of sugars, vitamin A and mineral elements, while unripe fruits are used for extraction of papain, which has proteolytic enzymatic activity. It is generally used in preparation of drugs in pharmaceutical industries and manufacturing of various industrial products.

Its cultivation is, however, besieged with several limitations like variable sex-forms, propagational problems, susceptibility to frost and water logging, fungal and viral diseases are well identified constraints in papaya cultivation. The papaya seeds are very costly because it is difficult to maintain the purity or viability of seeds. Lot of problems are associated with seeds like poor seed germination, poor seedling vigour etc. Papaya seeds possess highest viability and vigour at physiological maturity. Seed quality deterioration sets in early after extraction, resulting in low germination and seedling vigour. The subsequent reduction in seed germination after storage is also very fast due to accumulation of inhibitors in sarcotesta.

The quality of the seed lot not only define its permeability but also define its storability under normal conditions. Deterioration of quality of seed and its longevity during storage are well known. However, the extent of losses is governed by a number of internal and external factors. Internal factors include all such variations in seed metabolism which occur due to difference in environmental and adaphic conditions during plant growth and seed development. The external factors include seed storage environment i.e. relative humidity, temperature and oxygen availability in seed store.

Higher the moisture content of the seeds along with high temperature of storage environment, the quicker is the loss of viability. Seed ageing causes gradual decline in all vital cellular components thereby causing progressive loss of viability. The lipid auto-oxidation has also been suggested to be one of the causes of seed ageing. Seed deterioration leads to reduction in seed quality, performance and stand establishment.

The above mentioned problems impart serious threat to papaya cultivation hence it requires proper management to maintain seed viability and vigour. The significant role of plant growth regulators in relation to seed germination, growth and development of plants, flowering and fruiting, yield and quality of fruit have been worked out in number of fruit crops. Priming treatments have been reported to offer promising means for maintaining quality of seeds in fruit crops. Various treatments involving hydration, pre sowing treatments with different chemicals like-GA_3, Potassium nitrate, thiourea, have been found beneficial for enhancing the life of seeds

METHOD OF PRIMING

Seed priming is a system of soaking seeds in a solution for a given period of time prior to planting. Seed priming is commercially used to reduce germination time and increase the uniformity of the seedling stand. Uniform plant emergence allows for the full growth potential of every seedling. The fruits were cut longitudinally using a knife and seeds extracted by scooping out using a spoon. The seeds were then placed in a beaker containing distilled water and flotation test carried out to determine their viability. Those that floated were removed as they had low viability. The seeds were then washed to remove the gelatinous materials. The washed seeds were divided into lots. Sufficient number of seeds from different seed lots were placed over filter-paper soaked in solution of the desired treatment in a petri-dish kept at room temperature. The seeds were allowed to imbibe solution for 24 hrs in all the treatments. After the completion of treatment period, the seeds were dried at room temperature. Either salt solutions or water can be used for priming. When using water to prime seeds, priming should be terminated before radicle emergence. The osmotic potential is the key factor in developing salt solutions for seed priming.

Osmopriming (osmoconditioning) is the standard priming technique. Seeds are incubated in well aerated solutions with a low water potential, and afterwards washes and dried. The low water potential of the solutions can be achieved by adding osmotica like mannitol, polyethyleneglycol (PEG) or salts like KCl. It includes potassium solutions (KCL or KNO_3), Calcium solution ($CaCl_2$ or $Ca(NO_3)_2$, hydaration , thiourea, GA_3. GA_3 improved seed germination significantly during rainy and spring season. Soaking of papaya seeds in GA_3, thiourea and KNO_3 improved germination percentage. The role of gibberellin in seed germination has been well defined through conversion of starch into sugars, weakening of

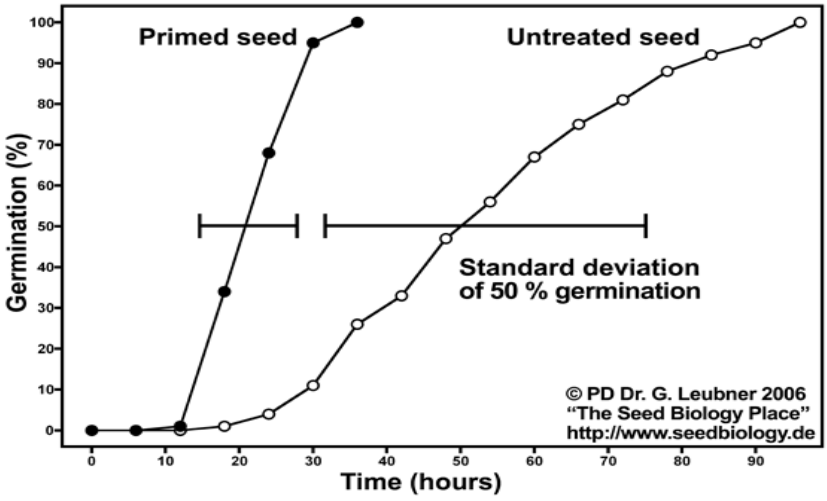
seed coat, cell elongation and emergence of radicles. The enhancement in standard germination by KNO_3 treatment can be due to its role in increasing enzyme activity. The increase in germination by KNO_3 can also be due to its dormancy breaking properties.

Hydropriming (drum priming) is achieved by continuous or successive addition of a limited amount of water to the seeds. Adrum is used for this purpose and the water can also be applied by humid air.

Matrixpriming (matriconditioning) is the incubation of seeds in a solid, insoluble matrix (vermiculite, diatomaceous earth, cross-linked highly water-absorbent polymers) with a limted amount of water. This method is conferring for slow imbibition.

Pregerminated seed is the only possible with a few species. In contrast to normal priming, seeds are allowed to perform radicle protrusion. This is followed by sorting for the specific stages, a treatment that reinduces dessication tolerance, and drying. The use of pregerminated seeds causes rapid and uniform seedling development.

Conclusion: Seed priming was shown in this study to enhance the total seed germination and seedling stand establishment for slow germinating varieties or varieties with reduced viability. The benefit of seed priming was to reduce the average seedling emergence time and increase the uniformity of plant emergence. Priming papaya seeds in water or one of the four salt solutions examined benefited seedling stand establishment. One of the beneficial effects of seed priming may be to leach some of the plant growth inhibitors from the seed coat and internal seed tissues. Using a salt solution for seed priming of some papaya varieties can enhance the performance of seedling stand establishment over that obtained by water priming or unprimed seed. The uptake of the nutrient salt during priming may increase metabolic activity during the priming process which can stimulate low vigor seeds to germinate. Pretreating papaya seeds with a salt solution can be used to enhance seed germination and provide uniform plant emergence in a shorter length of time than untreated seed. Priming papaya seeds in a $KN0_3$ solution resulted in the greatest seedling emergence in the shortest length of time. Seed priming can be effectively used to promote better papaya seedling stand establishment.



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