Biotechnological Approaches in Post Harvest Management of Horticultural Crops

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ABSTRACT

In recent days the population is shifting from a rural area to urban area at high concentration. This situation creates critical condition to the vegetable and fruits growers to supply the right food to the right place with a minimum post-harvest loss. Rapid increase in population and food demand put together researchers to work not only to improve the nutritional quality and food quantity but also to increase the shelf life of horticulture crops by using the biotech engineering. A technique called genetic modification can be used in the vegetables and fruits to enable plants to tolerate the biotic and abiotic stresses, resistant to pests and diseases, improve nutritional value and increase the shelf life of the fruits and vegetable products. The plant hormone ethylene influences many aspects of plant growth and development, such as fruit ripening and leaf senescence, which is the main player in vegetables and fruit degradation in the long run of post-harvest. Therefore, if we can take the help of biotechnology and target the gene for biosynthesis of ethylene, we can delay the process of senescence and can preserve the food for longer duration without facing the loss due to degradation by senescence.

INTRODUCTION

India is second largest producer of fruits and vegetables with first rank in production of ginger and okra, second in bananas, papayas, mangoes etc. With an increase in population there is an increase in demand of food. In India, it is estimated that about 50 % of the total fruits and vegetables production are decayed by pathogens during post-harvest handling. Senescence the final stage in the life of plants in which cell components break down due to intrinsic and extrinsic stimuli and the crop undergoes a process of decay, and the death of the plants/organism occurs. The nutritional value, colour, flavour, texture, processing qualities and shelf life of the

products are critical factors for consumer preference. Several biotechnological approaches are being used for the conservation and improvement of plant species for desired traits. The researchers should work more prominently not only to improve the product quality and quantity but also focus on challenges, like increase in population, water scarcity, changing global climate, high post-harvest decays and short shelf life of vegetables, through biotechnological applications in the vegetable and fruit production.

POST HARVEST ACTIVITIES

The post-harvest activities like handling, storage, processing, packaging, marketing, and transportation, eliminates undesirable elements, improve product appearance, ensures quality standards for fresh and processed products and increase the shelf life of the product.

POST HARVEST LOSS

There are many causes of qualitative and quantitative post-harvest loss

Primary Cause: careless handling during harvesting, packing, transportation, and storage etc.

Biological cause: respiration, transpiration, ethylene, and microbes etc

Environmental Cause: temperature, relative humidity, atmospheric condition etc.

POST HARVEST MANAGEMENT

To reduce the post-harvest loss, it is very important to maintain a good post-harvest management practices. Post-harvest management is a system of handling, storing, transporting agricultural commodities after harvest. Post-harvest management largely determines final quality. Ethylene plays a vital role in post-harvest loss of fruits and vegetables. It acts as gaseous hormone with diverse effects on growth and development of plants, commonly known as fruit ripening hormone. Ethylene can promote much benefits if they are controlled and applied in a proper way while it creates major losses in post-harvest produce if not controlled. Though we have many conventional post-harvest management techniques still we are lacking behind and facing severe post-harvest loss. Here, comes the field of biotech where biotechnological approaches can be used towards post-harvest management.

BIOTECHNOLOGICAL APPROACHES TOWARDS POST HARVEST MANAGEMENT

Biotechnology harnesses cellular and biomolecular processes to develop technologies and products that help to improve the lives and the health of the planet. Genes encoding the enzymes involved in biosynthesis (ACC synthase and ACC oxidase) responsible for the ethylene production can be identified, isolated and further can be cloned into a suitable vector. This technique will block the expression of those genes, which ultimately block or reduce the biosynthesis of ethylene. Due to the short life span of many vegetables, very quick and extensive actions need to be taken to extend their lifespan or delaying the senescence after harvesting the crop. A natural pigment anthocyanin, present in purple tomato fruit, can significantly extend shelf life by slowing down the ripening process and reducing or controlling the infection of Botrytis cinerea, one of the most important post-harvest pathogens. Polygalacturonase (PG) repression might be useful in increasing the shelf life of fruit. The biotechnological intervention not only led to increase the post-harvest storage life of fresh fruits and vegetables but also improve the supply of food. Presently, biotech application by using tissue culture techniques as regeneration, mass micropropagation and gene transfer studies in horticulture crops have been encouraging extensively. In interspecies cross of wild with cultivated lines may produce multiple biotic and abiotic stress-resistant

plants. Low temperature and refrigerated storage techniques are widely used to delay senescence in vegetables ultimately reducing the post-harvest losses and increase the shelf life. The accumulation of heat shock proteins (HSP) of certain plant species provides chilling injury tolerance due to their chaperone activity and capability to function as Reactive oxygen species (ROS) scavenger, membrane stability and wonderful massagers for coordinating cell antioxidant systems. The role and mode of action of ethylene biosynthesis give insights to perform basic research over the ethylene along with development of improved varieties. Use of hydrolases in fruit softening and senescence in leaf using up or down concentration of cytokinin also played an important role to extend shelf life of leafy and fruit vegetables. Nutritional value, flavour, colour, texture, processing qualities and shelf life are the desirable properties of fresh fruits and vegetables. Studies found that tomato plants transformed with yeast S-adenosylmethionine decarboxylase (SAMDC) gene under the control of ethylene biosynthesis promoter (E8 promoter) exhibited improvement in tomato lycopene content, fruit quality without affecting fruit colour and softness. An inventive solution to the use of cytokinin to delay senescence has been provided the isopentenyl transferase (IPT) gene under the control of a senescence-specific promoter (SAG12). In Transgenic tobacco plants at the onset of senescence triggers the senescence-associated gene (SAG12 promoter), leading to the production of cytokinin to delay in senescence with high levels of photosynthetic activity with no other developmental abnormalities.

CONCLUSION

Senescence due to post-harvest factors causes biochemical and cellular changes in the cell components. Due to this intricacy and inadequate knowledge of the cellular processes, developing new biotechnological technique is very challenging. People are still in confusion and afraid of consuming transgenic or biotechnological fruits and vegetables. The cost of intervention, development, and registration of a new traits for internationally traded crops faces a great challenge. There are several types of issues in development of the genetically engineered, commercially viable vegetable crops, which can provide better post-harvest characters. Despite of facing difficulties, biotechnological approach to post harvest management of horticultural cops has been reported a great success.

REFERENCES

Ekow, A. and Buah, J.N. 2014. Biotechnological Approaches to Improve Nutritional Quality and Shelf Life of Fruits and Vegetables. 13p

Gan, S. and Amasino, R.M.1997.Making Sense of Senescence (Molecular Genetic Regulation and Manipulation of Leaf Senescence). Plant Physiology, 113, 313-319.

Smart, Catherine, Scofield, Steven, Bevan, Michael and Dyer, Tristan. 1991. Delayed Leaf Senescence in Tobacco Plants Transformed with tmr, a Gene for Cytokinin Production in Agrobacterium. The Plant cell. 3. 647-656. 10.1105/tpc.3.7.647.