

# Emerging Trends to Minimize the Post Harvest Decay of Perishable Fruits

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**ABSTRACT-** Fruits and vegetables are mainly consumed for their nutritive value. India ranks high in the world in production of these commodities. But, a major part of the yield is lost due to a number of factors. Post harvest decay due to attack by a variety of pathogens is one of the main reason responsible for such losses. Most of the fruits and vegetable are prone to attack by post harvest pathogens. But, perishable fruits are at maximum risk due to high moisture content present in them. Various control measures have been practiced against the fungal pathogens. Traditionally used methods like irradiation, use of chemical fungicides etc. have certain environmental and health hazards associated with them. Recent trends are shifting towards safe and consumer friendly strategies to control the post harvest decay of perishable fruits. Presently, trends are focusing on the enhancement of the shelf life of perishables along with the minimization of the losses in quantitative as well as qualitative terms. In the recent past, a metamorphic change in the post harvest management scenario has been observed. Emerging trends was aimed at use of biological control measures to combat the post harvest losses.

**Key-words:** Biological control, Consumer friendly strategies, Emerging trends, Fungal pathogens, Post harvest decay, Post harvest management, Perishables

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## INTRODUCTION

Almost all crops are vulnerable to attack of some pathogen at all stages of life. However, the risk increases many fold after harvesting. Post harvest diseases result into reduction in both quality and quantity of the crop. Losses caused due to post harvest fungal pathogens are far more than realized [1-3]. A large number of pathogens attack various fruits and vegetables, but perishable fruits, due to their high moisture content are an easy prey to these pathogens.

A variety of strategies are evolved to enhance the shelf life of perishables by reducing chances of decay due to post harvest pathogens [4-9]. But, most of these have certain limitations associated with them. In today's world, consumer's concern over the presence of poisonous chemical residue, off taste or tissue softening resulting as after effects of some of control measures has prompted the search for some safe and consumer friendly strategies to deal with the issue.

Use of Biocontrol agents, microbial antagonists and natural fungicides are few of them to be named here. In the present paper, uses of biological control measures and natural fungicides to reduce the post harvest decay caused by various fungal pathogens have been reviewed [10-21]. This review describes key strategies underlying the development of Biocontrol of post harvest decay of fruits and possible approaches and prospects for future.

## MATERIALS AND METHODS

A large number of post harvest pathogens cause decay of perishables. Some of these have been listed in Table 1. Use of various biological control measures, natural fungicides or some antagonistic compounds to control post harvest losses in a number of fruits were studied. Many of these were able to yield favorable responses as reported by a number of workers. Although, the exact mechanism is not clear, but different types of interactions between the host and pathogen such as competition for site and nutrients, site exclusion or synthesis of some antagonistic compounds are thought to be responsible for the inhibitory role. Most of the studies involved use of biological control methods or use of natural fungicides to control post harvest decay caused by fungal pathogens.

**Biological control:** Growth of *R. stolonifer* has been

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reported to be checked by *E. cloacae*. Blue and green mold of citrus fruits was checked by *D. hansenii*. Storage rot of ginger by *S. rolfisii* was reported to be controlled by *Trichoderma* species. Silver scurf of potato is controlled by different microorganisms like *P. putida*, *N. globerula* and *X. compestris*. Blue mould of citrus fruit is reported to be checked by *P. guilliermondii*. *B. subtilis* has been patented for the control of brown rot of stone fruits. Post harvest biocontrol of grey mould and blue mould of apple by *C. albidus* has been reported. *P. syringae* is reported to control post harvest decay of peaches. Biocontrol of grey mould, black mould and soft rots of grapes has also been reported. *Bacillus subtilis* has been patented for biocontrol of brown rot of stone fruits caused by *M. fructicola*; *P. guilliermondii* strain US-7 and *Hanseniaspora uvarum* strain 138 have been used for biocontrol of citrus fruit rots. Growth of *H. solani* causing silver scurf of potato is checked by *Nocardia globerula*, *P. putida*, and *X. compestris*. Biocontrol of post harvest diseases of peach by application of *P. syringae* has been studied. Biocontrol of fruit rots of grapes caused by various fungal pathogens has also been studied.

**Natural fungicides:** Fungicidal properties have been shown by a number of compounds produced naturally by certain fungi. Fungicidal role of *T. spp.* is reported against *Botrytis cinerea* and *S. sclerotium*. Chitosan, a compound naturally present in the cell wall of certain fungi, possesses antifungal action against a number of fungal pathogens such as *A. alternata*, *B. cinerea*, and *R. stolonifer* etc.

**RESULTS**

Post harvest losses may occur at any point in the marketing process, from the initial harvest through assembly and distribution to consumers. Perishables are at risk at any of these stages. A variety of fungal pathogens caused the post harvest decay of various fruits is shown in Table 1.

**Table 1:** Some common fungal pathogens responsible for post harvest fungal decay of various fruits

Name of fungal pathogen	Type of Rot/decay
<i>Alternaria alternata</i>	Fruit rot
<i>Botrytis cinerea</i>	Grey mold rot
<i>Colletotrichum gloeosporoides</i>	Anthrachnose
<i>Geotrichum candidum</i>	Sour rot
<i>Penicillium spp.</i>	Blue and green mold rot
<i>Rhizopus stolonifer</i>	Soft rot
<i>Sclerotinia sclerotium</i>	Cottony rot

Enormous losses are caused due to these types of decay. These losses are however, minimized to some extent by using various natural fungicides or by biological control measures. Various types of biological agents or bio active compounds employed to reduce post harvest losses caused

by fungal pathogen have been given in Table 2.

**Table 2:** Various natural fungicides/Biological agents exhibiting antagonistic role against different fungal pathogens

Antagonistic compound /Microorganisms	Affected Fungal pathogen
Chitosan	<i>Alternaria alternata</i> , <i>Botrytis cinerea</i> , <i>Rhizopus stolonifer</i>
<i>Enterobacter cloacae</i>	<i>Rhizopus stolonifer</i>
<i>Debaryomyces hansenii</i>	<i>Geotrichum citri-aurantii</i> , <i>Penicillium italicum</i>
<i>Trichoderma sp.</i>	<i>Sclerotium rolfisii</i>
<i>Pseudomonas putida</i> , <i>Nocardia globerula</i> , <i>Xanthomonas compestris</i>	<i>Helminthosporium solani</i>
<i>Pichia guilliermondii</i>	<i>Rhizopus stolonifer</i> , <i>Penicillium italicum</i>
<i>Bacillus subtilis</i>	<i>Monilia fructicola</i>
<i>Cryptococcus albidus</i>	<i>Botrytis cinerea</i> , <i>Penicillium expansum</i>

**DISCUSSION**

India ranks high in the production of fruits and vegetables. However, there is a considerable gap between the gross production and net availability of these commodities. A large number of factors are responsible for it. Some of these are unavoidable, while others can be avoided to more or less extent. Post harvest losses, especially due to decay caused by fungal pathogens can be reduced to some extent by employing some suitable control measures. Post harvest management is necessary to be maintaining the quality as well as quantity of fruits and vegetables. For this purpose, various post harvest practices aim at keeping the produce free from contaminants and improve its market value. It is felt that a large number of fruits suffer from post harvest decay, thereby lowering both their quality as well as quantity [22-25]. Commonly practiced control measures such as irradiation; chemical fungicides etc. pose certain kind of threat to the consumer as well as the environment. So, trends are seen shifting towards some safer control measures like biological control. A number of studies have shown their positive outcomes. These types of control measures are also important for the enhancement of shelf life of the commodities, especially perishables. Biological control has emerged as an effective and alternative approach to minimize the post harvest losses. However, the limitations of these products should be addressed by improving their efficacy. It is also felt that the integration of biocontrol with other alternative methods that alone do not provide sufficient protection against post harvest, show synergistic effect.

## CONCLUSIONS

Most of the fungal pathogens attack various fruits and vegetables. However, perishables are under maximum threat from these pathogens. Various studies indicate that use of biological control methods is effective against most of the post harvest pathogens. Currently, trends are shifting towards this direction. These have almost little or no adverse effects as these are biodegradable. However, the potential toxicity of these compounds needs to be evaluated properly. There was a huge potential to explore more of microbes with anti fungal properties. Emerging trends are focussing on an enhanced spectrum of activity of biological agents to minimize post harvest losses and their future prospects.

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