IASET: Journal of Humanities and Social Sciences (IASET: JHSS)
ISSN(P): Applied; ISSN(E): Applied
Vol. 2, Issue 1, Jan - Jul 2016; 5-12

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

PLANT EXTRACTS IN POST HARVEST MANAGEMENT (DISEASE AND SPOILAGE) OF FRUITS - A REVIEW

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ABSTRACT

Purpose of Research: - This review focus of the utilization of plant extracts in the post harvest management of fruits and vegetables and this also emphasize the need for future research.

Findings: Plant products are an important source of agrochemicals used for the control various post harvest losses which include diseases as well as insect pests. The widely studied plants in this context are the neem tree (*Azadirachta indica*), chinaberry (*Melia azadrach*) and marigold (*Tagetes* spp.). They are being used to manufacture natural or bio insecticides, which are environmental friendly and do not have any toxic effects on plants and soil. Moreover, they possess fungicidal and insecticidal properties. It was found that application of 0.2 per cent neem azal formulations papaya fruits resulted in retention of fairly good amount of juice contents and completely eliminate storage rots of fruits. Extract of datura, *Azadirachta indica*, *ocimum gratissimum*, *Lantana camara* were found effective in reducing the mycelial growth and spore germination of *Altern aria alternate*, *Rhizophus* sp.

Directions for Future Research: Each of these categories requires further research. The industries would benefit from this article on the utilization of plant extract post harvest management of fruits and vegetables. There are several areas which require further exploration. One of these is the development of technologies for the extraction of plant extract and its awareness about the safety of its utilization without any effect on human health.

KEYWORDS: Neem, Chinaberry, Marigold, Post Harvest Management

INTRODUCTION

Post harvest disease control of fruits and vegetables is important to prevent spoilage of fruits and vegetables and so as to keep them available for long time. Although satisfactory control of the disease by using various chemicals have been documented in the literature (Choutwar and Datar, 1988; Maheshwari *et al.*, 1991; Abdul Mallek *et al*., 1995) during recent years, global concern for protection of the environment has led researchers to investigate the use of natural flora as one of the sources for crop protection (Wijewardane and Guleria, 2009).

A considerable amount of work has been carried out all over the world on the effect of plant extracts on the quality and shelf life in various fruit and vegetable crops. Singh *et al*. (2003) reported the effect of various extracts such as neem leaf extract, castor oil and neem oil on citrus fruits and reported that, among these extracts neem was best in retaining most of biochemical characteristics such as TSS (16.01°B), acidity (0.38 %), pectin (0.98 %) and ascorbic acid content

(20.56 mg/100 ml juice) as compared to control fruits in which the values for these parameters were 12.03°B, 0.23%, 0.55% and 15.68 mg/100 ml juice, respectively, after 12 days of storage

Neem (*Azadirachta indica* A. Juss) and chinaberry (*Melia azadrach*) are two trees belonging to the mahogany family (Meliaceae). Neem is an evergreen tree (Schmutterer, 1995), whereas chinaberry is a deciduous tree native to South Asia, Australia. Fishwick, (1989) and Eesware, *et al*. (1998) found the reputed value for its antifungal properties. Bina *et al.* (2004) reported the efficiency of leaf extract of neem and chinaberry against two tomato pathogenic fungi *Alternaria solani* and *Fusarium oxysporium*, the causal organisms of blight and wilt disease of tomato plants, respectively. Azadirachtin is considered as the most active principal substance in neem which has growth regulating, fungicidal and insecticidal properties (Schmutters, 1990). Neem leaf extract give good control of *Fusarium oxysporium* disease development with minimum percentage loss in fruit weight and was found most effective medicinal plant. Neem dust was found effective against population growth of the pulse beetle *Callosobruchus chinensis* (L.) reared on chickpea (*Cicer arietinum*). Azadirachtin has minimal impact on non-target organisms and is compatible with other eco-friendly bio control agents (Srivastava, 2003).

Marigold belongs to the genus *Tagetes* (Asteraceae) with 56 species and includes the popular ornamental budding plants known as marigolds. Deshmukh *et al.* (1992) have reported the beneficial effect of *Tagetes erecta* flower on various horticultural and agricultural crops, which are attributed primarily to the presence of an organic compound 'camacin' exhibiting antifungal and insecticidal effect. Further, Pandey *et al.* (1983) applied leaf extracts of *Mentha* and *Melia* to guava fruits and observed that these treatments were effective in retaining physical quality characteristics of fruits as they reduced moisture loss and storage rot symptoms.

Hasabnis and D'Souza (1987) reported beneficial effects of natural plant products for the control of storage rots in Alphonso mango. They further reported that these treatments also checked the incidence of disease development in banana. Arya (1988) reported that higher concentration (75%) of leaf extract of neem was effective in reducing spores (82.3%) of two fruit rot pathogens viz., *Phomopsis psidii* and *Phomopsis viticola*. Chauhan and Joshi (1990) reported the efficacy of phytoextracts on the storage quality of mango cv. Ratna and found them significantly better in retaining total soluble solids and sugar contents and in reducing reduction in the possible incidence of anthracnose pathogen in comparison to untreated fruits where lower soluble solid and sugar content and higher incidence of anthracnose pathogen was reported.

The beneficial effect of various botanical extracts such as neem leaf extract, *Melia* leaf extract, onion extract, garlic extract, mahua extract and eucalyptus extract on the post-harvest quality of fruits and vegetables were reported by Tiwari (1991) and Rao and Singh (1999). They are also reported to act as antifeedent and antirepellent agents against various storage pathogens.

Many plant and plant products have been reported to have antimicrobial activities against plant pathogenic fungi. It was reported that the effect of plant extracts as alternative synthetic fungicides in controlling mycelium growth of *Penicillium digitatum* that is pathogens for the post- harvest diseases of citrus (Gupta and Dikshit, 2010). These diseases could cause a loss of 10-30 per cent decrease in crop yield and marketing quality (Nicholson, 2007). The use of biocontrol agents in plant disease control with plant extracts like lemon, citronella, clove, mint, thyme, and oregano oils has been employed by Samson (1993) as alternative control measures to replace the conventional synthetic pesticides. The plant extracts reported to be effective on the fungi *Penicillium digitatum* including garlic, *Withania somnifera*, *Acacia seyal* and *mustard horseradish* used for the same purpose as natural alternative.

Deshmukh *et al.* (1992) have reported beneficial effects of Melia (*Melia Azadirachta*) and bavistin in controlling the storage fungi and insect-pests. They have also advocated commercial use of *Melia* extract as a substitute for fungicides and insecticides.

Lehmann and Ibenthal (1993) and Bottenburg and Singh (1996) reported beneficial effects of treatments with neem leaf and mentha leaf extract on the marketing quality characteristics of cow pea and sugar beet and concluded that these treatments were effective in retaining the physico-chemical characteristics of these crops.

Sarvamangla (1993) studied the effect of leaf extracts from *Azadirachta indica*, *Calotropis gigantean*, *Calthranthus* sp., *Eucalyptus* sp., *Parthenium chysterophorus* and *Pongamia pinnata* on fruit quality of mulberry and reported that among these extracts *Azadirachta indica* was the most effective in retaining higher sugar content, maintaining fruit size and shape, and resistance to fungal pathogens. He also reported that plant extracts can also control fungal rot on mulberry fruits.

Singh *et al*. (1993) reported that treatment of infested banana fruit with aqueous leaf extract of *Azadirachta indica* gave good control of *Fusarium oxysporum* disease development with minimum percentage loss in fruit weight. They also reported that various leaf extracts such as Neem leaf extract, Mentha etc. have efficiency in retaining most of the physical characteristics of papaya and banana fruits and also check the incidence of disease development in banana. Isman (1997) reported beneficial effect of botanical extracts of Meliaceae on citrus fruits and found them to be best in retaining most of bio-chemical quality characteristics.

Srivastava and Lal (1997) studied that the leaf extract of *Azadirachta indica* was effective in the control of fruit rot of pear and pomegranate. Sindhan *et al*. (1999) also reported the beneficial effects of neem, eucalyptus, tulsi, datura, bougainvillea and ginger on the bio-chemical and physical quality characteristics of citrus and mango fruits, as these extracts significantly reduced moisture loss and retained higher soluble solid content over the uncoated fruits.

Rameshwar *et al.* (2000) observed that a combination of neem leaf extract at 20% + UV radiation exposure for 10 minutes + rice starch 6% proved to be the most appropriate treatment in minimizing the reduction of juice contents and fruit rotting and fluctuation in physiological loss in weight was also minimum as compared to control.

Verghese (2000) studied the efficacy of botanical extracts of neem, mahua and mentha leaves on pomegranate fruit and reported that these extracts were effective in retaining marketable quality even after 22 days of storage. Patil *et al.*, (2001) compared the effect of fungicides and botanical extracts (neem, melia and mentha leaves) on tomato fruits and observed that the extracts resulted in significantly higher sugar-acid ratio in the fruit in comparison to fungicide (Bavistin) treatment.

Singh *et al*. (2000) observed that the quality of untreated mango cv. Langra fruit started deteriorating after about two weeks of storage and the fruits became unacceptable after five weeks. However, the fruits were reported to be acceptable even after five weeks of storage when they were given post-harvest dip of GA_3 (500 ppm) and 20% neem leaf extract and retained high pectin content (0.98%) over the control (0.55%) fruits. Bhardwaj and Sen (2003) observed that physiological loss in weight, rotting, loss in juice content and reduction in diameter of fruits of sweet orange cv. Nagpur Santra under zero energy cool chamber + 20% neem leaf extract were significantly less, whereas high under ambient condition + 10% neem leaf extract after 42 days of storage.

Chaudhary (2003) reported that aqueous extracts from different plants can be a viable alternative to chemicals in

controlling post-harvest pathogens as they are environmentally safe strategies for controlling the post- harvest storage pathogens in different crops. Yadav *et al.* (2007) observed that the extract from *Azadirachta indica* was significantly better over extract of *Vinca rosea* and control but was at par with the extracts from C*urcuma longa* and *Zinziber officinale* in controlling the rot of aonla.

Singh *et al.* (2007) tested the efficacy of aqueous leaf extracts of 20 plant species and 3 essential oils against management of *Penicillium expansum* rot of apple cv. Red Delicious. Among various treatments leaf extract of *Azadirachta indica* significantly reduced *P. expansum* rot when used as post-infection dip treatment. Borthakar *et al*. (2007) conducted experiments on the effects of neem leaf (5%), melia leaf (5%), garlic (5%) and neem oil (2%) on physico-chemical characteristics of Baramasi lemon fruit and concluded that among various treatments neem leaf extract and melia leaf extract was better in retaining most of the physico-chemical characteristics of fruits. Similar findings have been reported by Ali *et al.* (1992) and Abid and Maqbool (1991) on tomato fruits.

Chauhan *et al*. (2008) treated apple cv. Starking Delicious with plant leaves/flower based formulation of neem leaf extract (10, 20%), spearmint (*Mentha spicata*) leaf extract (10, 20%), marigold (*Tagetes erecta*) flower extract (10, 20%) and semperfresh (control 1.5%). Freshly harvested fruits were treated with above treatments and were kept under refrigerated storage (1 $\pm$1^{o}C) for analysis at a month interval up to 180 days. Among treatments, 20% spearmint leaf extract proved to be highly effective in reducing fruit spoilage followed by 20 per cent neem leaf extract. Fruit treated with 20 per cent drake leaf extract proved to be most effective treatment in reducing weight loss and also these leaf extracts were capable to retain maximum total soluble solids content.

Hassanein *et al*. (2008) studied the effectiveness of leaf extracts of neem and china berry against two tomato pathogenic fungi *Alternaria solani* and *Fusasuim oxysporum,* the causal agent of early blight and wilt disease of tomato plants respectively and reported promising results. Jakhar and Dheeraj (2008*)* also reported that the physiological loss in weight, colour, texture, shrivelling and rotting of Chakaiya cultivar of aonla fruit was significantly affected by packaging materials, neem leaf extracts and diphenyl fumigation and their combination throughout the storage period up to 21 days.

Kulkarni *et al.* (2008) reported that shelf life was maximum and number of rotten berries was least when grapes were treated with Azadirachtin 1% at 3 ml/L+ *Trichoderma harzianum* 5ml/L. Patel *et al*. (2008) reported that the extract from *Allium sativum* was significantly better followed by extract of *Jatropha curcas, Aloe barbadensis* and *Azadirachta indica* in controlling *Aspergillus niger* of aonla fruit rot. Phalisteen *et al.* (2008) reported that the medicinal plant extracts of neem (3%), nerium (3%) added with carbendazim (1%) showed maximum inhibition of fungus (*Alternaria solani).*

Wijewardane and Gularia, (2009) reported that the apple cv. Royal Delicious treated with 20 per cent marigold extract surface, coated with shrink-wrapped tray packing and pre-cooled retained highest pectin content. Okigbo *et al.* (2009) used ethanolic and water extractions of *Azadirachta indica* leaves and *Aframomum melegueta* seeds as antifungal agents against pathogenic fungi *Aspergillus niger, Botryodiplodia theobromae, Fusarium solani and Penicillium oxalicum* of cassava. They reported that *A. indica* was more active on the organisms than *A. melegueta* in preventing post-harvest deterioration of cassava as compared to other treatments. Bhardwaj *et al*. (2010) reported that the minimum losses of various physico-chemical characteristics of orange fruit was under dip treatment of 20% neem leaf extract combined with 100 ppm benzyl adenine.

CONCLUSIONS

Plant extracts are being used to manufacture natural or bio insecticides, which are environmental friendly and do not have any toxic effects on plants and soil. More ever they possessed fungicidal and insecticidal properties. So these can be used as compare to synthetic/chemical products. Plant products are an important source of agrochemicals used for the control various post harvest loses which include diseases as well as insect pests. The widely studied plants in this context are the neem tree (*Azadirachta indica*), chinaberry (*Melia azadrach*) and marigold (*Tagetes* spp). They are being used to manufacture natural or bio insecticides, which are environmental friendly and do not have any toxic effects on plants and soil. More ever they possess fungicidal and insecticidal properties. It was found that application of 0.2 per cent neem azal formulations papaya fruits resulted in retention of fairly good amount of juice contents and completely eliminate storage rots of fruits. Extract of datura, *Azadirachta indica*, *ocimum gratissimum*, *Lantana camara* were found effective in reducing the mycelia growth and spore germination of *Altern aria alternate*, Rhizophus sp. So it is beneficial to use the plant extracts in control of post harvest damages caused by insects and other damage causing agents because these plant extracts are environment friendly and have no environmental pollution.

REFERENCES

1. Abdul Mallek, A.Y, Hemida, S.K. and Bagy, M.K. 1995. Studies on fungi associated with tomato fruits and effectiveness of some commercial fungicides against three pathogens. *Mycopathologia*, **130**: 109-116.
2. Abid, M. and Maqbool, M.A. 1991. Effect of bare-root dip treatment in oil cakes of neem leaf extract on the root-knot development and growth of tomato and eggplant. *Pakistan Journal of Nematology,* **9**(1), 13-16.
3. Ali, T.E., Nasir, M.A. and Shakir, A.S.1992. In-vitro evaluation of certain neem products as mould inhibitors against post-harvest rotting fungi of tomato. *Pakistan Journal of Phytopathology,* **4:** (1-2): 58-61.
4. Arya, A. 1988. Control of phomosis fruit rot by leaf extract of certain medicinal plants. In: Kaushik, P. (ed.). *Indigenous Medicinal Plants.* Symposium, Today and Tomorrows Printers and Publishers, New Delhi. pp. 41-46
5. Bhardwaj, R.L. and Sen, N.L. 2003. Physico-chemical changes of stored mandarin orange (*Citrus reticulata* Blanco) cv. 'Nagpur Santra' as affected by neem leaf extract and zero energy cool chamber. *South Indian Horticulture*, **50** (4/6): 500-504.
6. Bhardwaj, R.L., Dhashora, L.K. and Mukherjee, S. 2010. Effect of plant extract and benzyladenine on post-harvest shelf life of orange (*Citrus reticulata* Blanco). *Journal of Advanced Developmental Research,* **1**: 32-37.
7. Bina, S.F., Siddiqui, Afshan, T. and Muddasar, H. 2004. Tetra cyclic triterpenoids from the leaves of *Azadiracta indica*. *Phytochemistry,* **65 (16)**: 2363-2367.
8. Borthakar, P.K., Ranjit, K. and Kumar R. 2007. Effect of plant extract on size and rind thickness of Baramasi lemon fruit *(Citrus lemon)* during storage. *Journal of Agricultural Science Society of North-East India*, **15**(1):98-103.
9. Bottenburg, B.H. and Singh, B.D. 1996. Effect of neem leaf extract applied using the broom method on cow pea pests and yield. *International Journal of Pest Management*, **42**(3):207-09.

10. Chaudhary, M. 2003. *Studies on the post-harvest diseases of tomato and their management.* Ph.D. thesis. Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni-Solan (HP).

11. Chauhan, H.I. and Joshi, H.N. 1990. Evaluation of phyto extracts for control of mango anthracnose. *Proceedings of Symposium of Botanical Pesticides.* pp 455.

12. Chauhan, Sandeep, K., Thakur, K.S. and Bhanot, 2008. Amandeep. Effect of pre and postharvest treatment of neem (*Azadirachta indica*) based formulations, plant leaves and their extracts on the storage quality of apple (*Malus domestica*). *Indian Journal of Agricultural Science*, **78** (11): 966-70.

13. Deshmukh, P.B., Chavam, S.R. and Rehapukar, D.M. 1992. A study of insecticidal activity of twenty indigenous plants. *Pesticide*, **16** (12): 7-10.

14. Fishwick, R.W.1989. Neem (*Azadirachta indica* A. Juss) Plantations in the Sudan Zone of Nigeria Rep., prepared for the Chief Conservator of Forests, Northern Nigeria. (C.F. Jacobson, M. (ed): The neem tree. P. 3. CRC Press, Inc., Boca Raton, Florida, USA).

15. Gupta, S.A. and Dikshit, K. 2010. Biopesticides: An eco-friendly approach for pest control. *Journal of Biopesticides*, **3:** 186-188.

16. Hasabnis, S.N. and D'Souza, T.F.1987. Use of natural products in the control of the storage rot in alphanso mango fruits. *Journal of Maharashtra Agricultural Universit,* **12**: 105-106.

17. Hassanein, M.M., Abou Zeid, M.A., Youssef, K.A. and Mahmoud, D.A. 2008. Efficacy of leaf extracts of neem (*Azadirachta indica*) and chinaberry (*Melia azedrach*) against early blight and wilt disease of tomato. *Australian Journal of Basic and Applied Sciences,* **2** (3): 763-772.

18. Isman, M.B. 1997. Neem and other botanical insecticides, barriers to commercialization. *Phytoparasitica*, **25**(4): 339-344.

19. Jakhar, R.P. and Dheeraj, S. 2008. Post-harvest effect of packaging material, neem leaf extract and fumigation on color, texture, shriveling and rotting of aonla (*Emblica officinalis)*. *Environment and Ecology*, **26**(4): 1652-1656.

20. Kulkarni N.S., Sawant, S., Sawant, S.D. and Adsule. P.G. 2008. Bioefficacy of neem formulations (Azadirachtin 1% and 5%) on important insect pests of grapes and their effect on shelf life. *Acta Horticulturae*, **785**: 305-311.

21. Lehmann, W. and Ibenthal, W.A. 1993. Fungicidal effects of neem extracts against seedling blight of sugar bet. *Symposium on useful Tropical Plants*, 22-24. Hamburg, Germany.

22. Maheshwari, S.K., Gupta, P.C. and Gandhi, S.K. 1991. Evaluation of different fungi toxicants against early blight of tomato. *Agriculture Science Digest*: **11**: 201-202

23. Nicholson, G.M. 2007. Fighting the global pest problem: Preface to the special Toxicant issue on insecticidal toxins and their potential for insect pest control, *Toxicant,* **49**, 413–422.

24. Okigbo, R.N., Putheti, Ramesh and Achusi, C.T. 2009. Post-harvest deterioration of cassava and its control using extracts of *Azadirachta indica* and *Aframomum melegucta*, *E-Journal of Chemistry*, **6**(4):1274-1280.

25. Pandey, R.S., Bhargava, S.N., Shukla, D.N. and Dwivedi, K.K. 1983. Control of pestololia fruit rot of guava by leaf extracts of two medicinal plants. *Revists Mexicana Fitopatologia*. **2**:15-16.

26. Patel, D.S, Nath, K., Patel, R.L. and Patel, S.I. 2008. Management of fruit rots of aonla caused by *Aspergillus niger*. *Journal of Mycology and Plant Pathology*, **38**(3): 658-660.

27. Patil, M.J., Ukey, S.P. and Raut, B.T. 2001. Evaluation of fungicides and botanicals for the management of early blight of tomato. *P.K.V. Research Journal*, **25**(1): 49-51.

28. Phalisteen, S., Ishaq. S., Amardeep, K., Asif, J. and Sami, S. 2008. Evaluation studies of some medicinal plants extracts and fungicides against *Alternaria solani*. *African Journal of Clinical and Experimental Microbiology*, **9**(1): 19-25.

29. Rameshwar, Dayal, Jeewa, Ram and Shafeal, M. 2000. Role of Post-harvest treatment with plant extracts, ultra violet radiation and rice starch on keeping quality of Sweet Orange (*citrus sinesis* osbeck) cv. mosambi. *Journal of Eco Physiology*. (Abstract).

30. Rao, P.J. and Singh, S. 1999. Effect of *Artemisia vulgaris* on the development of various pests during storage. *Indian Journal of Entomology.* **61**(5): 305-314.

31. Samson, J.A. 1993. Tropical fruits- Tropical agricultural series. Longman Inc., New York, 64-118.

32. Sarvamangla, H.S. 1993. Evaluation of plant extract for the control of fungal disease of blackberry. *Indian Phytopathology*, **46**(4): 398-401.

33. Schmutterer, H.1995. *The Neem Tree*, pp-696. Publisher VCH verlagsgesells chaft weinheim (Federal Republic of Germany) and VCH Publishers Inc., New York (USA).

34. Schmutters, H. 1990. Properties and potential of natural pesticides from neem tree, *Azadirachta indica*. *Annual Review of Entomology* **35**: 2719.

35. Sindhan, G.S., Hooda, Indira and Prashar, R.D. 1999. Effect of some plant extracts on the vegetative growth and storage rot causing fungi. *Journal of Mycology and Plant Pathology.* **29**(1): 110-111.

36. Singh, Dinesh, Thakur, R.K. and Singh, D. 2003. Effect of pre harvest sprays of fungicides and calcium nitrate on post-harvest rot of kinnow in low temperature storage. *Plant Disease Research*: **18**(1): 9-11.

37. Singh, H.N.P., Prasad, M.M. and Sinha, K.K. 1993. Efficacy of leaf extracts of some medicinal plant against disease development in Banana. *Applied Microbiology*: **17**: 269.

38. Singh, J.N., Acharya. P. and Singh, B.B. 2000. Effect of GA_3 and plant extracts on storage behavior of mango (*Mangifera indica*) CV Langra. *Haryana Journal Horticulture Science*, **29**: 3- 4.

39. Singh, Yash Paul, Sumbali and Geeta.2007. Efficacy of plant extracts and essential oils of some plant species against *Penicilluim expansum* rot of apples. *Annuals of Plant Protection Science*,**15**: 1.

40. Srivastava, A.K. and Lal, P.1997. Studies on bio fungicidal properties of leaf extracts of some plant. *Indian Phytopathology*. **50**: 408-411.

41. Srivastava, R.P. 2003. Neem (*Azadirachta indica*) bio pesticides and bio agents in integrated pest management of agricultural crops. International book distributing co. Lucknow. pp. 333.

42. Tiwari, D.N. 1991. *Monograph on neem* (*Azadirachta indica*). International book distribution New Delhi, India.

43. Verghese, A. 2000. Potential of botanicals in the management of the pomegranate aphid. *Insect Environment*. **5**(4): 147-148.

44. Wijewardane, R.M.N.A. and Guleria, S.P.S. 2009. Combined effect of Pre-cooling, application of natural extracts and packaging on the storage quality of Apple *(Malus domestica)* cv. Royal Delicious. *Tropical Agricultural Research*, **21** (1): 10-20.

45. Yadav, R.K., Jat, R.G. and Yadav, S.C. 2007. Management of Aonla fruit rot incited by *Aspergillus niger. Journal of Mycology and Plant Pathology*, **37**: 525-526.