Plant Archives Vol. 25, Supplement 1, 2025 pp. 1594-1598 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.220

THE IMPACT OF PRE-HARVEST POTASSIUM CHLORIDE SPRAY TO MITIGATE MANGO STEM END ROT

Dipali D. Hirani*, D.H. Tandel, Rahul L. Joshi, Jeslin Jose and Kishan R. Bhanderi

Department of Plant Pathology, N.M. College of Agriculture,

Navsari Agricultural University, Navsari (Gujarat) – 396 450, India.

*Corresponding author E-mail: hiranid80@gmail.com

(Date of Receiving : 18-09-2024; Date of Acceptance : 11-11-2024)

ABSTRACT

The mango (*Mangifera indica* L.), sometimes referred to as the "king of fruits," is an essential tropical fruit that has both therapeutic and nutritional benefits. Despite its importance, post-harvest diseases, especially stem end rot (SER) brought on by fungi such as *Lasiodiplodia theobromae*, pose a threat to mango production. The effectiveness of potassium chloride (KCl) as a pre-harvest treatment to manage SER in mangoes is investigated in this work. One month afterwards fruit set, mango fruits of the Kesar variety were treated with six different doses of KCl (0.5 to 3.0 g/l). Fruits were assessed for SER incidence and shelf life after harvest. The treatment with 3.0 g l^{-1}KCl significantly lowered the incidence of disease to 00 per cent and increased the shelf life to 13 days, according to the results. On the other hand, the control fruits had a lower shelf life of seven days and a 50 per cent disease incidence. In comparison to the control, treatments with 1.0 g l^{-1} and 0.5 g l^{-1}KCl also markedly decreased the incidence of disease and increased shelf life. By lowering dependency on chemical fungicides, this treatment not only improves fruit quality and shelf life but also fits with sustainable agriculture methods.

Keywords: Mango, Stem end rot, KCl, Per cent disease incidence, Shelf life.

Introduction

Economic development is significantly influenced by the horticulture industry, which includes fruits, vegetables, tuber crops, mushrooms, ornamental plants, spices, plantation crops aromatic and medicinal plants. Mangoes, citrus fruits and bananas account for 70% of all fruit crops produced (Ganeshmurthy *et al.,* 2023). There are 69 species in the genus *Mangifera*, but only the mango yields fruit that is edible (Ekanayake *et al*., 2019). Mango *Mangifera indica* L. is the king of all fruit sand it is a member of the order sapindales and the family Anacardiaceae (anusha *et al.,* 2023) having a basic chromosome number of 10 (2n = 4x = 40) (Hassan zai, 2024). Mango is the national fruit of India and considered as king of fruits due to its delicious taste, flavor aroma and attractive colour. It is often cultivated in Southeast Asian tropical and subtropical areas. Mangoes are said to have originated in India, Burma (Myanmar) and even the Malay area. It began to move to other continents in the sixteenth century (Anusha *et al.,* 2023).

The increasing demand for mangoes around the world presents problems with fruit quality, particularly with regard to post-harvest diseases, which are a major cause of crop loss. Post-harvest losses of fresh mangoes in India are reported to be 25–40 per cent; in Asian countries, microbial degradation accounts for 17.0–26.9 per cent of these losses. Disease-related post-harvest losses of 20–25% are a significant concern for India's fruit industry (Vahia, 2021). Fruits undergo significant biochemical and physiological changes as they ripen, including ethylene emission in climacteric fruit and other phytohormone changes, soluble sugar accumulation, cell wall loosening, a drop in phytoanticipin and phytoalexin levels, a rise in inducible plant defence mechanisms and adjustments to ambient conditions (Galsurker, 2018).

The two main postharvest diseases that affect fruit quality, shelf life and marketability are stem-end rot (SER) and anthracnose (Krishnapillai and Wijeratnam, 2013). Fungal pathogens known to be causing the SER in mango are *Dothiorella dominicana*, *Dinoderus mangiferae*, *Lasiodiplodia theobromae*, *Phomopsis mangiferae*, *Cytosphaera mangiferae*, *Pestalotiopsis* sp. (Johnson *et al.*, 1992) (adikaram, 2023) with the major causal organism of mango stem end rot disease is *Lasiodiplodia theobromae* (Pat.) [Syn.: *Botryodiplodia theobromae* (Pat.)] Griff. & Maubl. The SER disease is characterized by small dark-brown lesions in the peel surrounding the fruit stem end, eventually leading to soft and watery decay, causing complete fruit rot (Galsurker *et al.,* 2020 and Yeo, 2023).

Fungicides are commonly used to control SER, but their widespread and excessive use has led to drug-resistant pathogens and environmental pollution (Zhan, 2023). There have been reports of disease control in plants and harvested fresh products through the induction of host resistance and activation of defensive mechanisms (Nishansala, 2015).

As the "quality element" for crops (Usherwood, 1985), potassium is essential for several aspects of crop quality, including vitamin levels, taste, fruit size, appearance, color, sweetness, acidity, and shelf life (Ganeshamurthy *et al.,* 2011). Sufficient potassium increases plants' ability to produce defence mechanisms, which increases their resistance to disease (Perrenoud, 1994). As a result, fertilization provides enough potassium, which serves as a health insurance policy (Rathnayake *et al.*, 2010). Chloride ions serve several important roles in plants: (1) they help maintain cell hydration and turgor by acting as osmotic solutes; (2) they regulate the opening and closing of stomata; (3) they play a part in various biochemical functions during plant metabolism; and (4) they can help prevent disease infections (MAAS, 1986a). Additionally, chloride is also involved in activating enzymes and participating in other metabolic processes within plants.

In this study, an attempt was made to find out the possibility of using KCl as an effective agent of controlling stem-end rot disease of mango.

Materials and Methods

Methodology

Mango fruits (kesar variety) were sprayed with six different doses of potassium chloride (KCl) when they were the size of an egg (one month after fruit set in the tree). In six treatments, each concentration was sprayed once to ten mango fruits until the entire fruits were wet and the solution drained off from the fruit (approximately 10 ml) in three different trees. Following spraying, special paper bags were used on the farm to mark and cover all of the treated and control fruits. Fruits were taken to the lab after harvesting to check for the presence of the stem end rot pathogen.

Observations recorded

- Shelf life
- Number of infected fruits were recorded and per cent disease incidence was calculated by using following standard formulae (Mamatha *et al.*, 2000):

$$DI(\%) = \frac{Do}{D} \times 100$$

Where, DI = Disease incidence

Do = Number of infected fruit

D = Total number of fruit

Statistical analysis

For the experiment CRD design was done through statistical packages. The replicate fruits were used to assess disease incidence and shelf life. Data were subjected to analysis of variance (ANOVA) and disease incidence were arc sine transformed before analysis.

Table 1: Different concentration of KCl used in experiment

Treatment	KCl concentration (g l^{-1})
T_1	0.5
T_2	1.0
T_3	1.5
T_4	2.0
T_5	2.5
T_6	3.0
T_7	Control

PLATE 1
(a) KCl container (b) Paper beg (c) Egg size mango fruit
(d) Bagging of mango fruits after KCl spraying
(e) And (f) Bagged mango fruits

Results and Discussion

The data presented in table 1 showed that fruit treated with 3.0 g l^{-1} KCl had the lowest percentage of disease incidence (00.00%) and the highest percentage of disease reduction (100.00%), followed by 1.0 g l^{-1} KCl (10.00%) and 0.5 g l^{-1} KCl (20.00%), which was at par with 2.5 g l^{-1} KCl treatment (20.00%). Conversely, the control fruits had the highest disease incidence (50.00%) in relation to the remaining KCl treatments. So, the control treatment was less successful than the other treatments, while, fruit treated with 3.0 g l^{-1} KCl was shown to be the most effective, reducing disease incidence by up to 100 percent. In comparison to the control (7.00 days), fruits dipped in 3.0 g l^{-1} KCl had a longer shelf life (13.00 days), followed by 1.0 g l^{-1} KCl (12.33 days).

This, result was in accordance with, Nisansala *et al.* (2015) revealed that stem end rot disease incidence was reduced to 80.00 per cent in 2 g l^{-1} KCl treated fruits. 1 g l^{-1} KCl found less effective and disease incidence was at par with control fruits.

Table 2 : Effect of different KCl concentration on stem end rot disease development in mango cv. Kesar

Sr. no	KCl concentration (g/l)	PDI (%)	Disease reduction (%)	Shelf life (days)
1	0.5	(26.57)^{c}* 20.00	60.00	11.00
2	1.0	(18.43)^{b} 10.00	80.00	12.33
3	1.5	(31.00)^{d} 26.67	46.66	9.67
4	2.0	(39.23)^{e} 40.00	20.00	8.67
5	2.5	(26.57)^{c} 20.00	60.00	11.00
6	3.0	(0.00)^{a} 0.00	100.00	13.00
7	Control	(45.00)^{f} 50.00	0.00	7.00
	SEm ±	0.84	-	0.21
	CD at 5%	2.54	-	0.64
	CV %	5.43	-	1.94

*Figures in parenthesis are arc sine transformation value and those outside are original value.

Conclusion

In order to evaluate the effect of pre-harvest KCl treatment on the development of stem end rot disease, mango fruits were sprayed at different KCl (g l^{-1}) concentrations when they were in the egg-size stage. After three months, the fruits were bagged and collected and according to our findings, it was noted that the 3.0 g l^{-1}KCl (00.00%) treatment had the lowest disease incidence, while 1.0 g l^{-1}KCl (10.00%) had the highest, whereas the control treatment (50.00%) had the highest incidence. Because of this, fruits treated with 3.0 g l^{-1}KCl are the most effective treatment; they can reduce the incidence of disease by up to 100%. The control treatment, on the other hand, was less successful than the other treatments.

Acknowledgement

The authors are highly thankful to the Director of Research and Dean, Faculty of P.G. Studies, Navsari Agricultural University, Navsari, Gujarat, India for providing the necessary facilities to conduct the research work.

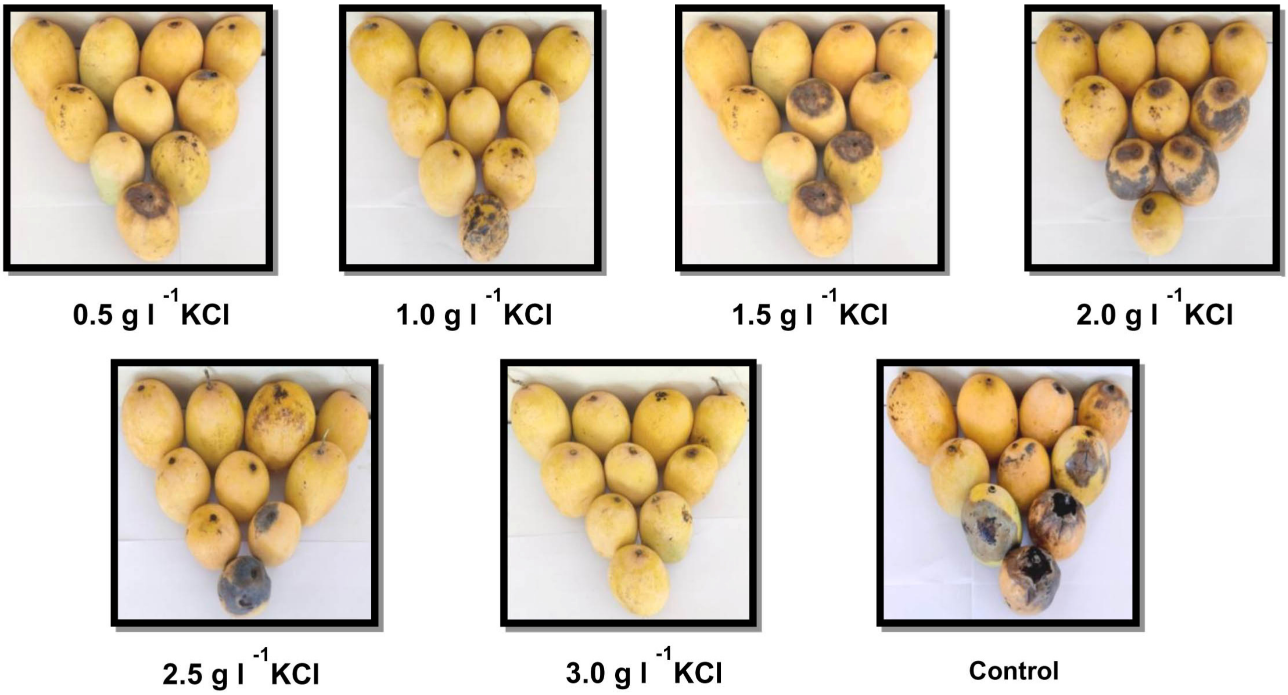

Plate 2 : Effect of different KCl concentration on stem end rot disease development in mango cv. Kesar

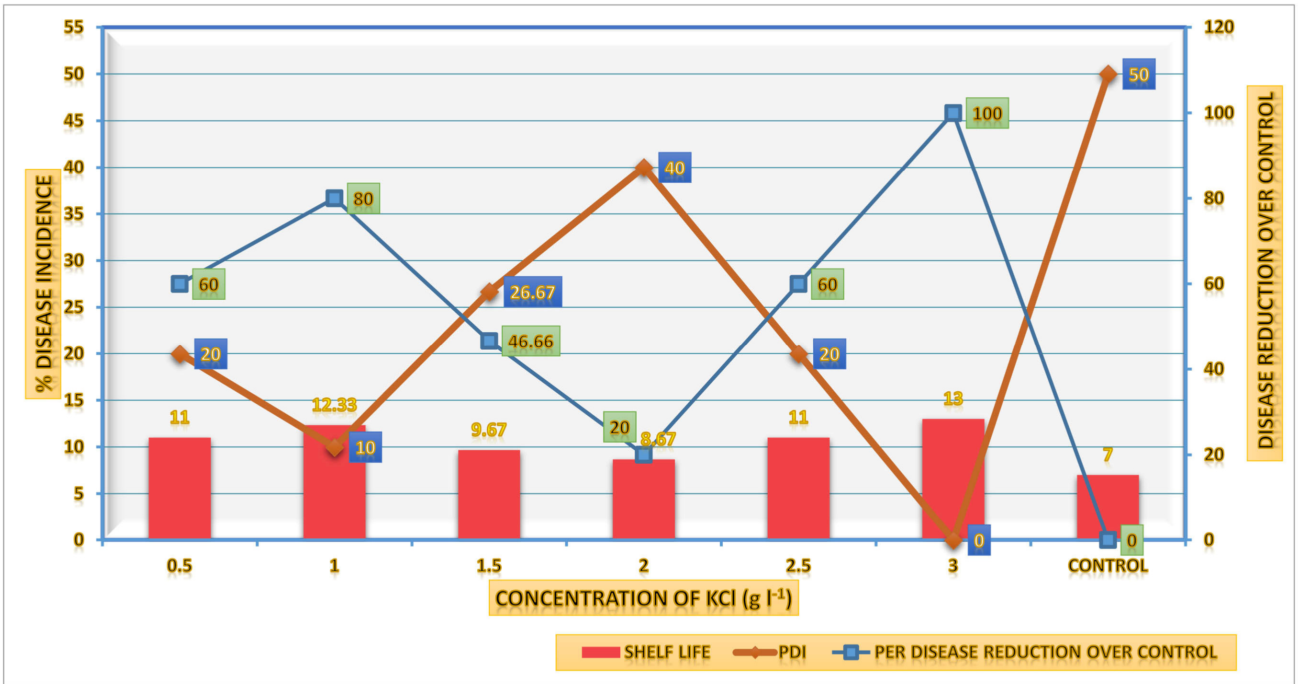

Fig. 1: Effect of pre harvest KCl treatment on stem end rot disease incidence in mango cv. Kesar

References

Adikaram, N.; Karunanayake, C. and Abayasekara, C. (2010). The role of pre-formed antifungal substances in the resistance of fruits to postharvest pathogens. *Postharvest pathology*, 1-11.

Anusha, S.; Indra, N.; Kannan, R.; Geetha, P. and Rahale, C.S. (2023). Morphological and Molecular Characterization of Major Postharvest Diseases of Mango. *Int. J. Plant and Soil Sci.*, **35**(19): 1291-1299.

Ekanayake, G.; Abeywickrama, K.; Daranagama, A. and Kannangara, S. (2019). Morphological characterization and molecular identification of stem-end rot associated fungal species isolated from 'KaruthaColomban' mango fruits in Sri Lanka. *J. Agric. Sci.,* **14**(2): 120-128.

Galsurker, O.; Diskin, S.; Duanis-Assaf, D.; Doron-Faigenboim, A.; Maurer, D.; Feygenberg, O. and Alkan, N. (2020). Harvesting mango fruit with a short stem-end altered endophyticmicrobiome and reduce stem-end rot. *Microorganisms*, **8**(4): 558.

Galsurker, O.; Diskin, S.; Maurer, D.; Feygenberg, O. and Alkan, N. (2018). Fruit stem-end rot. *Hortic.*, **4**(4): 50.

Ganeshamurthy, A.N.; Satisha, G.C. and Prakash, P. (2011). Potassium nutrition on yield and quality of fruit crops with special emphasis on banana and grapes. *Karnataka J. Agric. Sci.,* **24**(1): 29-38.

Hassanzai, R. G.; Pratap, B.; Sonkar, A. and Jain, S. (2024). Studies on effect of bagging and foliar application of different chemicals on physico-chemical characteristics and post-harvest quality of mango fruits (*Mangifera indica* L.) Cv. Amrapali. *Plant Archives*., **24**(01): 620-624.

Johnson, G. I.; Mead, A. J.; Cooke, A. W. and Dean, J. R. (1992). Mango stem end rot pathogens-Fruit infection by endophytic colonisation of the inflorescence and pedicel. *Ann. Appl. Biol.*, **120**(2): 225-234.

Krishnapillai, N. and Wijeratnam, R. S. W. (2013). Aspergillus rot of ripe mangoes (*Mangifera indica* L.) var. Ambalavi, Willard and Karutha kolumban. *J. Natn. Sci. Foundation* Sri Lanka, **41**(1): 69-70.

MAAS, E.V. (1986a). Physiological response of plants to chlodride. In: TL Jackson (ed.): Chloride and Crop Production. Potash and Phosphate Institute, Atlanta, 4-20.

Mamatha, T.; Lokesh, S. and Rai, V. R. (2000). Impact of seed mycoflora of forest tree seeds on seed quality and their management. *Seed res.*, **28**(1): 59-67.

Nisansala, Y.M.C.; Jayakody, L.K.R.R.; Sarananda, H. A. and Somaratne, S. (2015). Effect of pre-harvest potassium treatment on stem-end rot disease development of mango (*Mangifera indica* L.) cv. Tom EJC during Fruit ripening. *Sabaragamuwa Uni. J*., **14**(2): 119-132.

Perrenoud S. (1994). Potassium and plant health. Bern: International Potash Institute. pp. 218.

Rathnayake, R. P. S. H.; Sarananda, K. H. and Abesekara, C. P. (2010). Effect of potassium (KCl) application on postharvest disease condition and fruit quality of ripe papaya (*Carica papaya* L.). In: Proceedings of Uva Wellassa University Annual Research Symposium, p. 63.

Usherwood, N.R. (1985). The role of potassium in crop quality. In: *Potassium in Agriculture*. Ed. Munson, R.S., ASA-CSSASSSA, Madison, WI, pp. 489-513.

Vahia, C.G. (2021). Prevalence, loss assessment and management of stem end rot disease of mango (*Mangifera indica* L.). *Thesis M.Sc. (Agri.)*, Navsari Agricultural University, Navsari.

Yeo, Y.S.; Kone, Y.; Dembele, D.D.; Amari, G.E.; Rey, J.Y.; Del Ponte Sr, E.M.; Fernandez D. andKone, D. (2023). Prevalence of mango postharvest Stem-end rot disease in Cote d'Ivoire and identification of fungal pathogens associated. *Trop. plant pathol.,* **49**: 367–383.

Zhan, X.; Khan, R. A. A.; Zhang, J.; Chen, J.; Yin, Y.; Tang, Z. and Liu, T. (2023). Control of postharvest stem-end rot on mango by antifungal metabolites of *Trichoderma pinnatum* LS029-3. *Sci. Hortic*., **310**: 111696.