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Influence of tree age and management practices on incidence of stem end rot in mango cv Alphonso of Eastern dry zone of Karnataka

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Abstract
A field experiment was carried out to investigate the influence of tree age and management practices on incidence of stem end rot in mango cv Alphonso of Eastern dry zone of Karnataka during 2018-19 and 2019-20. The experiment comprised of two mango orchards of different age groups *i.e.*, A_1- 10 years aged trees at Regional Horticultural Research and Extension Centre (RHREC), College of Horticulture, UHS campus, GKVK and A_2- 25 years aged trees at Dryland Agriculture Project (DLAP), GKVK, Bengaluru with two management levels: M_1- Control and M_2-With plant protection chemicals (*: Two sprays comprising of Hexaconazole 5% SC @ 1 ml/litre and Wettable Sulphur 80% WP @ 2 g/litre were given at the time of flower bud initiation and fruiting stage). The study revealed that the disease severity of the SER and percentage of fruit infested by the pathogen was observed in both 10 and 25 years old tree but it was non-significant. However, highest disease severity was observed in case of 10 years old trees (49.00±31.44%) compared to 25 years old trees (35.50±29.02%). While, significant differences were observed in case of fungicide treated trees, where the disease severity was significantly higher in the untreated trees (49.00±31.44% and 35.50±29.02% in 10 and 25 year old trees, respectively) than fungicide treated trees (11.00±13.65% and 18.00±23.68% in 10 and 25 year old trees, respectively).

Keywords: Stem end rot, mango, alphonso, tree age

Introduction
Mango (*Mangifera indica* L.) is the most popular tropical fruit. It is referred as the "King of fruits" (Dutta *et al.*, 2013) [1] and also as the "Ambassador Fruit of India" due to its nutritional content, flavour, alluring fragrance and health-promoting properties. India is the world's top producer and exporter of mangoes, but it faces a number of challenges, including significant losses from postharvest diseases that limit its market share internationally. Postharvest losses of fresh mango fruits are reported to be 25-40% in India and 69% in Pakistan, and microbial decay accounts for 17.0-26.9% of the total postharvest losses in Asian countries (Prabakar et al., 2005) [2]. Because of physiological changes and senescence, the harvested fruits are more susceptible to postharvest infections during storage, which encourages the dormant state of infection to spread quickly.

Stem end rot (SER) is considered to be the second most severe post harvest disease in mango worldwide, after anthracnose, caused by *Botrydiplodia theobromae*, while in dry areas, SER is the major postharvest pathogen. The cv Alphonso is most popular and potential variety found to be susceptible to the stem end rot disease. The fungal infection takes place in the field during flowering, fruit set and at an early stage of maturity. The fruit susceptibility to post-harvest diseases, increases during ripening due to physiological changes and senescence favouring disease development (Prusky *et al*., 2002) [3]. Symptoms appear after fruit ripen, a soft brown decay begins from the stem end of the fruit and rapidly involves the whole fruit, the fruit turns completely black within 2 to 3 days and causes the spoilage of fruits. The decay may also exude a straw-colored fluid from the stem end of the fruit (Johnson, 2008) [4]. Due to the dynamic nature of the pathogen, the status of the pathogen changes rapidly based on the prevailing weather conditions. Thus, the present study was undertaken to study Influence of weather parameters on stem end rot of mango.

2. Materials and Methods

The experiment was carried out during 2018-19 and 2019-20 in two plantations/locations of different age groups: A_1- 10 years aged trees at Regional Horticultural Research and Extension Centre (RHREC), College of Horticulture, UHS campus, GKVK and A_2- 25 years aged trees at Dryland Agriculture Project (DLAP), GKVK, Bengaluru with two management levels: M_1- Control and M_2-With plant protection chemicals (*: Two sprays comprising of Hexaconazole 5% SC @ 1 ml/litre and Wettable Sulphur 80% WP @ 2 g/litre were given at the time of flower bud initiation and fruiting stage)

The mango fruits were harvested at optimum maturity with respect to colour, shoulder development and formation of beak. The fruits were harvested with stalk to prevent exudation of latex. The fruits were sorted out to remove bruised, damaged, diseased and insect infested fruits. From the harvested fruits, twenty five fruits of uniform size were randomly selected. The sorted fruits were surface disinfected with 200 ppm sodium hypochlorite solution followed by washing with water. Further, fruits were air dried and de-sapping was done by holding the fruit inverted and trimming the stalk to 0.6-1.0 cm and kept in de-sapping tray for about 4 hours at room temperature. Fruits were kept for ripening in the crates. The inspections were made daily and data on stem end rot was recorded on natural disease incidence basis. The disease severity was assessed by using disease severity scale as devised by Rose (1974) [5] as the fruits became fully ripe.

Grade	Description
0	No infection
1	1 to 25% fruit surface infected
2	25.1-50% fruit surface infected
3	50.1-75% fruit surface infected
4	> 75% fruit surface infected

Percent disease index (PDI) will be calculated by adopting the formula devised by McKinney (1923) [6] as below.

$$\text{Disease index (\%)} = \frac{\text{Sum of all the disease ratings}}{\text{Total number of samples observed} \times \text{Maximum disease grade}} * 100$$

3. Results and Discussions

The results during two years of investigation revealed that, stem end rot disease severity and percentage of fruit infestation in mango cv. Alphonso showed significant difference among the fruits collected from fungicide treated and untreated trees. While, it was non-significant amongst the age of the trees (Table 1 and 2).

The disease severity of the SER and percentage of fruit infested by the pathogen was observed in 10 and 25 years old tree and was non-significant. However, highest disease severity was observed in case of 10 years old trees (49.00±31.44%) compared to 25 years old trees (35.50±29.02%). Significant differences were observed in case of fungicide treated trees, where the disease severity was significantly higher in the untreated trees (49.00±31.44% and 35.50±29.02% in 10 and 25 year old trees, respectively) than fungicide treated trees (11.00±13.65% and 18.00±23.68% in 10 and 25 year old trees, respectively).

Percentage of fruits infested by SER was higher in the fruits of untreated (72%) compared to fungicide treated (66%) in the 10 and 25 year old trees. In case of fruits obtained from 25 years old trees, infestation was less in untreated (54%) compared to 10 year old trees. In 10 years old trees, 72 percent of the fruits kept for ripening had been infested with SEM (Table 2) when stored at ambient temperature and RH. The favourable environmental conditions such as frequent rain fall, high RH and moderate temperature during fruiting stage were responsible for the infection and similar result was observed by Dutta and Majumder (2012) [7]. The pathogen survived on diseased panicles, dead twigs and on leaf litter during unfavourable conditions. Airborne inoculum was responsible for primary infections in inflorescence and developing fruit and the disease was expressed after harvest during storage of fruits. Hence, removing leaf litter and dead branches from the orchard floor can reduce SER incidence and retaining a portion of the pedicel on harvested fruit also helps to suppress SER during ripening (Alam, *et al*., 2020) [8].

Table 1: Stem end rot disease severity in mango cv. Alphonso as influenced by weather parameters

Treatment	PDI percent (2018-19)		't' test at 5% for age	PDI percent (2019-20)		't' test at 5% for age	PDI percent (Pooled)		't' test at 5% for age
	A_1	A_2		A_1	A_2		A_1	A_2	
Untreated	46.00±40.62	31.00±30.00	NS	52.00±33.79	37.00±33.17	NS	49.00±31.44	35.50±29.02	NS
Fungicide treated	22.00±27.31	17.00±25.74	NS	29.00±33.60	19.00±28.21	NS	11.00±13.65	18.00±23.68	NS
't' test at 5% for Management practice	2.45*	2.16*		2.41*	2.07*		5.54*	2.34*	

Note: * Significant at 5% level NS : Non significant

Table 2: Percentage of fruit infestation by stem end rot incidence in mango cv. Alphonso as influenced by weather parameters

Treatment	2018-19		2019-20		Pooled	
	A_1	A_2	A_1	A_2	A_1	A_2
Untreated	64	68	80	64	72	54
Fungicide treated	52	40	56	48	66	44

Fig 1: Incidence of stem end rot in mango cv. Aplhonso

4. Conclusion

Effective plant protection measures (spraying of Hexaconazole 5% SC @ 1 ml/litre, and Wettable Sulphur 80% WP @ 2 g/litre) at the time of flower bud initiation and early fruit development stages can significantly reduce the incidence of stem end rot in mango.

5. References

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