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RESEARCH ARTICLE

ASSESSMENT OF POSTHARVEST ROT OF MANGO AT DIFFERENT STAGES OF MARKET IN PORT HARCOURT, NIGERIA

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ABSTRACT

A survey was conducted from February – May 2009, to assess the level of loss due to storage rot diseases in mango at the farm and the different stages of marketing via wholesale and retail. The degree of losses due to storage rot diseases varied at the different stages of marketing. The rots were highest at the retail stage (25.9 to 57.8% at Fruit Garden market and 24.5 to 48.5% at Loco market). At the wholesale stage, the severity of the rot disease ranged from 2.0 to 3.9% at Loco market to 3.7 to 8.4% at Fruit Garden market. The rot severity at the farm stage was 1.43%. The fungi species that infected the mangoes were *Aspergillus niger, Alternaria* sp, *Botryodiplodia theobromae* and *Collectrotrichum gloeosporioides. Fusarium* sp, *Aspergillus flavus* and *phoma* sp were also isolated but were not associated with the mango rots. Anthrancnose caused by *C. gloeosporioides* and stem end rot caused by *B. theobromae* were the most severe at both markets.

INTRODUCTION

Mango (*Mangifera indica*) is a member of the family Anacardiaceae, also known as cashew nut family (Nakasone and Paull, 1998). It is considered one of the most popular fruits among millions of people in the tropical area and increasingly in the developed countries (Diedhiou, *et al.*, 2007). Annual production is estimated at approximately 16million tones of which India and Mexico contribute the most (Oosthuyse, 1993). Because of its delicious taste and high caloric value, it is ranked as one of the good fruits in the international market. Mango has become an essential fruit crop in Asia, Southern and Central America as well as in many parts of Africa (Diedhiou *et al.*, 2007). For this reason, fruit quality in terms of color, taste, and minimal physiological damage is of vital importance (Dokin and Oosthuyse, 1996). Also, because mangoes are marketed as fresh vegetables and used in the manufacture of a wide range of processed foods, the demand is high and cannot be met by home-grown crops (PPEA, 2003). In Nigeria, for instance, the bulk of mangoes produced come from the northern part of the country and is then transported to the south. However, during the 3-to-4-day journey a sizeable

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percentage of these products become rotten due to microbial activities resulting from poor packaging and handling (Odebode and Unachukwu, 1997). The close proximity in which these products are packed during transportation and marketing to final consumers where individual fruits and/or packs serve as inoculum source for the others (Sander and Korsten, 2003) play an important role in the microbial deterioration of the products. This results sometimes to completely unmarketable fruits. A study in southern Nigeria showed that up to 20-30% of harvested fruits are lost during transportation and marketing (Onesirosan and Fatunla, 1976) and these losses tend to be highest in those areas where the need for the fruits is greatest (Harvey, 1978).

However, since quantitative and qualitative fruit losses of extremely variable magnitude occur at all stages in the postharvest system i.e. through handling, transportation, storage, and marketing to the final consumer, this study was aimed at assessing the losses at different stages of the postharvest system namely farm and wholesale and retail stages from the North where they are produced to markets in Port Harcourt where they are sold to consumers.

MATERIALS AND METHODS

A survey of production areas in the North and two fruit markets within Port Harcourt city was conducted to assess the extent of loss due to postharvest fungal rots in Mango. The production areas were Ipaac and Ukan in Gboko of Benue State, a distance of over 800km from Port Harcourt. The Loco and Fruit garden markets in Port Harcourt are centres of commerce that receive consignments of these fruits. These markets are located at the heart of Port Harcourt city. The loss due to fungal spoilage was assessed at weekly intervals for four months (February to May, 2009). At the different levels of handling after harvest, four samples each of twenty (20) fruits were selected at random. The sampling periods coincide with the beginning and the end of the mango market season. The severity of disease was assessed using a special score chart based on the area of infection.

Description	Category
No. infection	0
<1% fruit surface infection	1
1-5% fruit surface infection	2
6-25% fruit surface infection	3
26-50% fruit surface infection	4
>50% fruit surface infection	5

Loss due to disease was expressed in % Disease index (%DI) as used by Rose, 1974.

$$\%DI = \frac{\text{Sum total of all individual rating}}{\text{Total number of fruits graded}} \times \frac{100}{\text{max grade}}$$

During survey, infected fruits were collected in sterile polythene bags, labeled and taken to the laboratory. Fungi species were isolated using Potato Dextrose Agar (PDA). The isolation and identification of the causal agents were performed for every single rotting fruit. The pathogenicity of the isolated fungal species was confirmed by inoculating them to healthy mangoes to induce the rotting symptoms.

RESULTS AND DISCUSSION

The fungi species isolated from the infected mangoes were; *Aspergillus niger, Alternaria* sp. *Botryodiolodia theobromae* and *Colletotrichum gloeosporioides. Fusarium* sp, *Aspergillus flavus* and *Phoma* sp. were also isolated but could not prove pathogenicity when inoculated into healthy mango fruits (Table 1). *Aspergillus niger* was responsible for brown round shaped spots showing a depression. Penetration of the fruits was through injuries and weakened areas of the mango flesh. Fruits infected with *Alternaria* sp. showed small black spots. The flesh beneath showed no changes either in colour or in consistency. *Botryodiplodia theobromae* caused stem rot of the mangoes and affected the entire fruit within days after initiation. *Colletotrichum gloeosporioides* caused dark-brown to black spots.

The degree of loss due to these fungal rot varied with stages of market. Results of the storage rot as assessed in Ippac and Ukan Mango farms are as shown in Table 2. The postharvest loss at the farm level was 1.43%. The storage rot was generally higher in March and April when compared with the other months (February and May). This variation in

severity over the period under survey may be due to the favourable temperature (20-33°C) and relative humidity (51-87%) (Agromet Division, NRCRI, 2009). Also these months are the peak production period of mango and other fruits and vegetables. At the wholesale market, the severity of storage rot was less as the fruits were kept only for between 1-2 days before disposal to retailers. The severity of rot varied form 2.0 to 3.9% at Loco Market and 3.7 to 8.4% at FGM. (Table 3). These losses were mostly caused by *C. gloeosporioides* which was responsible for mango anthracnese and *B. theobromae* responsible for stem end rot. Their losses ranged from 0.5 to 2.5% at Loco market and

Table 1. Fungi species isolated from the mango fruits at the different stages

Fungi	Loco Mkt	FGMkt	Farm
A. niger	+	+	+
Alternaria sp.	+	+	-
B. theobromae	+	+	+
C. gloeosporioides	+	+	+
Fusarium sp.	+	+	-
A. Flavus	-	+	-
Phoma sp.	-	+	-

+: Presence of fungi; -: Absence of fungi; FGMkt: Fruit Garden Mark

Table 2. Storage rot of mango at the farm

Production Centre	Month	% Disease index (% DI)				
		A. niger	*Alternaria sp*	*B. theobromae*	*C. gloeosporioides*	Total
Ippac	Feb., 2009	0.0	0.0	0.3	0.8	1.1
and	March, 2009	0.3	0.0	0.5	1.0	1.8
Ukan	April, 2009	0.5	0.0	0.8	0.5	1.8
	May, 2009	0.0	0.0	0.5	0.5	1.0
	Mean	0.2	0.0	0.53	0.7	1.43

Table 3. Storage rot of mango at wholesale market

Month	*Market*	*% Disease index (% DI)*				
		A. niger	Alternaria sp	B. theobromae	C. gloeosporioides	Total
February	LOCO	0.0	0.0	0.8	1.2	2.0
	FGM	0.0	0.0	1.2	2.5	3.7
March	LOCO	0.2	0.0	1.3	1.5	3.0
	FGM	0.8	0.4	2.8	3.5	7.5
April	LOCO	0.2	0.2	1.0	2.5	3.9
	FGM	0.8	0.8	1.8	5.0	8.4
May	LOCO	0.2	0.0	0.5	2.5	3.2
	FGM	0.5	0.0	0.8	4.0	5.3
	Grand Mean	0.34	0.18	1.28	2.83	4.63

FGM: Fruit Garden Market.

Table 4. Storage rot of mango at retail market

Month	*Market*	*% Disease index (% DI)*				
		A. niger	*Alternaria sp*	*B. theobromae*	*C. gloeosporioides*	Total
February	LOCO	4.0	5.0	5.0	10.5	24.5
	FGM	4.3	5.0	5.6	11.0	25.9
March	LOCO	10.0	8.0	10.0	20.5	48.5
	FGM	12.5	10.0	12.5	22.8	57.8
April	LOCO	10.0	9.0	10.0	15.5	44.5
	FGM	12.6	10.4	10.0	18.2	51.2
May	LOCO	6.0	3.5	12.0	10.0	31.5
	FGM	10.2	10.5	15.5	12.0	48.2
	Grand Mean	8.7	7.68	10.08	15.06	41.5

0.8 to 5.0% at FGM (Table 3). *Aspergillus niger* and *Alternaria* sp. damage were to a lesser extent. Mango fruits at the retail stage were more vulnerable to storage rot disease (Table 4). The rot at this stage was the highest. The severity of rot varied from 25.9 to 57.8% at FGM and 24.5 to 48.5% at Loco market (Table 4). In both markets *C. gloeosporioides* and *B. theobromae* were the major causes of the rots and their severity were higher in FGM compared to Loco market (Table 4). This could be attributed to the method of packaging. Since the consignments to FGM were usually packed in wicker baskets and sometimes mixed with other fruits during transportation and even at the markets where they were stacked, injuries sustained and infection rate were more than in Loco markets where the fruits are properly packaged in bags and sometimes in wooden boxes. This is also so because the packaging materials were not disinfected in any way. The hygienic condition of the markets is also an important factor, where damaged mango fruits were not properly disposed but rather dumped at a spot within the market thus aiding microbial build up in the environment.

Anthracnose has been reported extensively wherever mangoes were produced (Snowdon, 1990) and shows characteristic brown to black lesions (Jeffries *et al.*, 1990). Furthermore, the method of dispersion of these fungi species either by wind or through water (Dodd *et al.,* 1997) could also explain the occurrence of the pathogens on the fruits since they are exposed to these climatic conditions during transportation and marketing. The length of time these fruits stay in market before sales also favors full development and succession of the pathogens. However, postharvest disease control could be aimed at preventing infection or delaying symptom development so that fruits can be marketed and consumed before disease appears (Johnson and Sangchote, 1994). Infection prevention could be achieved by the observance of simple initial disinfection using very simple disinfectants and methods. The simplest disinfection materials and methods are washing with sterile water which is never done. Market hygiene especially proper disposal of damaged fruits is also very useful to minimize infection rate and could be practiced to ascertain clean fruits. This could be achieved by the provision of waste bins at strategic points within the markets. These waste bins should be emptied after the day's activities into dump sites constructed away form the city. The waste bins should also be washed and disinfected. The existing methods of harvest, transport, storage and marketing could also be improved upon to reduce the sources of inoculum. The need for effective pre- and post-harvest disease or pest control measures for mangoes from the field to market cannot be emphasized (Darvas, 1991) as mango is making gains in prominence in the world fruit market.

Conclusion

Fruits are more prone to contamination to microbial rots and some of these organisms produce mycotoxins which affect man and animals. It becomes necessary to observe strict pre- and post-harvest practices in order to reduce fungal infection and potential mycotoxin associated with these organisms. In some countries there are centers to deal with food safety, working to protect human health and the environment by curbing the proliferation of harmful food production technologies but that is not obtainable in Nigeria. Regulations on norms for food and fruits either do not exist or are poorly enforced. To ensure proper sanitary measures, the public should be educated and sensitized on the necessity to observe sound food safety. Government should reinforce existing legislation; enforce systems for standard, inspection, monitoring and surveillance as well as management structures for quality control of ready-to-eat fruits, foodstuffs and grains.

REFERENCES

Agromet Division. 2009. National Root Crops Research Institute, Umudike.

Darvas, J.M. 1991. *Dothiorella dominicana*, a new mango Pathogen in South Africa. Ph*ytophylactica,* 23: 295-298.

Diedhiou, P.M., Mbaye, N., Drame, A. and Samb, P.I. 2007. Alteration of postharvest diseases of mango *Mangifera indica*, through production

practices and climatic factors. African Journal of Biotechnology, 6(9): 1087-1094.

Dodd, J.C., Prusky, D. and Jeffries, P. 1997. Fruit diseases. In: The Mango: Botany, Production and uses. R.E. Litz (ed) CAB International, Oxon, UK. 57-280.

Donkin, D.J. and Oosthuyse, S.A. 1996. Quality evaluation of sea-exported South African Mangoes in Europe during the 1995/96 Season. South African Mango Growers' Association. Yearbook 16:1-5.

Harvey, J.M. 1978. Reduction of losses in Fresh Market Fruits and vegetable. *Ann. Rev. Phytopathol.,* 16: 321-341.

Jeffries, P., Dodd, J.C., Jeger, M.J. and Plumbley, R.A. 1990. The biology and control of *Collectotrichum* species on tropical fruit crops. *Plant Pathology,* 39: 343-366.

Johnson, G.I. and Sangchote, S. 1994. Control of post-harvest diseases of tropical fruits. Proceedings of an international congress, Chaing Mai, Thailand. Champ, B.R., Highley, E. and Johnson, G.I. eds. Australian Centre for International Agricultural Research, Canberra.

Nakasone, N.Y. and Paull, R.E. 1998. Mango. Pages 208-237. In Tropical Fruits. CAB International, Wallingford.

Odebode, A.C. and Unachukwu, N.E. 1997. Effects of storage environment on carrot root rots and biochemical changes during storage. Z lebensm Unters Forsch, A., 205: 277-281.

Onesirosan, P.T. and Fatunla, T. 1976. Fungal fruit rot of tomatoes in Southern Nigeria. *J. Hortic. Sci.,* 51: 473-79.

Oosthuyse, S.A. 1993. Research on mango aimed at increasing orchard productivity and export fruit quality. South African Mango Growers' Association Yearbook, 13: 40-44.

PPEA. 2003. Project de Promotion des Exportation Agricoles s/c Ministere de l'Agriculture et de l'Elevage du Senegal. Guide Export-Manque du Senegal. Editions Techniques IFLEX, 55p.

Rose, D.H. 1974. Diseases of apple fruits in the market. *Bull. US. Dep. Agric.,* 1253: 24.

Sanders, G.M. and Korsten, L. 2003. Comparison of Cross inoculation potentials of South African avocado and mango isolates of *Collectotrichum gloeosporiodies*. Canadian Journal of Botany, 877.

Snowdon, A.L. 1990. Miscellaneous tropical and subtropical fruits. Pages 92-93 In: A color atlas of post harvest diseases and disorders of fruits and vegetables. Vol.1. General introduction and fruits. Wolfe Scientific, London.

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