Disorders in Avocado, Mango, and Pineapple Shipments to the New York Market, 1972-1985

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Fresh avocado (*Persea americana* Mill.), mango (*Mangifera indica* L.), and pineapple (*Ananas comosus* (L.) Merr.) are tropical fruits highly favored by certain segments of the New York metropolitan population. Consumption of avocados and mangos in the New York metropolitan area has increased during the last decade, while that of pineapples has decreased. The principal sources of supply of avocados are California and Florida, and mangos come chiefly from Mexico. Cuba was the principal source of pineapple for the eastern seaboard until the U.S. embargo on Cuban products, after which Hawaii became the principal supplier (17,18).

This report is a continuation of a series (1–15) that summarizes information retrieved from a data bank abstracted from USDA inspection certificates. Inspections were conducted at the request of receivers or shippers who questioned the quality of the produce at arrival in terminal markets. Analysis of this type of information should be useful in formulating measures to maintain produce quality during marketing.

Avocados. USDA inspectors examined 937 shipments with 3,368 t, or about 5% of the volume, of avocados shipped to the New York market during 1972–1985 (Tables 1 and 2). Eight parasitic diseases were reported in 451 occurrences, six physiological disorders in 977 occurrences, and four kinds of injuries in 104 occurrences (Table 3). Anthracnose (*Colletotrichum gloeosporioides*) was the leading parasitic disease; "anthracnose rot" described infection extending beyond the rind and into the flesh. Soft fruit was the most frequent physiological disorder, and bruise damage was the most common injury.

The disorders reported in shipments from California and Florida were generally the same (Tables 4 and 5), with distribution within the shipments ranging from 1–5% to more than 50%. Brown discoloration was reported most often in shipments from California, followed by soft fruit; the reverse was true in shipments from Florida. Brown discoloration, scored when more than 10% of the surface area is discolored, may be related to chilling injury or overmaturity (16). Soft fruit was reported excessively among and within shipments from Florida; occurrences in California shipments were fewer but similarly distributed. The other disorders affecting 10% or more of the shipments, from either source, were anthracnose rot, anthracnose, and unidentified decays. Other damaging disorders were overripe fruit, bruise damage, and Rhizopus rot. The remaining disorders noted from both sources occurred infrequently; the most damaging was freezing.

Mangos. USDA personnel examined 717 shipments with 6,232 t, or about 12% of the volume, of mangos shipped to the New York market during 1972–1985 (Tables 1 and 2). Nine parasitic diseases in 1,067 occurrences, five physiological disorders in 488 occurrences, and 61 occurrences of bruise damage were reported (Table 6). More than one-half of all occurrences reported were anthracnose. The leading physiological disorder was soft fruit.

Anthracnose affecting only the rind and anthracnose rot affecting the flesh were the most destructive disorders (Table 6); substantial portions of many shipments were affected. Stem-end rot (*Diplodia natalensis*) was reported in 10.5% of shipments and was distributed less extensively than anthracnose in the incidence classes. Unidentified decays were reported in 9.3% of shipments but almost always in the lowest incidence class (1–5%). Of the remaining six parasitic diseases, mushy brown rot (3.1%) and Rhizopus rot (2%) were the most important. Few or no differences were noted in parasitic diseases reported from the main sources of supply (Table 7).

Soft fruit and overripe fruit were the most damaging nonparasitic disorders reported. Incidences of brown discoloration (scald), shriveling, and sunken discoloration were also high, but fewer shipments were affected. Brown discoloration (scald) may be a manifestation of chilling injury.

Pineapples. USDA personnel inspected 677 shipments with 7,085 t, or about 4% of the volume, of pineapples shipped to the New York market during 1972–1985 (Tables 1 and 2). Five parasitic diseases in 552 occurrences, six physiological disorders in 222 occurrences, and six kinds of injuries in 147 occurrences were reported (Table 8).

Black rot (*Ceratocystis paradoxa*) was the most prevalent (70.3% of shipments) and damaging disorder reported (Table 8), with most affected shipments having 11% to more than 50% rot. Brown rot, caused by species of *Fusarium, Penicillium, Erwinia*, or *Pseudomonas*, was the other principal parasitic disease, with similar distribution but affecting fewer shipments (6.5%). Unidentified decays were reported in only 3.2% of shipments, with nearly all in the lowest (1–5%) incidence class.

Internal breakdown, the most important physiological disorder of pineapple, was reported in 19.5% of shipments and

Table 1. Volume of avocados, mangos, and pineapples shipped to the New York market, 1972–1985

Year	Number of 45,400-kg units		
	Avocados	Mangos	Pineapples
1972	70	34	249
1973	67	49	215
1974	72	60	328
1975	86	77	344
1976	66	82	374
1977	56	45	374
1978	82	49	421
1979	111	68	381
1980	123	89	410
1981	156	70	363
1982	190	122	306
1983	206	128	215
1984	181	118	102
1985	113	121	81
Total	1,579	1,112	4,163

Table 2. Avocado, mango, and pineapple shipments inspected by the USDA on the New York market, 1972–1985

Year	Avocados		Mangos		Pineapples	
	Shipments (no.)	Packs[a] (no.)	Shipments (no.)	Packs[b] (no.)	Shipments (no.)	Packs[c] (no.)
1972	79	29,743	0	0	54	35,171
1973	100	42,627	17	19,112	81	51,906
1974	54	19,730	17	21,808	28	16,767
1975	78	35,684	18	16,770	21	12,767
1976	32	10,649	17	16,608	14	8,043
1977	45	54,153	20	22,147	14	10,013
1978	63	39,652	17	42,407	50	86,761
1979	61	26,754	22	26,850	30	9,878
1980	59	35,558	35	47,247	22	8,798
1981	92	113,650	17	19,922	19	8,937
1982	101	78,361	42	59,165	31	18,125
1983	29	16,459	200	303,109	69	34,651
1984	36	24,264	136	231,412	102	35,249
1985	108	43,556	159	306,475	142	52,310
Total	937	570,840	717	1,133,032	677	389,296

[a] Flat or carton with net weight of 5.9 kg.
[b] Flat or carton with net weight of 4.5 or 6.4 kg.
[c] Carton with net weight of 18.2 kg.

Table 3. Disorders reported in USDA inspections of 937 avocado shipments on the New York market, 1972–1985

Parasitic diseases	Shipments (no.)	Physiological disorders	Shipments (no.)	Injuries	Shipments (no.)
Anthracnose rot	166	Soft fruit	538	Bruise damage	58
Anthracnose	131	Brown discoloration	341	Grade defects[a]	28
Unidentified decays	107	Overripe fruit	88	Freeze damage	9
Rhizopus rot	34	Sunken discoloration	7	Scarring	9
Stem-end rot	5	Internal discoloration	2		
Alternaria rot	3	Shriveling	1		
Scab	3				
Gray mold rot	1				
Black rot	1				

[a] Pulled stems, healed cuts, and misshapen fruit.

Table 4. Frequency of disorders reported in USDA inspections of 428 California avocado shipments on the New York market, 1972–1985

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% fruit)						
		0	1–5	6–10	11–20	21–33	34–50	>50
Brown discoloration	53.7	198	72	43	64	34	8	9
Soft fruit	42.5	246	45	37	52	23	11	14
Anthracnose rot	16.1	359	50	14	1	2	1	1
Unidentified decays	10.3	384	44	0	0	0	0	0
Anthracnose	9.8	386	25	7	8	1	0	1
Overripe fruit	8.4	392	6	9	8	7	2	4
Bruise damage	5.8	403	15	7	3	0	0	0
Rhizopus rot	1.9	420	5	3	0	0	0	0
Grade defects	0.9	424	2	1	0	0	1	0
Freeze damage	0.7	425	0	0	0	2	1	0
Sunken discoloration	0.5	426	1	1	0	0	0	0
Scarring	0.5	426	0	1	1	0	0	0
Stem-end rot	0.2	427	0	0	1	0	0	0
Black rot	0.2	427	1	0	0	0	0	0
Gray mold rot	0.2	427	1	0	0	0	0	0
Shriveling	0.2	427	1	0	0	0	0	0

Table 5. Frequency of disorders reported in USDA inspections of 461 Florida avocado shipments on the New York market, 1972–1985

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% fruit)						
		0	1–5	6–10	11–20	21–33	34–50	>50
Soft fruit	74.0	120	51	55	92	64	41	38
Brown discoloration	23.4	353	41	33	23	6	5	0
Anthracnose rot	20.6	366	57	22	12	2	1	1
Anthracnose	18.7	375	38	22	9	4	3	0
Unidentified decays	13.0	401	56	2	0	1	1	0
Overripe fruit	10.2	414	6	11	13	12	2	3
Bruise damage	6.9	429	18	10	3	1	0	0
Rhizopus rot	5.4	436	10	9	5	0	1	0
Grade defects	4.6	440	13	8	0	0	0	0
Freeze damage	1.3	455	0	1	1	1	2	1
Scarring	1.3	455	1	4	0	1	0	0
Sunken discoloration	1.1	456	0	3	2	0	0	0
Stem-end rot	0.9	457	3	1	0	0	0	0
Alternaria rot	0.7	458	2	0	1	0	0	0
Scab	0.7	458	1	1	1	0	0	0
Internal discoloration	0.2	460	0	0	0	1	0	0

Table 6. Frequency of disorders reported in USDA inspections of 717 mango shipments on the New York market, 1972–1985

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% fruit)						
		0	1–5	6–10	11–20	21–33	34–50	>50
Anthracnose rot	67.6	232	127	135	121	58	20	24
Anthracnose	54.1	329	62	80	143	69	22	12
Soft fruit	33.2	479	44	57	64	42	21	10
Overripe fruit	21.3	564	22	32	44	39	12	4
Stem-end rot	10.5	642	31	24	16	3	1	0
Unidentified decays	9.3	650	64	3	0	0	0	0
Bruise damage	8.5	656	27	16	15	0	2	1
Brown discoloration (scald)	6.6	670	7	12	14	10	4	0
Shriveling	4.0	688	7	8	9	3	1	1
Mushy brown rot	3.1	695	6	6	4	3	1	2
Sunken discoloration	2.9	696	1	4	11	3	0	2
Rhizopus rot	2.0	703	6	1	5	2	0	0
Alternaria rot	0.4	712	1	1	2	1	0	0
Bacterial soft rot	0.7	712	3	1	1	0	0	0
Blossom-end rot	0.4	714	2	1	0	0	0	0
Gray mold rot	0.4	714	1	1	1	0	0	0

Table 7. Parasitic diseases reported in USDA inspections of mango shipments to the New York market from principal sources of supply, 1972–1985

Source	Shipments (no.)	Diseases and percentages of shipments affected						
		Anthracnose rot	Anthracnose	Unidentified decays	Stem-end rot	Rhizopus rot	Mushy brown rot	Others
Mexico	465	66.7	51.8	9.2	10.5	2.2	2.8	1.7[a]
Haiti	104	79.9	62.5	7.7	11.5	0	4.8	1.0[b]
Florida	55	65.5	58.2	10.9	9.1	3.6	5.5	1.8[c]

[a] Alternaria rot, gray mold rot, and blossom-end rot.
[b] Blossom-end rot.
[c] Alternaria rot.

seriously damaged most of them (Table 8). Internal, or physiological, breakdown is characterized by discoloration of the flesh, originating at the core and radiating outwardly. It commonly follows chilling injury, although suboxidation and other factors may be implicated (16). A number of shipments had high incidences of overripe or soft fruit. Discolored tops and gummosis were other physiological disorders noted.

Bruise damage, found in 14.2% of shipments, was the most frequently reported injury of pineapple. The only other injury of note was freeze damage, which was serious in a few shipments (Table 8).

The incidence of black rot varied little among the three major sources of supply (Table 9). Shipments from Puerto Rico had more brown rot and less internal breakdown than those from

Table 8. Frequency of disorders reported in USDA inspections of 677 pineapple shipments on the New York market, 1972–1985

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% fruit)						
		0	1-5	6-10	11-20	21-33	34-50	>50
Black rot	70.3	201	50	89	134	100	63	40
Internal breakdown	19.5	545	8	16	29	41	19	19
Bruise damage	14.2	581	37	25	27	7	0	0
Brown rot	6.5	633	4	13	9	7	2	9
Overripe fruit	6.1	636	6	8	9	7	9	2
Soft fruit	4.4	647	3	6	9	7	2	3
Grade defects[a]	4.4	647	24	4	1	1	0	0
Unidentified decays	3.2	655	19	0	2	0	1	0
Freeze damage	2.7	659	0	2	3	3	2	8
Discolored tops	2.2	662	2	4	4	3	2	0
Gummosis	0.6	673	4	0	0	0	0	0
Fusarium rot	0.3	675	0	1	0	1	0	0
Miscellaneous[b]	1.3	668	1	3	4	0	1	0

[a] Malformed or double tops and unidentified defects.
[b] Bacterial rot, insect damage, sunburn, soft tops, and crushing.

Table 9. Diseases reported in USDA inspections of pineapple shipments to the New York market from principal sources of supply, 1972–1985

Source	Shipments (no.)	Disorders and percentages of shipments affected				
		Black rot	Brown rot	Internal breakdown	Unidentified decays	Other
Hawaii	264	79.2	7.2	21.6	1.5	0
Puerto Rico	119	65.6	10.1	1.7	3.4	0.8[a]
Mexico	92	78.3	2.2	25.0	4.3	3.3[b]

[a] Fusarium rot.
[b] Bacterial rot and Fusarium rot.

Hawaii and Mexico. The high levels of internal breakdown in pineapples from Hawaii and Mexico may be related to the time and temperatures involved in reaching the New York market.

Summary. The data in this report were derived from inspections of shipments distressed or of questionable quality and are not necessarily typical of the condition of all avocados, mangos, and pineapples arriving on the New York market. Routinely, inspectors examine a minimum of six packs, containing 50 or more fruit per shipment and more if needed to determine quality. In light of the tens of thousands of fruit examined by the inspectors over 14 years, it is reasonable to accept this profile of disorders as causes of loss in the marketing of these commodities. Further, this information underscores the need for more effective field disease control measures, improved handling, and protective services during marketing.

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