

Disorders in Potato Shipments to the New York Market, 1972–1980

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Nearly 2 million metric tons (t) of fresh fruits and vegetables are shipped annually to the metropolitan New York market. Many of these shipments are inspected by private, state, and federal agencies to determine whether specified grades and quality standards have been met. The most reliable information on the condition of fresh produce is obtained through inspections by the Fresh Products Branch of the Agricultural Marketing Service, U.S. Department of Agriculture. This information, which has not been available to the public, could be of value to scientists concerned with the market quality of fresh fruits and vegetables.

Permission was granted by the USDA to abstract useful data from inspection certificates. A multivariate data bank was established through the collaborative efforts of the Postharvest Pathology Laboratory of the Agricultural Research Service, USDA, and the Department of Plant Pathology at Rutgers University, New Brunswick, NJ. To date, information on the arrival condition of 30 fruit and vegetable crops has been abstracted from approximately 100,000 federal inspection certificates, and data on at least 25 additional crops are currently being processed for entry into our bank. This is the first comprehensive report on these crops to be published.

The white table potato (*Solanum tuberosum* L.) is the leading horticultural crop (about 230,000 t) delivered annually to the New York market (4). Although a certain amount of information is available on the quality of potatoes at retail and

consumer levels (1–3,5), virtually nothing has been published on the condition of this commodity on arrival at the terminal markets.

Data were obtained from federal inspection of nearly 14,000 potato shipments to metropolitan New York during 1972–1980. Tuber weights averaged 30 t per load in 7,648 rail shipments and 19 t per load in 6,109 truck shipments. Trained personnel inspected the shipments at the requests of receivers or shippers, sometimes routinely to determine tuber condition at arrival but usually because quality standards or specifications previously agreed on were being questioned.

The number of inspection certificates examined ranged from 564 in 1980 to 2,468 in 1973. The potato shipments inspected originated from 31 states and Canada. During the 9-year period, 500 or more shipments originated from seven states. Maine led with 4,767 shipments, followed by Idaho (2,687), California (2,324), Washington (978), Wisconsin (615), New Jersey (550), and New York (527). Federal inspectors classify all potatoes into four tuber types. The types and number of inspected shipments were: Round White, 6,319; Long Russet, 4,416; Long White, 2,189; and Round Red, 408. Unidentified types in 425 shipments made up the remainder. Of vital importance are the disorders identified or described and the incidence and degree of their involvement in the tuber shipments.

The 13,757 inspections disclosed 20,477 incidences of damage to the tubers by 41 disorders (Table 1). Thirteen fungal, three bacterial, and two viral diseases were reported, with bacterial soft rot the most common, followed by *Fusarium* tuber rot. More than 2,400 certificates described a sunken discoloration resulting from pressure bruising during storage. Impact bruises and punctures and cuts were other frequent mechanical injuries. Internal black spot was the leading nonparasitic physiological disorder. Table 2 lists the principal disorders according to origin of shipments.

Prepared as part of New Jersey Agricultural Experiment Station Project No. 11120, supported in part by Hatch Act and NJAES funds.

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Table 1. Disorders and incidences in 13,757 potato tuber arrivals at the New York market, 1972–1980

Parasitic diseases	No.	Physiologic disorders	No.	Injuries	No.
Bacterial soft rot	5,208	Internal black spot	923	Sunken discoloration ^a	2,445
<i>Fusarium</i> tuber rot	2,535	Misshapen	608	Bruising	2,002
Soft rot ^b	224	Enlarged lenticels	232	Punctures and cuts	1,853
Scab	149	Sprouting	195	Grade defects ^c	1,619
Late blight	74	Hollow heart	178	External discoloration	880
Pink rot	23	Internal browning	101	Sunburn	767
Black scurf	10	Shriveling	52	Freeze damage	218
Black leg	10	Scald	24	Skin checks	35
Miscellaneous ^d	47	Miscellaneous ^e	39	Insect damage	27
Total	8,280		2,352		9,846

^a Pressure bruises incurred during storage.

^b Probably bacterial soft rot.

^c Includes growth cracks.

^d Sclerotium rot, silver scurf, leak, ring rot, gray mold rot, early blight, charcoal rot, *Rhizopus* rot, net necrosis, corky ring spot, and unidentified rots.

^e Black heart, vascular browning, vascular discoloration, greening, and pitting.

Table 2. Origin of potato tuber shipments and principal disorders found on arrival at the New York market, 1972–1980

Origin ^a	No. of shipments	Disorder ^b /percentage of shipments				
		BS	PC	BG	SK	GD
Alabama	24	BS/62.5	PC/33.3	BG/25.0	SK/12.5	GD/12.5
Arizona	17	BS/35.3	GD/23.5	FU/17.6	SK/17.6	XD/17.6
California	2,324	BS/50.6	GD/20.4	BG/16.0	PC/15.1	JB/10.5
Canada	327	BS/42.2	FU/42.2	SK/37.6	BG/30.3	PC/28.3
Colorado	52	BS/51.9	PC/48.1	BG/48.1	FU/44.2	JB/21.2
Delaware	83	BS/68.7	BG/7.2	GD/7.2	MS/6.0	SU/4.8
Florida	210	BS/41.1	GD/19.2	FU/8.1	XD/8.1	EL/5.7
Idaho	2,687	BS/30.4	FU/29.0	JB/12.1	GD/10.6	BG/9.9
Maine	4,767	BS/33.1	SK/32.0	FU/23.5	BG/18.1	PC/16.6
Michigan	35	PC/37.1	BS/34.3	FU/31.4	BG/31.4	MS/17.1
Minnesota	23	BS/39.1	GD/26.1	FU/13.0	XD/13.0	SK/8.7
Nevada	11	GD/90.1	BS/72.7	JB/72.7	FU/63.6	SK/9.1
New Jersey	550	BS/52.8	GD/6.2	EL/5.3	SU/5.1	BG/4.7
New York	527	BS/20.2	GD/9.5	SK/9.3	FU/7.2	BG/4.0
North Carolina	19	BS/36.8	GD/15.8	SK/10.5	RF/5.3	XD/5.3
North Dakota	62	BS/43.5	PC/22.6	SK/21.0	BG/19.4	FU/12.9
Oregon	170	XD/31.8	BS/27.6	PC/15.9	GD/15.3	BG/11.8
Texas	32	BS/75.9	GD/20.7	SU/17.2	MS/17.2	BG/10.3
Virginia	178	BS/39.9	PC/10.7	BG/10.1	SK/5.6	GD/5.1
Washington	978	BS/45.9	JB/16.7	BG/14.3	PC/12.1	XD/10.3
Wisconsin	615	BS/50.6	FU/32.7	GD/25.2	JB/20.3	SK/16.9
Other states ^c	66	BS/31.2	XD/19.7	FU/16.4	GD/16.4	PC/11.5

^aTen or more shipments.

^bBG = bruising; BS = bacterial soft rot; EL = enlarged lenticels; FU = Fusarium tuber rot; GD = grade defects; JB = internal black spot; MS = misshapen; PC = punctures and cuts; RF = black scurf; SK = sunken discoloration; SU = sunburn; XD = external discoloration.

^cArkansas, Connecticut, Illinois, Iowa, Louisiana, Maryland, Massachusetts, Missouri, Montana, Nebraska, and Pennsylvania.

Table 3. Occurrence of the leading disorders in New York arrivals of Long Russet potato shipments from Wisconsin,^a 1972–1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Fusarium tuber rot (%)	Internal black spot (%)	Sunken discoloration (%)	Grade defects (%)
0	48.6	66.6	79.2	82.7	73.9
1	32.0	12.1	3.1	2.4	1.7
2–5	12.1	17.3	11.1	6.6	24.0
6–12	5.7	3.3	4.7	6.0	0.3
13–20	1.2	0.7	1.6	1.7	0
21–50	0.3	0	0.3	0.5	0
50	0	0	0	0	0

^a94.0% of 615 shipments.

Table 5. Occurrence of the leading disorders in New York arrivals of Long Russet potato shipments from Idaho,^a 1972–1980

Incidence in shipment (%)	Disorders and shipments affected					
	Bacterial soft rot (%)	Fusarium tuber rot (%)	Internal black spot (%)	Grade defects (%)	Bruising (%)	
0	70.0	71.2	87.8	89.2	90.5	
1	24.7	14.5	3.6	1.5	5.0	
2–5	4.0	12.1	6.3	9.2	4.4	
6–12	0.9	2.1	1.8	0.1	0.1	
13–20	0.2	0.1	0.3	0	0	
21–50	0.1	0.1	0.2	0	0	
50	0.1	0	0	0	0	

^a96.1% of 2,687 shipments.

Table 4. Occurrence of the leading disorders in New York arrivals of Long Russet potato shipments from Washington,^a 1972–1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Punctures and cuts (%)	Internal black spot (%)	Grade defects (%)	Bruising (%)
0	56.8	84.5	78.8	87.4	81.1
1	28.6	6.8	3.4	2.2	7.7
2–5	11.3	8.6	10.3	10.2	11.2
6–12	2.8	0	3.4	0.1	0
13–20	0.3	0	2.2	0	0
21–50	0.1	0	2.0	0	0
50	0	0	0	0	0

^a73.2% of 978 shipments.

Table 6. Occurrence of the leading disorders in New York arrivals of Long White potato shipments from California,^a 1972–1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Punctures and cuts (%)	Internal black spot (%)	External discoloration (%)	Bruising (%)
0	49.0	84.8	88.5	80.2	83.8
1	34.8	6.3	2.0	3.3	7.5
2–5	9.4	8.9	5.6	9.5	8.6
6–12	4.4	0	2.4	5.2	0.1
13–20	1.6	0	0.8	1.1	0
21–50	0.7	0	0.6	0.7	0
50	0.1	0	0	0	0

^a89.3% of 2,324 shipments.

Table 7. Occurrence of the leading disorders in New York arrivals of Round White potato shipments from Maine,^a 1972-1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Fusarium tuber rot (%)	Punctures and cuts (%)	Sunken discoloration (%)	Bruising (%)
0	63.6	76.8	83.5	68.4	81.8
1	30.4	10.3	7.2	8.5	8.3
2-5	4.7	11.0	9.7	13.9	9.6
6-12	1.2	1.6	0.1	6.8	0.2
13-20	0.1	0.2	0	1.6	0.1
21-50	0.1	0.1	0	0.6	0
50	0	0	0	0	0

^a94.8% of 4,767 shipments.

Table 8. Occurrence of the leading disorders in New York arrivals of Round White potato shipments from New Jersey,^a 1972-1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Grade defects (%)	Sunburn (%)	Enlarged lenticels (%)	Misshapen (%)
0	46.6	93.6	95.3	95.1	95.7
1	46.4	1.3	3.0	1.1	2.1
2-5	4.7	3.0	1.5	3.6	2.1
6-12	2.1	2.1	0	0.2	0.2
13-20	0	0	0	0	0
21-50	0.2	0	0.2	0	0
50	0	0	0	0	0

^a96.7% of 550 shipments.

Table 9. Occurrence of the leading disorders in New York arrivals of Round White potato shipments from New York,^a 1972-1980

Incidence in shipment (%)	Disorders and shipments affected				
	Bacterial soft rot (%)	Grade defects (%)	Sunken discoloration (%)	Fusarium tuber rot (%)	Bruising (%)
0	82.6	91.0	90.6	92.8	96.5
1	9.8	0.4	3.5	2.0	1.8
2-5	4.7	7.6	3.9	3.7	1.8
6-12	2.4	1.0	1.4	1.2	0
13-20	0.2	0	0.4	0.4	0
21-50	0.4	0	0.2	0	0
50	0	0	0	0	0

^a96.3% of 527 shipments.

Tables 3-9 list the occurrences of the leading disorders in three tuber types shipped from the main sources of supply. The Long Russet type constituted 96, 73, and 94% of all potato types shipped from Idaho, Washington, and Wisconsin, respectively. The most damaging disorders in shipments of Long Russet potatoes from Wisconsin were bacterial soft rot (affecting one-half), Fusarium tuber rot (affecting one-third), and internal black spot (affecting one-fifth) (Table 3). The incidence of these three disorders was high—over 20% in some instances. The incidence of sunken discoloration was lower but the pattern was similar. Grade defects (growth cracks, undersized, secondary growth, stained, dirty, skinned, etc.) were found in more than

one-fourth of the shipments, but the incidence in nearly all of these shipments was only 2-5%.

Long Russet potatoes from Washington also showed substantial bacterial soft rot, and the incidence of internal black spot was almost identical to that in tubers from Wisconsin (Table 4). Only 13% of the shipments had tubers with grade defects, nearly all with an incidence of 5% or less. Damage from punctures and cuts was found in 15% of the shipments. In shipments of other tuber types from Washington, the incidence of bacterial soft rot was higher (53.4%) and that of internal black spot was lower (4.2%) than in the Long Russet type.

Bacterial soft rot and Fusarium tuber rot were the principal disorders in shipments of Long Russet potatoes from Idaho, with Fusarium tuber rot generally more severe (Table 5). The incidence of internal black spot was considerably less than in shipments from Washington or Wisconsin. Grade defects were found in about 10% of the shipments.

Long White potato shipments from California usually arrive at the New York market in late spring and early summer. Half of those inspected had bacterial soft rot, with the incidence sometimes exceeding 20% (Table 6); this high incidence may be related to immaturity, underdeveloped periderm, or washing of the tubers. Fusarium tuber rot, on the other hand, was found in less than 3% of the shipments, probably because the potatoes had not been stored for any length of time. External discoloration of tubers was noted in 20% of shipments and internal black spot in 11%; these disorders had similar incidences within shipments. The frequency of punctures and cuts and of bruising was about the same. The occurrence of disorders in other types of potatoes from California (11% of shipments) was similar to that in Long White tubers.

Bacterial soft rot was found in 36% of Round White potato shipments from Maine, predominantly in the lowest (1%) incidence (Table 7). Sunken discoloration was also found in about one-third of shipments but the incidence ranged from 1 to 50%. Fusarium tuber rot was found in about one-fourth of shipments, with the incidence mostly between 1 and 5%. Bruising and punctures and cuts were noted in less than one-fifth of shipments. Results in the other types of potatoes shipped from Maine were similar to those in Round White tubers, except that less than 1% of Round White potatoes had internal black spot.

Most of the potatoes shipped to the metropolitan New York market from New Jersey and New York are the Round White type. Bacterial soft rot again was the principal disorder observed and was more prevalent in New Jersey shipments (Tables 8 and 9). Incidence of all other disorders was generally 10% or less.

Bruising, usually resulting from rough handling, was found in 10-20% of shipments of Long Russet potatoes from Washington and Idaho, Long White potatoes from California, and Round White potatoes from Maine and New York, but incidence seldom exceeded 5%.

Overall, these data underlie several important points. Bacterial soft rot was the most damaging disorder found, followed by Fusarium tuber rot. Field diseases, such as late blight, scab, black leg, and ring rot, that used to be economically important in potato shipments were inconsequential. Injuries, though not as damaging, had a higher incidence than parasitic diseases and usually resulted from careless or improper handling. This information can provide guidelines for reducing losses and improving tuber quality.

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