Special Report

Disorders in Onion Shipments to the New York Market, 1972–1984

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Onions (*Allium cepa* L.) are a popular fresh produce commodity on the New York market, with more than 60,000 t arriving annually (7,8). Most of the onions are dry, and the major types are fleshy bulbs of Yellow Globe, Grano-Granex, and Sweet Spanish. The so-called red and white onion bulbs are of lesser commercial importance. Scallion-type onions, valued for their leaves, are not dried and are called green onions by the trade. New York State supplies about one-third of the dry onions, and Texas, Idaho, Oregon, and California combined supply about one-half. California, Arizona, and New Jersey are the chief suppliers of green onions.

On request of receivers or shippers, USDA personnel examine the arrival condition of onion shipments to determine if specified grades and/or conditions are met, then report their findings on inspection certificates. The Fresh Products Branch of the USDA Agricultural Marketing Service in New York City granted us permission to review about 10,000 onion inspection certificates generated during 1972–1984. Data from the certificates were abstracted, stored, and subsequently retrieved from a computer data bank to provide the information in this report—a continuation of a series on the arrival condition of USDA-inspected fresh produce shipments on the New York market (1,3–5).

During the 13-year span, 9,617 dry onion shipments (about 8.38 million packs) and 437 green onion shipments (about 286,000 packs) were inspected (Table 1). Most dry onion packs were 22.7 kg (50 lb) net weight in open-mesh twine sacks. Some red, white, or Sweet Spanish onions came in sacks, crates, or cartons ranging in net weight from 11.35 kg (25 lb) to 22.7 kg. Green onions were usually packed 4 dozen bunches per waxed carton.

Twenty-four disorders of dry onions were either identified by their common designations or described by USDA inspectors, trained to diagnose disorders chiefly by symptomatology and pathogenic signs (Table 2). Eleven disorders were caused by pathogens, the most prevalent and damaging being bacterial soft rot (*Erwinia* spp.) and gray mold/Botrytis neck rot (*Botrytis allii, B. byssoidea, B. squamosa*). Federal inspectors called all decays caused by *Botrytis* spp. gray mold rot, whether occurring at the neck or other parts of the onion, as per Smith et al (6). Two other conditions that may be parasitic in nature were described as sunken discoloration and external discoloration or staining. Five disorders were physiologic but nonparasitic and six were injuries inflicted mechanically or by environmental extremes. The most damaging physiologic disorders were translucent scales and sprouting; the principal injuries were sunscald and freeze damage. Grade defects, mostly minor mechanical damage along with split and double bulbs, excessively long tops, and seed stems, were noted in substantial numbers but were not as commercially damaging as the other disorders.

Gray mold rot was the most prevalent disorder in Yellow Globe onions, reported in 35% of 4,880 shipments and affecting from 1% to more than 50% of the onions in a shipment (Table 3). Bacterial soft rot was identified in 28% of shipments, with incidence ranging from 1% to more than 75%. Black mold rot (*Aspergillus niger*) affected 11% of shipments, some with a high disease incidence, and black surface mold (*A. niger*) was reported in 4% of shipments in varying degrees of severity; federal inspectors classify surface growth of *A. niger* in the absence of any decay as a separate disorder. Fusarium bulb rot (*Fusarium* spp.), blue mold rot (*Penicillium* spp.), sour skin (*Pseudomonas cepacia*), smut (*Urocystis cepulae*), and white rot (*Sclerotium cepivorum*) were each found in about 1% or less of the shipments. Unidentified decays were reported in 27% of the inspections but incidence was almost always low (10% or less). Decays are often unidentified by federal inspectors when grade tolerances are met, symptoms are not fully developed, or a disease is unrecognized.

Translucent scales (cause unknown) was the physiologic disorder reported most often (15%) in inspections of Yellow Globe onion shipments (Table 3); the fleshy scales have a characteristic grayish, water-soaked appearance (6). Sunscald was the most common injury (9%), but freeze damage (1%) was more harmful.

Bacterial soft rot was found in 51% of 3,187 shipments of Grano-Granex onions, affecting more than 10% of the load in 438 shipments (Table 4). Gray mold rot was noted in 20% of shipments, with incidence ranging up to 75%. Black mold rot was reported in 12% of shipments and black surface mold, in 6%; incidence of each disorder ranged from 1 to 75% or higher. Sunscald was reported in 21% of shipments, compared with 9% of Yellow Globe and 3% of Sweet Spanish onion shipments. Translucent scales were noted in only 0.2% of shipments.

In 944 shipments of Sweet Spanish onions, the most frequent disorder was unidentified decays (39%) but gray mold rot (31%) caused more damage (Table 5). Bacterial soft rot was reported in 21% of shipments and translucent scales, in 12%. Black mold rot (3%) and black surface mold (0.6%) were observed much less often than in other onion types.

Bacterial soft rot and gray mold rot were the leading causes of damage in 389 shipments of red onions (48 and 37%, respectively), with bacterial soft rot more destructive (Table 6). Sunscald was reported in 23%, unidentified decays in 17%, black mold rot in 7%, black surface mold in 4%, and Fusarium bulb rot in 3%. Translucent scales were found in 2% of shipments, considerably less often than in Yellow Globe and Sweet Spanish onion shipments.

Bacterial soft rot was also the most frequently reported disorder (33%) in 437 shipments of green onions and often was highly destructive (Table 7). Yellowing of the fleshy leaf tissues (23%) was the other seriously damaging condition observed.

Incidences of the leading disorders in the three major dry onion types and the origins of the shipments are shown in Table 8. The incidences of bacterial soft rot and gray mold rot were substantially lower in shipments of Yellow Globe onions from New York State and Canada, possibly because these sources are closer than the others to the New York market.

Because USDA inspections were made on request, usually because the condition of a shipment at arrival was suspect, these data do not truly represent the arrival condition of all onion

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shipments to the New York market. The inspected shipments, which included a substantial number of distressed loads, contained about 16% of all onions delivered to the New York market. A routine inspection of a shipment usually involved at least six packs selected at random; more packs were inspected if the receiver or shipper requested a more extensive examination.

We believe the data from the large number of shipments inspected provide a fairly accurate picture of the diseases and other disorders affecting the market quality of onions. Furthermore, some of the disorders reported on arrival worsen and cause further deterioration of the onions as they move through the marketing channels. A recent 3-year study on retail and consumer losses of onions marketed in metropolitan New York revealed losses ranging from 4% for Yellow Globe to 7% for Grano-Granex to 14% for Sweet Spanish (2).

The data in this report suggest an increased research effort is needed in the growing and marketing of onions in order to reduce storage, transit, retail, and consumer losses of this major fresh produce commodity.

ACKNOWLEDGMENT

We thank the New York office of the USDA Fresh Fruit and Vegetable Inspection, Fresh Products Branch of the Agricultural Marketing Service for making available the inspection certificates from which the data for this report were obtained.

LITERATURE CITED

1. Cappellini, R. A., Ceponis, M. J., Wells, J. M., and Lightner, G. W. 1984. Disorders in potato shipments to the New York market, 1972–1980. Plant Dis. 68:1018-1020.
2. Ceponis, M. J., and Butterfield, J. E. 1981. Dry onion losses at the retail and consumer levels in metropolitan New York. HortScience 16:531-533.
3. Ceponis, M. J., Cappellini, R. A., and Lightner, G. W. 1985. Disorders in

Table 1. Load volumes of onions inspected by USDA on the New York market, 1972–1984

Year	Railcar		Truck		Other[a]		Total	
	Shipments (no.)	Packs[b] (no.)	Shipments (no.)	Packs (no.)	Shipments (no.)	Packs (no.)	Shipments (no.)	Packs (no.)
1972	1,117	836,941	87	60,343	14	7,446	1,218	904,730
1973	1,009	726,589	168	113,130	4	4,494	1,181	844,213
1974	856	637,248	157	115,346	6	6,732	1,019	759,326
1975	596	450,461	479	372,871	25	31,445	1,100	854,777
1976	759	662,822	734	576,852	21	18,896	1,514	1,258,570
1977	323	308,892	265	205,486	40	122,001	628	636,379
1978	162	208,031	220	168,950	0	0	382	376,981
1979	202	249,585	145	91,120	4	4,965	351	345,670
1980	232	304,855	200	151,177	4	1,452	436	457,484
1981	173	237,293	157	105,920	7	3,650	337	346,863
1982	173	266,744	298	216,862	13	8,787	484	492,393
1983	232	310,330	381	297,183	29	19,913	642	627,426
1984	143	162,905	484	482,444	135	116,989	762	762,338
Total	5,977	5,362,696	3,775	2,957,684	302	346,770	10,054[c]	8,667,150[c]

[a] Boat and lot inspections.
[b] Net weight of all packs, 11.35–22.7 kg.
[c] Includes 437 shipments containing 285,988 packs of green onions.

Table 2. Frequency of disorders reported in USDA inspections of 9,617 dry onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2-5	6-10	11-15	16-20	21-25	26-33	34-50	51-75	>75
Bacterial soft rot	36.4	6,121	117	1,662	945	336	181	85	68	68	20	14
Gray mold rot	30.0	6,735	86	1,423	852	281	118	58	31	25	7	1
Unidentified decays	27.1	7,009	2,142	421	32	3	0	4	1	3	1	1
Grade defects	17.4	7,948	158	1,394	102	5	6	0	1	2	1	0
Sunscald	13.1	8,359	265	754	171	44	12	8	3	1	0	0
Black mold rot	10.5	8,609	202	495	182	59	37	11	7	10	3	2
Translucent scales	9.2	8,733	238	472	120	29	16	4	4	1	0	0
Misshapen bulbs	6.9	8,957	131	515	13	1	0	0	0	0	0	0
Black surface mold	4.6	9,177	67	200	82	30	22	9	11	15	3	1
Punctures/cuts	4.1	9,227	39	341	10	0	0	0	0	0	0	0
Sprouting	2.3	9,400	60	111	26	15	3	0	2	0	0	0
Fusarium bulb rot	1.2	9,503	8	70	25	7	2	1	1	0	0	0
Freeze damage	0.8	9,538	0	9	23	12	11	6	3	7	4	4
Blue mold rot	0.8	9,543	12	33	14	6	1	4	2	2	0	0
External discoloration	0.4	9,572	2	15	10	4	2	7	1	4	0	0
Bruise damage	0.4	9,577	4	30	2	1	2	0	1	0	0	0
Soft/spongy bulbs	0.1	9,610	2	5	0	0	0	0	0	0	0	0
Smut	0.1	9,611	0	3	1	1	0	1	0	0	0	0
Sour skin	0.1	9,612	1	3	1	0	0	0	0	0	0	0
Greening	0.1	9,612	1	2	1	0	0	0	1	0	0	0
White rot	<0.1	9,613	0	4	0	0	0	0	0	0	0	0
Other[a]	0.1	9,611	1	1	1	0	0	0	0	0	3	0

[a] Alternaria rot, sunken discoloration, and insect damage.

Table 3. Frequency of disorders reported in USDA inspections of 4,880 Yellow Globe onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75
Gray mold rot	35.3	3,158	43	841	535	174	63	37	16	11	2	0
Bacterial soft rot	28.2	3,502	53	742	350	110	44	30	20	20	4	5
Unidentified decays	27.4	3,543	1,108	202	22	0	0	1	1	2	1	0
Grade defects	19.1	3,950	99	804	23	1	0	0	1	1	1	0
Translucent scales	15.4	4,129	201	402	101	27	12	3	4	1	0	0
Black mold rot	10.7	4,356	133	270	77	22	9	7	3	2	0	1
Sunscald	9.2	4,432	115	275	46	7	3	2	0	0	0	0
Misshapen bulbs	5.8	4,598	69	209	4	0	0	0	0	0	0	0
Black surface mold	4.2	4,673	37	101	36	14	5	4	5	4	1	0
Punctures/cuts	4.0	4,684	28	168	0	0	0	0	0	0	0	0
Sprouting	2.6	4,753	38	61	19	7	1	0	1	0	0	0
Fusarium bulb rot	1.1	4,827	4	33	9	5	1	0	1	0	0	0
Freeze damage	1.1	4,828	0	7	16	9	7	4	1	4	2	2
Blue mold rot	1.0	4,831	8	18	13	5	1	2	0	2	0	0
Bruise damage	0.4	4,862	1	14	1	1	1	0	0	0	0	0
External discoloration	0.2	4,871	0	3	0	1	1	3	0	1	0	0
Sour skin	<0.1	4,878	0	1	1	0	0	0	0	0	0	0
Other[a]	0.2	4,868	2	8	2	0	0	0	0	0	0	0

[a] White rot, smut, greening, and soft/spongy bulbs.

Table 4. Frequency of disorders reported in USDA inspections of 3,187 Grano-Granex onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75
Bacterial soft rot	51.3	1,551	38	687	473	189	109	43	41	39	12	5
Unidentified decays	24.6	2,404	642	134	6	1	0	0	0	0	0	0
Sunscald	21.5	2,503	134	409	101	28	5	5	2	0	0	0
Gray mold rot	20.6	2,530	26	320	180	69	32	15	8	5	2	0
Grade defects	16.5	2,661	29	429	62	1	5	0	0	0	0	0
Black mold rot	12.7	2,782	58	186	92	32	18	4	4	8	2	1
Misshapen bulbs	9.1	2,897	34	247	9	0	0	0	0	0	0	0
Black surface mold	6.5	2,981	26	86	41	16	15	5	4	10	2	1
Punctures/cuts	4.9	3,032	6	140	9	0	0	0	0	0	0	0
Fusarium bulb rot	1.3	3,147	2	25	9	2	1	1	0	0	0	0
Sprouting	0.9	3,159	7	12	2	5	2	0	0	0	0	0
Blue mold rot	0.5	3,170	2	11	1	0	0	1	2	0	0	0
Bruise damage	0.5	3,172	1	13	1	0	0	0	0	0	0	0
Translucent scales	0.2	3,180	2	2	3	0	0	0	0	0	0	0
Other[a]	0.3	3,176	2	4	3	0	0	0	0	1	1	0

[a] Sour skin, external discoloration, smut, insect damage, and freeze damage.

Table 5. Frequency of disorders reported in USDA inspections of 944 Sweet Spanish onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75
Unidentified decays	38.9	577	297	66	3	0	0	1	0	0	0	0
Gray mold rot	31.2	649	11	182	70	11	11	4	1	3	1	1
Bacterial soft rot	21.4	742	16	131	38	8	7	1	0	1	0	0
Translucent scales	11.8	833	29	63	15	1	2	1	0	0	0	0
Grade defects	9.5	854	16	74	0	0	0	0	0	0	0	0
Misshapen bulbs	6.5	883	22	39	0	0	0	0	0	0	0	0
Sprouting	4.7	900	12	27	4	1	0	0	0	0	0	0
Black mold rot	3.1	915	4	16	3	1	5	0	0	0	0	0
Sunscald	2.9	917	4	16	3	3	1	0	0	0	0	0
Freeze damage	2.3	922	0	2	6	3	4	0	2	2	1	2
Punctures/cuts	2.3	922	3	19	0	0	0	0	0	0	0	0
Fusarium bulb rot	0.7	937	2	3	2	0	0	0	0	0	0	0
Blue mold rot	0.6	938	1	3	0	1	0	1	0	0	0	0
Black surface mold	0.6	938	1	2	0	0	2	0	0	1	0	0
Other[a]	0.7	937	1	5	0	1	0	0	0	0	0	0

[a] Bruise damage, white rot, and external discoloration.

Table 6. Frequency of disorders reported in USDA inspections of 389 red onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75
Bacterial soft rot	48.1	202	6	71	54	15	16	10	2	5	4	4
Gray mold rot	36.8	246	3	50	51	17	10	2	3	5	2	0
Sunscald	22.9	300	10	46	21	6	3	1	1	1	0	0
Grade defects	21.9	304	8	59	13	3	1	0	0	1	0	0
Unidentified decays	17.5	321	53	10	1	2	0	0	0	1	0	1
Black mold rot	6.9	362	3	13	5	1	4	0	0	0	1	0
Black surface mold	4.4	372	2	9	4	0	0	0	2	0	0	0
Fusarium bulb rot	3.6	375	0	9	5	0	0	0	0	0	0	0
Sprouting	2.8	378	0	8	1	1	0	0	1	0	0	0
Punctures/cuts	2.6	379	0	10	0	0	0	0	0	0	0	0
Translucent scales	2.3	380	3	2	1	1	2	0	0	0	0	0
Freeze damage	0.8	386	0	0	1	0	0	1	0	1	0	0
Other[a]	1.0	384	1	1	1	0	0	0	2	0	0	0

[a] Soft/spongy bulbs, greening, external discoloration, and bruise damage.

Table 7. Frequency of disorders reported in USDA inspections of 437 green onion shipments on the New York market, 1972–1984

Disorder	Shipments affected (%)	Number of shipments affected according to incidence class (% onions)										
		0	1	2–5	6–10	11–15	16–20	21–25	26–33	34–50	51–75	>75
Bacterial soft rot	33.4	291	2	32	48	23	9	5	9	4	10	4
Yellowing	22.9	337	4	35	24	17	11	2	5	1	0	1
Unidentified decays	8.2	401	27	7	0	0	0	1	0	1	0	0
External discoloration	6.2	410	1	11	7	1	1	4	0	2	0	0
Bruise damage	2.8	425	1	6	3	1	1	0	0	0	0	0
Freeze damage	1.6	430	0	0	1	0	0	1	0	3	0	2
Gray mold rot	0.9	433	0	1	1	1	1	0	0	0	0	0
Other[a]	0.9	433	0	3	0	1	0	0	0	0	0	0

[a] Grade defects, soft/spongy bulbs, and distorted onions.

Table 8. Incidences of leading disorders of three major dry onion types reported in USDA inspections on the New York market of shipments from major sources of supply, 1972–1984

Onion types Sources	Shipments (no.)	Disorders and percentages of shipments affected									
		Bacterial soft rot	Gray mold rot	Unidentified decays	Black mold rot	Grade defects	Translucent scales	Sunscald	Misshapen bulbs	Black surface mold	Fusarium bulb rot
Yellow Globe											
Idaho	1,502	24.9	44.8	28.4	9.7	22.6	25.1	5.9	5.7	2.1	1.1
Oregon	903	23.2	44.9	27.1	11.8	23.8	20.6	7.3	8.3	2.3	1.1
California	666	49.2	30.2	21.6	19.1	17.9	12.9	21.3	7.2	15.5	2.7
New York	389	13.9	12.9	26.0	1.6	5.9	12.9	1.0	1.0	0	0
Canada	346	4.0	7.8	47.7	4.6	5.2	15.0	2.3	1.2	1.7	0
Texas	258	56.6	29.1	20.5	15.9	15.5	0.4	29.8	10.1	2.3	0.4
Colorado	218	34.0	43.6	17.9	8.7	22.9	2.8	9.6	2.8	10.6	0.9
Grano-Granex											
Texas	1,909	52.3	18.4	23.8	8.9	17.7	0.2	20.0	8.4	4.8	0.5
California	786	55.0	27.1	23.8	20.7	16.2	0.1	28.8	11.5	9.9	2.3
Arizona	245	46.9	18.0	31.0	19.6	14.7	0.4	17.6	9.4	6.1	2.9
New Mexico	117	37.6	15.4	30.8	12.0	11.1	0	0	9.4	9.4	2.6
Sweet Spanish											
Idaho	523	20.7	31.7	39.6	2.5	11.3	14.5	0.8	6.3	1.0	0.6
Oregon	256	20.7	35.2	43.4	3.1	9.0	11.7	2.7	8.6	0	1.6

crisphead lettuce shipments to the New York market, 1972–1984. Plant Dis. 69:1016-1020.

4. Ceponis, M. J., Cappellini, R. A., and Lightner, G. W. 1986. Disorders in tomato shipments to the New York market, 1972–1984. Plant Dis. 70:261-265.
5. Ceponis, M. J., Cappellini, R. A., and Lightner, G. W. 1986. Disorders in muskmelon shipments to the New York market, 1972–1984. Plant Dis. 70:605-607.
6. Smith, M. A., McColloch, L. P., and Friedman, B. A. 1966. Market diseases of asparagus, onions, beans, peas, carrots, celery, and related vegetables. U.S. Dep. Agric. Agric. Handb. 303. 65 pp.
7. United States Department of Agriculture. 1973–1982. Fresh fruit and vegetable unloads in eastern cities. U.S. Dep. Agric. Agric. Mark. Serv. FVUS-1 (1972–1981).
8. United States Department of Agriculture. 1983–1985. Fresh fruit and vegetable arrivals in eastern cities. U.S. Dep. Agric. Agric. Mark. Serv. FVAS-1 (1982–1984).