RESISTANCE OF ONION VARIETIES TO FUSARIUM BASAL ROT AND TO PINK ROOT[1]

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Abstract

Field tests with 23 hybrid and 23 open-pollinated onion varieties indicated that (a) open-pollinated varieties are, in general, more resistant to fusarium basal rot, and (b) individual hybrid and open-pollinated varieties vary widely in their susceptibility to the rot. The results also indicate that both types of onion are less resistant to pink root than to fusarium basal rot and that, in general, resistance of an individual variety to fusarium basal rot is converse to its resistance to pink root.

Introduction

The choice of onion varieties for commercial production in the Interior dry belt of British Columbia has been strongly influenced by the need for providing resistance to saveral serious diseases. Within the last five years onion production has been confined almost exclusively to the hybrid varieties 'Autumn Spice', 'Autumn Splendor', 'Premier', 'Epoch', and 'Brown Beauty'. These have replaced open-pollinated onions including 'Yellow Globe Danvers', 'Mountain Danvers', and 'Yellow Globe'. The change to hybrids was especially prompted by the need to utilize their greater resistance to neck-rot, Botrytis Munn, which was causing serious losses in the open-pollinated varieties, especially during winter storage.

The change to hybrid varieties has been followed by increased concern with losses from fusarium basal rot, Fusarium oxysporum Schlecht. f. cepae (Hanz.) Snyd. & Hans. This disease, introduced to the region over 40 years ago (4), has been responsible for varying amounts of rot in growing and stored onion bulbs. However, the losses in open-pollinated varieties were seldom sufficient to cause concern among growers. Since the industry has replaced these with hybrid onions, growers have suffered losses as high as 50% rotted bulbs at harvest,

Pink root, Pyrenochaeta terrestris (Hans.) Gorenz, J. C. Walker & Larson, appeared in the B. C. Interior at about the same time as basal rot (4). Although less is known of the extent of actual loss from this disease, and the relative susceptibility of varieties, it is recognized as a common disease on practically all farms.

Because of the increased importance of fusarium basal rot, tasts have been made of the comparative resistance of a number of hybrid and open-pollinated varieties to this disease. The reactions of the same varieties to pink root have been included in the comparisons.

Materials and methods

The relative degrees of disease resistance of 23 hybrid and 23 open-pollinated varieties or strains were compared in field plantings. Seed of nearly all the hybrids tested and also some of the open-pollinated varieties was supplied by one firm that specializes in seed production of hybrid onions. Seed of the rest of the varieties tested was supplied by several seed firms (Table 1) and included onions of different colors and uses including pickling and bunching onions. The seed of each variety was pelleted with 25% Trithion for onion maggot control, and sown in single 40-foot rows in a field in which basal bulb rot had been severe and pink root present the previous year. The entire field was fertilized by the owner prior to seeding, and a side dressing of ammonium phosphate was applied to the test plots during June to promote growth of the plants and to minimize losses (1). The dates of sowing and of lifting the bulbs were those selected by the grower for his commercial onion crop that was growing adjacent in the same field. Readings of basal bulb rot and pink root were made at the time of lifting.

Results and discussion

The percentages of fusarium basal rot infection (Table 1) ranged from 58.0% to 6.0% among the hybrids, and from 42.2% to 1.7% among the open-pollinated varieties. The most susceptible of the hybrids tested, with over 50% of the bulbs affected, were 'Experimental No. 6', 'Experimental No. 16', 'Fiesta', and 'Brown Beauty'; the most resistant, with less than 10% of the bulbs affected, were 'Hickory', 'Spartan Era', Experimental No. 14', and 'Experimental No. 11'.

Among the open-pollinated varieties, only two had more than 20% basal rot infection. These were a strain of 'Yellow Globe Danvers', with 42.2% rotted bulbs, and 'Sweet Spanish Large Utah', with 24.5% rot. The most resistant of these varieties, with less than 5% infection, were 'Silver Queen'. Mountain Danvers', and 'Annual Bunching'.

There was a wide range of susceptibility between the three tested strains of 'Yellow Globe Danvers'. Although the one strain proved unusually susceptible, with 42.2% rotted bulbs, the other two strains from commercial sources (Table 1) had only 20.0% and 7.1% loss,

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Table 1. Resistance of onion varieties to fusarium basal rot and pink root at harvest.

Variety	Total bulbs	% Healthy	% Basal rot	% Pink root only	*Source of seed
Hybrid varieties					
Exp. No. 6	162	15.5	58.0	26.5	A
Exp. No. 16	134	9.7	56.0	34.3	A
Fiesta 61	114	15.8	55.3	28.9	A
Brown Beauty	127	4.8	53.5	41.7	A
Magnifico	128	8.6	35.9	55.5	A
Exp. No. 4	214	12.1	31.8	56.1	A
Abundance	198	3.5	29.8	66.7	A
Exp. No. 9	158	5.7	28.5	65.8	A
Exp. No. 15	165	10.9	28.5	60.6	A
Encore	195	8.2	23.1	68.7	A
Exp. No. 10	149	19.5	20.1	60 4	A
Elite	136	7.4	19.1	73.5	A
Exp. No. 8	183	2.2	18.6	79 2	A
Autumn Spice	146	8.9	17.1	74.0	A
Exp. No. 12	156	1.9	14.1	84.0	A
Early Harvest	169	1.8	13.6	84.6	B
Nugget	200	6.5	13.0	80.5	A
Spartan Gem	194	5.1	12.9	82.0	A
Autumn Splendor	161	7.4	12.5	80.1	A
Hickory	211	5.7	9.0	85.3	A
Spartan Era	186	1.6	8.6	89.8	A
Exp. No. 14	185	28.1	7.0	64.9	A
Exp. No. 11	167	26.9	6.0	67.1	A
Open pollinated varieties					
Danvers Yellow Globe	206	4.9	42.2	52.9	A
Sweet Spanish Large Utah	151	10.6	24.5	64.9	C
Yellow Globe Danvers	220	4.1	20.0	75.9	C
White Globe	118	0.8	19.5	79.7	C
Yellow Ebenezer	167	2.4	18.6	79.0	E
Southport White Globe	178	2.4	13.5	84.3	E
Sw. Span. Early Imperial	240	15.0	12.5	72.5	C
Iowa 44 Yellow Globe	116	6.0	12.1	81.9	E
White Ebenezer	167	3.6	11.4	85.0	E
Early Yellow Globe	137	7.3	10.9	81.8	C
Yellow Sweet Spanish	212	6.6	10.4	83.0	A
Early Yellow Globe	188	8.5	10.1	81.4	A
Silverskin Pickling	180	0.0	10.0	90.0	C
Red Weathersfield	121	6.6	9.1	84.3	C
Stuttgarter	161	31.7	7.5	88.8	E
White Portugal	196	3.6	7.1	89.3	E
Yellow Globe Danvers	155	20.0	7.1	72.9	D
Giant Prizetaker	156	4.5	7.0	88.5	C
Southport Red Globe	196	1.6	6.6	91.8	E
Walla Walla Sw. Span.	167	7.8	6.6	85.6	D
Annual Bunching	184	4.3,	4.9	90.8	C
Mountain Danvers	219	10.9	2.3	86.8	C
Silver Queen	118	2.5	1.7	95.8	E

*Supplier of seed
A - Crookham Co., Caldwell, Ida.
B - Roy A. Nicholson Ltd., Burlington, Ont.
C - A. E. McKenzie Co. Ltd., Brandon, Man
D - Gill Bros. Seed Co., Portland, Ore.
E - Stokes Seeds Ltd., St. Catharines, Ont.

Fusarium basal rot infection on individual bulbs at harvest varied from slight, following recent bulb infection, to severe, following infection earlier in the growing season. The rot was normally quite extensive on bulbs that had been infested by onion maggots.

Only four of the 46 onion varieties and strains had less than 50% pink root infection. Twenty-seven had over 75% root infection. The four most resistant varieties were 'Experimental No. 6' (26.5% infection), 'Fiesta 61' (28.9% infection), 'Experimental No. 16' (34.3% infection), and 'Brown Beauty' (41.7% infection).

The degree of pink root infection on individual bulbs at harvest varied from as few as two or three pink-colored, turgid, and still functioning roots to root systems that were totally wilted, desiccated, and functionless. Lightly infected bulbs were well sized for the variety, but severly affected bulbs were smaller than normal. Most diseased bulbs had pink root symptoms on 50% or more of the roots. No distinction in severity of infection was made in the records of disease incidence.

Discussion

The results indicate that hybrid onion varieties are characteristically much less resistant than open-pollinated sorts to fusarium basal rot. Nevertheless, four hybrid varieties suffered less than 10% infection, and five others less than 15%. This suggests that hybridonions with satisfactory resistance to the disease can be found, either among varieties already released, or through breeding programmes using the more resistant varieties as parents.

Obviously there is a much wider selection of resistant material among the open-pollinated varieties. Where production is satisfactory in other respects, their susceptibility to botrytis neck rot can be minimized if facilities are available for quick drying and proper storage after harvesting. However, the demonstrated variations in susceptibility of the tested strains of 'Yellow Globe Danvers' indicates that their resistance to basal rot cannot be taken for granted. The strain of this variety that was selected and propagated in the Okanagan valley, and widely grown over 30 years ago, was tested at that time for basal rot resistance and, under experimental conditions comparable to those imposed in the recent tests, developed basal rot on only 10 to 13% of the bulbs (2, 3). Thus the resistance of this strainapproximated that of the most resistant of the three strains used in these tests, whereas the other two strains developed infection in 42.2% and 20.0% respectively.

Obviously resistance to pink root is much more rare among both hybrid and open-pollinated varieties. Unfortunately, the highest levels of resistance were displayed by the four hybrids that were most susceptible to basal rot, and conversely, the open-pollinated varieties such as 'Silver Queen', that showed the highest level of resistance to basal rot, were among the most susceptible to pink root. Indeed there is justification for speculating that pink root infection may in some manner reduce the susceptibility of bulbs to basal rot infection.

Literature cited

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