RESPONSE OF GROWER-AVAILABLE SEBAGO POTATO SEED STOCKS TO DIFFERENT SEED PIECE TREATMENTS

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ABSTRACT

Several grower-available, certified Sebago potato seed stocks originating from different geographical areas were tested during the 1969 and 1970 growing seasons. Seed piece treatments—nontreated stem-end and bud-end and fungicide treated bud-end—were also evaluated in the 1970 study. Results show great variation among seed stocks and seed piece treatments for the incidence of black leg and seed piece decay. Earlier plant emergence and increases in stand and yield were associated with those stocks having low incidence of disease(s) and with treated seed. Significant seed stock x seed piece interactions were found for stands. Differences in tuber specific gravity values associated with stocks and seed piece treatments are discussed.

INTRODUCTION

Imperative to successful and profitable potato production is obtaining a good vigorous stand by the prevention of seed piece decay and black leg disease. The need for and use of sound, healthy seed stocks is apparent and widely accepted. This is accomplished, primarily, by use of certified seed. Florida growers have recently utilized a State Seed Inspection Service to implement their needs for high-quality planting stocks. However, even with the use of certified seed, coupled with local inspection and recommended management practices, north Florida growers have observed differences in response among Sebago seed stocks. As a result, additional information is needed on the variability among grower-available Sebago seed stocks.

Several investigators (1, 2, 4) have extensively reviewed the intra- and inter-effect of seed piece decay and black leg pathogens on potato stands. Eddins, et al. (2) reported that the majority of these pathogens are present in most Florida soils and infect the potato seed piece after it is planted. While less than 1 per cent incidence of black leg has been reported as being transmitted through infected seed, per se (1, 2), the bacterial pathogen was generally present and was isolated from tuber fungus lesions (1).

Kehr, et al. (3) reported differences in response among seed of the same variety originating in different locations to be due to "place effect". Possible contributing causes to "place effect" are differences in: (a) seed dormancy; (b) virulence of tuber transmitted diseases; (c) soil and moisture conditions; (d) fertilizer practices; and (e) natural selection of somatic mutation.

The primary purpose of these experiments was to study the stand and yield response of Sebago seed stocks as affected by seed piece decay and black leg. Comparison was made between fungicide treated seed and nontreated seed, and between stem-end and bud-end seed pieces.

MATERIALS AND METHODS

The responses of grower-available Sebago seed stocks were evaluated in 1969 and 1970. During both seasons: (1) Certified stocks were obtained via Fruit and Vegetable Inspection Division, Florida Department of Agriculture; (2) A control (USDA maintenance seed) stock was obtained from Aroostook State Farm, Presque Isle, Maine; (3) As stocks arrived, they were held under uniform conditions until planting; (4) Soft and dry rot tubers were removed before seed was cut by hand into approximately 2 ounce pieces; (5) Recommended management practices of the Hastings area were followed during the growing season; and (6) Seed piece decay was associated with failure of a plant to emerge and black leg with a declining stand.

In 1969, 3 grower-available stocks and the control were tested. A randomized block with 5 replications constituted the field design. Seed was planted 8 inches apart in 24 hill units on January 28. Thirty-two days after planting, first symptoms of black leg appeared, and stand counts were taken. Black leg continued to develop, and its incidence was recorded on the 13th
In 1970, the experimental procedures were expanded to include: (1) a control; (2) 8 grower-available stocks (certified) from widely varying geographical locations; and (3) a certified stock rejected by inspection on arrival for containing approximately 40% internal browning. Four days before planting each stock was divided into 10 sublots. From each sublot 15 tubers, each weighing approximately 6 ounces, were selected and cut into one stem-end and two bud-end pieces. At this time, the number of shatter bruised and other abraded tubers was recorded. Half of the bud-end pieces were treated with Polyram® seed treater (7% W).

A split plot with whole units arranged in a 10 x 10 Latin square constituted the field design. Whole units were seed stocks and sub-units were seed piece treatments. Seed was planted 12 inches apart in 15 hill units on January 29. Emerging stand counts were taken at 43, 47, and 55 days after planting. Incidence of black leg was recorded at 70 and 79 days. Tubers were harvested on May 28 from 5 replications. Specific gravities were determined the following day by the weight in water-weight in air method. Because of the low black leg incidence the data were transformed by the expression, $\sqrt{x+1}$, to test for significance.

Results and Discussion

1969

Stand

The effect of seed stock on established and declining stand in 1969 is shown in Figure 1. At 62 days after planting, no significant difference was noted among the control, Maine, and Ontario stocks. However, these stocks did have significantly greater stands than did the PEI (Prince Edward Island) stock. Figure 1 also shows a decline in stand due to black leg. The control stock was free of black leg and maintained a stand of 98% throughout the experiment. From 62 to 75 days after planting, PEI and Maine stock stands declined significantly. Further decline for these stocks was shown at 83 days, but this was not significant. However, there was a significant decline in the Ontario stock. At this time, the control stock had a significantly greater stand than all grower-available ones. While stands of the Maine and Ontario stocks did not differ significantly, their stands were significantly greater than the PEI stock at 83 days.

Yield

Yields of the control stock were significantly (39 cwt/A) greater than the best grower-available stock (Figure 2). Maine and Ontario stocks were not significantly different from each other in yields. They did, however, produce significantly greater yields than the PEI stock. The
direct relationship between stand and yield of stocks is quite evident. As stock stands significantly decreased from each other, both as a result of early seed piece decay and, later, black leg, there was a significant decrease in yield.

1970

STAND

Conditions during the early season of 1970 were ideal for seed piece decay. Four days after planting, rains totalling 5.15 inches were recorded. Low temperatures of 24 and 30°F. were recorded on two consecutive nights following the rain. Unseasonably low soil temperatures and above average rainfall followed during February and early March. Black leg incidence was considered nominal when compared to 1969. Early symptoms of the black leg disease did not appear until the middle of April. The effect of seed stock on emerging and declining stand is shown in Figure 3. There were significant differences between stands at 43, 47, and 55 days after planting. When emergence was considered complete at 55 days, the stock stands ranged from 91% (control) to 42% (rejected). Maine and New York stocks did not differ significantly from the control. The rejected stock did differ significantly from all other stocks. Between 43 and 47 days, there was a rather sharp increase (3 to 7%) in emergence of all stocks. Increases in stands from 47 to 55 days ranged from 0 to 3%. This variability was probably a result of varying extraneous factors affecting the physiology of stocks coupled with exposure to different environmental conditions in transit to the area. Figure 3 also shows the decline in seed stock stands due to black leg. Between 55 and 70 days after planting, the decline was nonsignificant, ranging from 0 to 2%; a significant decline, ranging from 1 to 6%, was evident between 70 and 79 days.

Stand emergence of fungicide treated bud-end seed pieces was significantly increased at 43, 47, and 55 days over stand of nontreated seed pieces (Figure 4). Stands of nontreated bud-end pieces were significantly increased over stands of stem-end seed pieces. There was significant seed stock-seed piece interaction at 47 and 55 days. Figure 5 shows the pattern of response at 55 days after planting. For simplicity, only the control, an intermediate grower-available, and the rejected stocks were selected and shown. They represent the range and the approximate mean of stocks previously shown in Figure 3. A positive linear pattern of seed piece treatment, from stem-end to bud-end (nontreated) to bud-end (treated), was evident over all seed stocks. As the stand of seed stocks decreased, the magnitude of differences between seed pieces increased. Similar linear effects were associated with interactions at 43 and 47 days. Between 43 and 47 days, increases in emergence ranged from 3% for the treated seed to 6% for the stem-end seed (Figure 4). Differences were
nominal between 47 and 55 days. The better performance of bud-end seed can be explained by apical dominance which subjected them for a lesser period of time to conditions favorable to seed piece decay.

Figure 4 also shows the effect of seed pieces on declining stands due to black leg. From 55 to 70 days, decreases were nominal. At 79 days, the declines were still considered nominal. However, there was a significantly greater decline (2%) associated with treated seed. A possible explanation for this is that a greater percentage of seed-borne black leg pieces were protected from decay by the fungicidal treatment.

Over the course of this experiment stands were decreased by 76% due to seed piece decay. Black leg accounted for further reduction of less than 5%. The correlation coefficient (r=.34) between number of bruised-abraded tubers and emerged stand was not significant.

**YIELD AND SPECIFIC GRAVITY**

Seed stocks significantly differed in yield, ranging from 275 cwt/A for the control stock to 107 cwt/A for the rejected stock (Table 1). While there was no significant difference between yields of nontreated bud-end and stem-end seed, treated seed produced significantly greater yields than either. Although there was no significant seed stock-seed piece interaction, the patterning of their response is also shown in Table 1. The pattern was mixed for stocks yielding above 200 cwt/A, with no significant differences. Treated seed produced significantly greater yields than nontreated seeds for stocks yielding below 200 cwt/A. In the nontreated seed, there was a tendency for the bud-end seed to produce greater yields than the stem-end. However, these differences were not significant.

There were no significant differences in specific gravity among seed stocks. Tubers from bud-end seed, both treated and nontreated, had significantly higher specific gravities than those from stem-end seed. However, this difference has no practical significance.
Table 1. Effect of Sebago seed stock and seed piece treatment on the yield and the specific gravity of potato tubers - 1970.

<table>
<thead>
<tr>
<th>Seed Stock</th>
<th>Specific Gravity</th>
<th>Seed Piece</th>
<th></th>
<th></th>
<th>Seed Stock Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Treated</td>
<td>Nontreated</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bud-end</td>
<td>Bud-end</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>1.0589</td>
<td>270</td>
<td>274</td>
<td>283</td>
<td>275 e-1/</td>
</tr>
<tr>
<td>Maine</td>
<td>1.0583</td>
<td>257</td>
<td>226</td>
<td>225</td>
<td>236 ab</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>1.0598</td>
<td>257</td>
<td>221</td>
<td>212</td>
<td>230 ab</td>
</tr>
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<td>New York</td>
<td>1.0583</td>
<td>215</td>
<td>233</td>
<td>231</td>
<td>227 b</td>
</tr>
<tr>
<td>PEI - 5878</td>
<td>1.0571</td>
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<td>220</td>
<td>215</td>
<td>225 b</td>
</tr>
<tr>
<td>PEI - 2778</td>
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<td>183</td>
<td>204</td>
<td>201 bc</td>
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<td>205 a</td>
<td>153 b</td>
<td>147 b</td>
<td>168 cd</td>
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<tr>
<td>PEI - 2920</td>
<td>1.0572</td>
<td>173 a</td>
<td>120 b</td>
<td>110 b</td>
<td>134 de</td>
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<tr>
<td>PEI - 4286</td>
<td>1.0564</td>
<td>169 a</td>
<td>111 b</td>
<td>70 b</td>
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<td>1.0564</td>
<td>152 a</td>
<td>98 b</td>
<td>72 b</td>
<td>107 e</td>
</tr>
</tbody>
</table>

Seed Piece Mean

- **Yield**
  - 215 a
  - 184 b
  - 177 b

- **Specific Gravity**
  - 1.0586 a
  - 1.0581 a
  - 1.0569 b

F value:

<table>
<thead>
<tr>
<th><strong>Yield</strong></th>
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<tbody>
<tr>
<td>Seed Stock**</td>
</tr>
<tr>
<td>Seed Piece**</td>
</tr>
</tbody>
</table>

** Significant at 1% level

1/ Any two means in any seed stock, seed piece, or seed piece by seed stock group with the same letter are not significantly different at the 5% level. Absence of letters in a grouping denotes nonsignificance.

ASSOCIATION BETWEEN STAND AND YIELD-SPECIFIC GRAVITY

Significant positive correlation coefficients (r) were found between emerging, established, and declined stands for yield and specific gravity (Table 2). They estimate the portion of total variability of yield and specific gravity which can be ascribed to the effect of stand. While it is obvious that there is a direct association between stand and yield, it is interesting to note that the declined stand shows the highest degree of association (96%) for yield. Thus, both seed piece decay and black leg, as causative effects on stand, are affecting the components of yield. Inversely, the highest degree of association for specific gravity (66%) was attributed to emerging stand. Early plant emergence increased tuber maturity at harvest, which presumably accounted for the close relationship with specific gravity.

Table 2. Association between stand and the yield and specific gravity of potato - 1970.

<table>
<thead>
<tr>
<th>Stand</th>
<th>Correlation Coefficient (r)**</th>
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<tr>
<td></td>
<td><strong>Yield</strong></td>
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<tr>
<td>Emerging</td>
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<tr>
<td>Emerged</td>
<td>.93</td>
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<tr>
<td>Declined</td>
<td>.98</td>
</tr>
<tr>
<td></td>
<td><strong>Specific Gravity</strong></td>
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<tr>
<td></td>
<td>.81</td>
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<td></td>
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<td>.79</td>
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</table>

** All r values judged highly significant.
Summary

Seed piece decay and black leg disease, as causative effects on 1970 stand, accounted for 96% of the variation in yields of potatoes. As stands decreased, there was a decrease in yields. Results show great variation among grower-available Sebago seed stocks for both stand and yield. As seed stock emerging stands decreased due to seed piece decay, fungicide treated seed increased stands over nontreated seed. The use of locally inspected, high quality, certified seed is recommended. While fungicide treated seed of the better performing stocks did not increase yields, economical benefits were obtained by treating the poorer performing stocks. On this basis, the relatively low cost of seed treatment would provide insurance when inferior seed stock is planted.

Literature Cited


Cucumber Mosaic and Western Celery Mosaic—Two Aphid-Transmitted Virus Diseases of Florida Celery

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Abstract

All commercial celery varieties grown in Florida are susceptible to both Cucumber Mosaic Virus (CMV) and Western Celery Mosaic Virus (WCMV). Although symptoms of both diseases are similar in the early stages of infection, they are clearly distinguishable after a 2 to 3 week incubation period. Cucumber mosaic symptoms consist of vein clearing followed by necrotic specks, which give the plant a bronzed appearance. At times, this appears as a distinct oak-leaf pattern. Petioles show sunken brown spots and collapsed areas. Malformation and an obvious shiny appearance of the foliage, together with whitish-green mottled areas on the petioles, are the main characteristics of WCMV.

Cucumber mosaic infected plants occur throughout the growing season, but are most commonly found during the fall and early winter months. Extensive spread of WCMV has occurred only during the spring. In both cases aphids are responsible for field spread. Weed hosts are the primary sources of inoculum for CMV. So far only celery has been demonstrated as the source for WCMV.

Introduction

Southern celery mosaic virus, now recognized as a strain of cucumber mosaic virus (CMV) (5), has been present in Florida for many years (2, 3). Cucumber mosaic virus has a very wide host range, infecting crops of economic importance including celery (Apium graveolens L. var dulce Pers.) (10, 11). During the spring of 1966 a mosaic disease of celery with symptoms differing from those caused by CMV was discovered in central and southern Florida. Based on host range, transmission trials, and virus properties, Purcifull and Shepard (6) concluded that the new disease was caused by western celery mosaic virus (WCMV). This virus is apparently limited in host range to umbelliferous species (6, 7). It has caused considerable losses in celery each spring since 1966. The purpose of this study was to compare the symptoms, sources of inoculum, and spread of these two virus diseases in south Florida.

Materials and Methods

Virus isolates of CMV were collected from wild wandering jew (Commelina spp. L.) and