Recent History of Onion Disease

Research by Oregon State University

by

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In response to a request by E. D. "Mike" Michelson and the Research Marketing Order Committee, I have prepared a brief review of onion disease research that has been carried on by Oregon State University personnel in the Eastern Oregon-Western Idaho onion producing area over the past several years. The report consists mainly of a summary of research conducted by O.S.U. plant pathologist, E. K. Vaughan, and his associates. Dr. Vaughan worked periodically on onion diseases from 1956 until his retirement in 1974.

In 1956, studies on neck rot of onion, a problem which perennially plagues onions, were begun by Dr. Vaughan, M. C. Cropsey of the Department of Agricultural Engineering, and E. M. Hoffman, superintendent of the Malheur Experiment Station. After a series of preliminary reports (1,2,3), results of six years work was published in a comprehensive, 22-page bulletin (4). These experiments involved several diverse aspects of the neck rot problem, the major areas of which are briefly listed below:

(1) Field Curing — Significantly less neck rot occurred in onions that had been cured in the field for at least five days. There was no significant difference whether curing was with the onion tops on or off, in sacks, or in crates.

(2) Artificial Drying — 16-24 hours of drying in 95-115°F, heated air gave excellent control of neck rot. Rapid circulation of air without artificial heat also proved satisfactory when the drying was extended to three days. Shrinkage losses during drying were never excessive and should not be considered in deciding whether or not to dry onions artificially. Drying temperatures above 115°F caused some breakdown of onions and should be avoided.
(3) Effect of type of storage container – Onions stored in crates had 3-7% less neck rot than those stored in burlap bags.

(4) Method of curing – Topping or leaving tops on during curing had little effect on the rate at which onion necks dried.

(5) Effects of excess nitrogen and water on incidence of neck rot – Excess N fertilization and late season irrigation contributed indirectly to incidence of neck rot by increasing the number of onions with hard-to-cure, succulent, large diameter necks. High incidence of neck rot appeared to be closely linked to the production of the much desired, jumbo onions. 10-13% of onions 4 inches or greater in diameter had neck rot after 10 weeks of storage whereas only 1% by onions with diameters of 2 inches or less had neck rot.

(6) Effect of handling practices – Rough handling and resultant bruising of onions during harvest significantly increases the incidence of neck rot in stored onions.

In summary, these studies, in large part, have led to the recommendation of the following practices for the control of neck rot:

(1) Avoid late season application of nitrogen or late season irrigations which delay maturity.

(2) After lifting, allow minimum of 5 days, and ideally, 6-10 days of field curing before placing onions in storage.

(3) Harvest and handle onions carefully to minimize bruising.

(4) Store onions in well-ventilated storages at 32-36° if possible. Circulate forced-air through and around onion stacks to remove moisture from surface of onions.
In 1962, a six year study on the chemical control of onion pink root was begun by Dr. Vaughan and several students (5,6,7,8,9). A wide range of fungicides and soil fumigants were tested for pink root control. The most extensive of these studies was done as part of a Ph.D. thesis by S. R. Siemer (7,9). He demonstrated that Vorlex and Telone applied in fall as broadcast or bed treatments delayed the onset of pink root and resulted in significant increases in no. 1 Jumbo onions in the following growing season. An accompanying cost analysis of these treatments, based on a 4 year average market price for onions, indicated that both materials resulted in substantial net dollar return on investment, but that Telone, because of its lower cost, generally gave a greater net return. As a result of these studies, fumigation has become a standard practice in Yellow Sweet Spanish fields where pink root is severe. Significant reduction in disease or increase in size were not obtained with the very susceptible Southport White Globe variety.

In addition to these field studies, numerous greenhouse and laboratory studies on the pink root disease and the fungus which causes the disease have been carried out. Among these were studies on the interaction of pink root and basal plate rot (5) induction of sporulation in Pyrenochaeta (the pink root fungus) (10), the host range of the pink root fungus (5,11), factors affecting the growth of Pyrenochaeta in culture (6), the development of bioassays for Pyrenochaeta in soil samples (12,13), the chemical and structural changes which take place in onion roots attacked by the pink root fungus (14), and the effect of soil temperature and moisture on pink root (6). To discuss each of these studies even briefly would require
much more time and space than is intended for this brief historical account. However, it should be emphasized that these studies are just as important to carry on as the field studies. Controlled laboratory studies are not as subject to the whims of "mother nature" as are field studies. Examination of the response of the fungus and the disease to various factors in a carefully controlled laboratory experiments can often allow researchers to discover important facts about the disease that could not be detected under much more variable field conditions. In addition, it is extremely important to develop as much understanding as possible about all aspects of the development of the disease and about the pathogen itself. Such an accumulation of information leads to a more thorough understanding of the problem and inevitably to better control of the disease in the field.

Since I have started working with onion diseases 1½ years ago, I have initiated research along three lines: (1) the effect of soil compaction on pink root, (2) the distribution and role of mycorrhizae (beneficial soilborne fungi) in onion soils of Eastern Oregon and Southwestern Idaho, and (3) the nature of the overwintering propagule of pink root. The purpose of (1) and (2) are to investigate new possibilities for better management of pink root soils. The third area of study is attempting to better understand the survival of the pink root organism in soil and possibly to develop a technique to directly measure the level of pink root in a particular soil. Such a technique might be used to determine level of pink root in a soil before it was planted to onions and would also be an extremely valuable research tool.
As previously mentioned, this report contains only a description of the onion disease work conducted over the past several years. Other departments at Oregon State University have also conducted research on onions. Entomology (Dr. Crowell) has had studies in Ontario on wireworms, thrips, and maggot control. Several years ago, Dr. Frazier of the Horticulture department cooperated with Dr. Vaughan in a screening program for pink root resistance which was subsequently terminated to avoid duplication of Dr. Franklin's efforts in Parma. Dr. Tom Jackson of the Soils department cooperated with Dr. Vaughan to study the effect of form of nitrogen fertilizer on pink root. And, of course, we are all aware of the excellent onion weed control work that Chuck Stanger has carried on at the Malheur Experiment Station.

In closing, let me mention that I have often heard growers comment that after all this research work, we still have the same disease problems. These comments are, in part, true. Except in the case of development of a completely resistant variety of a crop (which often loses its resistance when the disease-causing microorganism mutates to form a new race) or an extremely effective chemical treatment, we seldom achieve complete control of a disease. Many plant diseases like pink root are even more difficult to control because they are soil-borne and are protected by the soil from chemical treatments. Even when we have effective controls, we cannot eradicate disease completely, but must apply control procedures year after year. Research into these disease problems, however, helps us to better understand these diseases so that we can devise better systems to manage crops to keep the diseases at levels that we can live with.


