TUBER ROT CAUSED BY PONDING OF IRRIGATION WATER [1/]

by
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ABSTRACT

A rot of potato tubers grown under sprinkler irrigation in soils varying from silt loams to sandy loams caused considerable post-harvest losses in 1973-74. This problem was associated with ponding of irrigation water in swales in fields. Suggestions to prevent ponding are discussed.

INTRODUCTION

A large tonnage of potatoes (Russet Burbank variety) was lost during the 1973-74 storage period because of a new rot problem. Some losses likewise occurred in unstored potatoes being used for fresh market or immediate processing.

Affected areas are usually on one end or one side of the tuber, although the entire tuber surface may be involved. The tuber surfaces are dull gray or brown, not sunken and usually only have a slight demarkation between damaged and healthy tissue. Affected tissue directly under the epidermis (skin) is initially firm and reddish brown. Irregular, reddish brown zones and blotches can extend 3/4 - 1 inch in depth. After several months' storage, depending upon temperature, the affected tissue becomes soft and watery; a putrid acrid odor becomes noticeable, the tuber pile shrinks and a trickle of water flows from the storage.

An investigation began in the fall of 1973 to determine the cause of the new rot.

METHODS AND MATERIALS

Pieces of rotted tissue from stored tubers were placed on various media to determine if pathogenic organisms were present. Media used were: 3 P (pimaricin, penicillin and polymixin) for isolation of Phytophthora and Pythium spp. (3); L B 3 P (lima bean, pimaricin, penicillin polymixin) for isolation of Phytophthora infestans, the late blight fungus (3, 4); PCNB (pentachloronitrobenzene) for isolation of Fusarium spp. (8); PDA (potato dextrose agar) for isolation of general fungi and bacteria; and WA (water agar) for isolation of Alternaria, Phytophthora, Pythium and Rhizoctonia spp. Incubation of all media was at room temperature (70-72 F), except that L B 3 P was incubated at 59 F. Isolations were attempted on six different dates from November 1973 to February 1974.

In the fall of 1974, tubers were hand dug throughout a 100-acre field under center pivot irrigation where harvest had ceased because of excessive tuber rot. The purpose of hand digging was to determine specific locations of the problem. The south end of this field had a deep swale 50-100 ft in width running across the rows. The surface soil texture ranged from silt loam to fine sandy loam (9). Soil at the bottom of the swale was compacted and cracked, indicating that water had ponded before draining.

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RESULTS

No pathogenic aerobic bacteria or fungi were isolated from the rotted tuber tissue with any of the media. The few bacteria and fungi that did grow from the rotted tissue were either identified as saprophytes or did not macerate or discolor "healthy" tuber tissue.

Hand digging throughout the field which had been rejected because of tuber rot revealed that the problem existed only in the swale area. The tuber rot symptoms were similar to those found in storage in 1973. Severity of symptoms increased with the depth of the swale. At the periphery of the swale, affected russet red areas in the tubers were small and usually located on the underside only (that side which remained wettest as ponded water drained). Usually all the tubers in each hill at the bottom of the swale were affected--gray in color with a soft rot and a putrid odor.

CONCLUSIONS

Because no disease-producing organisms could be found associated with tuber rot and because tuber damage was always found where water had ponded in the field, we concluded that ponding of water caused the problem. Evidently, the ponding doesn't occur until late in the season since the affected tubers are quite large. Anaerobic conditions probably exist in the saturated soil and predispose the tubers to break down.

This tuber rot associated with ponding of water can be confused with other tuber rots. Necrotic areas of affected tubers are similar to those caused by high summer heat (nonpathological cause), but are not located in the vascular system and do develop a true rot (2, 11). Leak (Phytophthora spp.) (6) and water rot (Pythium ultimum Trow) (7) have similar color of internal rotted tissue as this new rot, however, their affected tissues are extremely soft and watery at first development of symptoms. External tuber color of the new rot and rot from infection by the late blight fungus (Phytophthora infestans Mont. DBy.) (10) are similar, except that there is no distinct demarkation between rotted and healthy tissue of tubers associated with ponding of water.

Control of this new rot requires prevention of ponding of water in the field. The causes of this ponding may be multiple, such as irrigated applications exceeding the infiltration rate of the soil, the sealing of the soil surface by water droplet impact causing excessive run-off into swales, and by fine material eroded from the slopes into the swales preventing drainage of swales, and/or by a raised water table caused by deep drainage from higher topographical areas into lower subsurface basins. Suggestions for the control of ponding would be to: (1) reduce slope of swales by land leveling, (2) apply "dam pitting" cultivation principles to potato ditches at last cultivation (1, 5), (3) avoid excessive irrigation rates, (4) use minimum tillage practices (chisel plow rather than plow) so that residues from a previous crop are left on the surface to aid in preventing erosion and compaction by sprinkler droplets (1), and (5) plant steep-sloped swales to crops other than potatoes that will not interfere with potato harvesting equipment. Several or all practices may be needed in a given field.

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