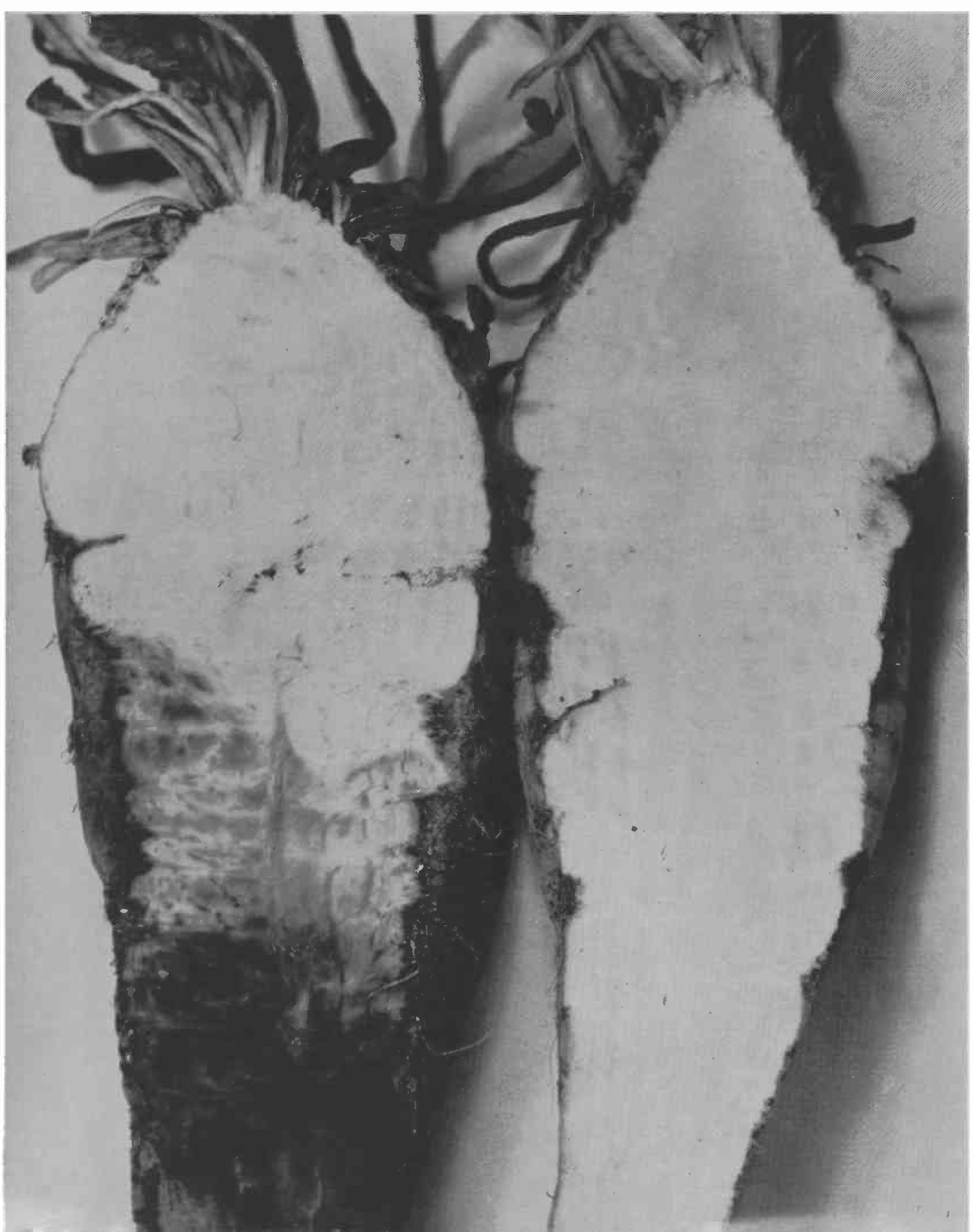
Root Rot Causes Sugar Beet Loss

By R. B. Hine, D. L. Johnson, J. L. Sears, Earl Ruppel, O. C. Zirkle

A soil-borne fungus, **Pythium aphanidermatum,** has been shown to be responsible for a serious root rot of mature sugar beets in the Safford, Eden, Bryce, and Thatcher areas of Graham County, Arizona.

High disease incidence occurred during July and August, 1967 but decreased during September and October. Total loss in the area was approximately 30 percent, with losses in individual fields ranging from about 10 to 50 percent. The disease, although known to occur in California and Colorado, has not previously been reported from Arizona.



It has, at present, been found in commercial plantings only in the Safford area although experimental plantings at Marana, Arizona were also affected. The unusual severity of the disease in land new to sugar beets prompted this report.

Above ground symptoms of the disease included leaf yellowing, wilting, and eventual plant collapse. Fungal invasion of the mature root resulted in an extensive, firm, black root rot which eventually destroyed the entire plant. A naturally diseased root is shown in the photo. Localized areas in some fields had up to 80 percent mortality, whereas the disease was well scattered in other fields. Other diseases known to occur in Arizona which have somewhat similar symptoms include southern Sclerotium rot (*Sclerotium rolfsii*) and Texas root rot (*Phymatotrichum omnivorum*). Both fungi live in the soil, cause a root decay, and eventually kill the plant. Sclerotium rot, however, may be distinguished from the other two diseases by the production of small, round, tan to dark brown sclerotia resembling mustard seed found on the diseased root and in the soil, along with abundant, white cottony, fungus mycelium. Texas root rot causes a rather soft, brownish decay on mature beet roots and produces fungal strands on the infected beet which may be seen with a hand lens. Identification of the *Pythium* disease requires isolation and identification of the pathogen from diseased roots.

Pythium aphanidermatum, which has a wide host range among cultivated plants, has undoubtedly been long present in these fields. The fungus lives in the soil and initiates disease only when favorable environmental conditions exist and a susceptible host is present. Water is necessary for the production of a motile swimming spore which is the infective fungal unit. No disease occurs unless these spores are produced. The optimum temperature for fungal growth and spore production was shown to be high, occurring between 85 and 100°F. Growth and spore production was reduced below these optimum temperatures and at 60°F sparse growth and little spore production occurred.

It is significant that highest disease incidence occurred during months when soil temperatures and

NATURALLY DISEASED sugar beet rot (left), compared with a healthy root (right). (Photo courtesy of Fred Knuhtsen).

rainfall were optimum for pathogen development. (See table). Official rain records for July (1.79 inches) are somewhat deceiving, however, as many fields received 3 to 5 inches of rain in heavy showers shortly after irrigation. Thus, excessive moisture during periods of high soil temperatures apparently triggered the disease epidemic.

Although *Pythium aphanidermatum* has been described from other states as a damping off pathogen of sugar beet seedlings, this phase of the disease did not develop under Safford conditions. Greenhouse studies in soil temperature tanks demonstrated that the fungus was a serious pathogen only when soil temperatures were high. Sugar beet seedling death in similarly infested soil at 75°F was approximately 50% less than at 95°F. Thus, low soil temperatures during February plantings (See table) allowed seedling growth but inhibited pathogen development. The decline of disease incidence in the field with decreasing soil temperatures in September and October is a further manifestation of soil temperature effects.

There was no correlation between root knot nematode, a common sugar beet problem in the Safford area, and *Pythium* root rot as some of the most severely diseased fields were free of nematode infection.

Analysis of soil samples from several typical fields with high disease incidence revealed high soluble salt levels (3500 to 7210 ppm), high exchangeable sodium levels (14.5 to 22.5%) and a high soil reaction (pH 7.9 to 8.2).

CONTROL

Any technique preventing or minimizing excess moisture situations, such as proper field leveling and avoidance of over-irrigation (particularly during periods of high soil temperature), should be practiced. Land preparation to increase water penetration also is desirable. Plant beds should be raised as high as practical for better drainage. Although there are no known practical methods for chemical control, the above cultural techniques should minimize disease losses.

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Average Monthly High and Low Soil Temperatures and Total Monthly Rainfall at the University of Arizona Experimental Station, Safford, Arizona[1].

Temperature °F 2 inch depth	*Jan.*	*Feb.*	*Mar.*	*Apr.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*
high	51	61	70	78	86	94	98	95	89	71	56
low	38	46	53	59	66	76	81	77	73	54	44
8 inch depth											
high	44	51	59	68	75	84	88	86	81	67	53
low	42	50	57	63	70	79	84	82	78	61	51
Rainfall (in inches)	0.09	0.09	0.11	0.20	0.26	0.08	1.79	2.77	1.16	0.56	0.31

[1] Soil temperatures taken at 2 and 8 inch soil depth from an unshaded plot.

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