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RHIZOMANIA FORUM

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The objectives of the forum were to 1) provide a current status report on the incidence of rhizomania throughout the USA and Europe and 2) discuss development and use of rhizomania resistant varieties.

Current Status of Rhizomania

California - presented by Roger McEuen. Rhizomania was first observed in the San Joaquin Valley in 1984. The first response was to fumigate fields known to be infested with the virus, and begin a search for varietal resistance. Fumigation with Telone II has given generally good results, but because of the cost, it is applied only on fields that have a high yield potential and known to test positive for the virus. Growers are now using varieties with tolerance or resistance to rhizomania on fields known to have the virus.

Several growers with infested fields have returned to the beet business and yields are back to near normal levels with good sugar content. Most beets are fall planted in relatively cool soils, which helps to escape optimum conditions for infection.

Idaho - presented by Del Traveler. Rhizomania was first observed in 1992, (17 fields and 370 acres) and since then positive identification has been made in all four factory districts. A total of 11,000 acres have tested positive; however, this overstates the scope of the infection since some areas of the fields were very small in size. In the fall of 1993, the agricultural staff began an aerial survey to look for suspect areas within fields. The company now will not contract those fields which have tested positive without a minimum four-year rotation. Resistant varieties are then recommended on those fields. A few small fields of the 1996 crop were planted on fields which tested positive in 1992, and the final yield and sugar with resistant varieties showed near normal sugar production. New fields continue to be identified as infested with the virus, but the overall affect has been only a slight impact on total production.

Nebraska - Colorado - presented by Steve Godby. Rhizomania was first identified in 1993 in Nebraska, and since then a total of 4,000 acres within Western Sugar have tested positive. A rhizomania task force has been established within each state that Western Sugar grows beets. Initially, no contracts were written on fields that tested positive. As of now, 6 - 7 resistant varieties are available for use, but growers are reluctant to return to the infested fields. Fields continue to be surveyed for the virus within one mile surrounding known outbreaks. A lab has been established in Scottsbluff with the University of Nebraska to conduct bioassays on soil samples.

Symptoms which mimic rhizomania have shown to be caused by Beet Soil Borne Mosaic Virus.

United Kingdom - prepared by M.J.C. Asher, IACR Broom's Barn, and presented by Jim Widner. Since rhizomania was first recorded in England in 1987 the number of infected fields detected each year, amongst the 2000+ inspected, has increased only gradually. Some of the fluctuations in numbers of new outbreaks may be due to varying spring soil temperatures; warm springs may lead to more obvious symptom development. The total cumulative area affected to date, 2354 hectares, compares very favorably with the rest of continental Europe. In 1995 alone, for example, France had 98,000, Germany 95,000 and Italy 105,000 hectares infected with the disease. The slower development in England is probably due to a combination of our cooler spring weather and the containment policy, which prevents heavily infected crops (or parts of crops) being delivered to factories.

All the 77 farms affected to date in the UK have been in Norfolk and Suffolk and almost all have been on light sandy soils where sugar beet has been grown in close rotation on irrigated land. These light soils have been shown to warm up more rapidly in the spring after drilling and would therefore be expected to be the first to show up the disease. This may follow several years of sugar-beet cropping since the field was first contaminated. Rhizomania is likely to appear on other soil types eventually; there is no reason to suppose that some of those have not been exposed to contamination. For the same reason we would expect the disease to show up in other beet growing areas of England with light soils before too long. The peats, which are particularly cold, may be the last to show the disease.

Spread of the disease from farm to farm may be by long distance transport, eg. on contaminated machinery, planting material or crop waste, or by relatively short distance movement such as through wind-blow (strongly implicated on some farms) or contaminated manure. It has not been possible to identify with certainty the exact origin of the contamination in any of the outbreaks so far because of the long incubation time before the disease shows up. For the same reason it is unlikely that the spread of the disease can be halted. Mathematical models based on the progress of the disease to date

suggest that about 7-8,000 hectares will be taken out of beet cultivation by the year 2000 if the current containment policy continues.

The large scale economic effects of rhizomania have been difficult to measure precisely. Yields of susceptible varieties in severely infested Dutch trials have commonly been reduced by 60 percent or more. In England, yields of beet in the center of rhizomania patches can be less than 50 percent of those outside the patch; the disease clearly has the potential to become severely damaging if the growing of susceptible varieties continued on infested fields.

However, there is now at least one rhizomania resistant variety (Ballerina) that has performed well both in NIAB trials and on severely infested trial sites in Holland. Virus multiplication in the roots of this variety is extremely low. Serious consideration should be given to introducing this variety for use on non-affected fields on rhizomania affected farms, without further relaxing the containment policy at this stage.

Europe - Rudolph Jansen, KWS. The spread of rhizomania in Europe has been more severe in south Europe than in the northern sugarbeet producing acres. The use of resistant varieties is also more concentrated in the southern areas i.e.,

Italy -	70% of area planted to resistant types
Austria -	55%
Spain -	21%
Switzerland	6%
France	17%
S. Germany	near 100%
N. Germany	16%
Belgium	< 1%
Netherlands	15%
U.K.	2%
Denmark/Sweden	- no resistant varieties at present

Spread and incidence is probably lower in northern Europe due to cooler spring soil temperatures.

General Discussion on Development of Resistant Varieties

It is reasonable to expect that all varieties may have to carry some resistance. Production of rhizomania resistant varieties have maintained near normal levels of sugar per acre, particularly in heavily infected fields.

The primary source of resistance is the "Holly gene", which behaves as a monogenic factor with complete dominance, little or no pleiotropic effects, and no deleterious close linkages. To date, there has been no reported case of breakdown of resistance.

Future considerations will be to improve sugar content of resistant types, combine rhizomania with other resistant factors i.e., cercospora, aphanomyces, curly top, etc., and converting both sides of the percentage to resistance. The number and usage of approved varieties will continue to increase.

Other research objectives could include identification and utilization of additional resistance genes from B. maritima, evaluation of pathotypes, utilization of map based cloning of resistant genotypes, and exploration of resistance to Polymyxa (probably difficult since Polymyxa invades host tissue through mechanical means).

Europe - Rhizomania is more severe in south Europe than in the northern countries. The use of resistant varieties is also more concentrated in the southern areas (e.g. Italy, Spain, France, Germany, N. Germany, Belgium, Netherlands, U.K., Denmark/Sweden - no resistant varieties at present).

Country	% of area planted to resistant types
Italy	70%
Austria	55%
Spain	21%
Switzerland	9%
France	17%
S. Germany	near 100%
N. Germany	10%
Belgium	< 1%
Netherlands	15%
U.K.	2%
Denmark/Sweden	no resistant varieties at present

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