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Aster Yellows and Carrot Production

David K. Wildung, Horticulturist

Perhaps the most limiting factor to commercial carrot production in Minnesota is the disease aster yellows that is transmitted by aster leafhoppers. Aster leafhoppers feed on many plant species and while carrots are not considered a preferred host, the insect can inflict much damage to the carrot plant. Aster yellows damaged carrot plants typically show injury first as a yellowing or bronzing of the foliage that can lead to reduced foliage growth. Often there is "witches broom" or multiple stem development at the crown of the root. Root injury is most commonly seen as development of fine fibrous secondary root development. Usually the root is lighter orange to yellow orange in color, often bitter or strong flavored and may be more susceptible to storage breakdown. The severity of the disease can depend on the stage of carrot growth when infected. When young plants are infected, yield reductions are possible. In addition, infected plants seem to be preferred feeding sites for leafhoppers which can then go on to infect healthy plants. The possibility of early infection means growers have to start monitoring their fields early for the presence of aster leafhoppers.

Identification of the aster leafhopper becomes critical when scouting the fields to determine when to apply insecticides because many different leafhopper species can be found in any given location. The adult aster leafhopper is usually greenish-yellow with three pairs of spots on top of its head or behind the head (it is also called six-spotted leafhopper.) They vary in size from 3.2-3.8 mm (just over one-eighth inch.)

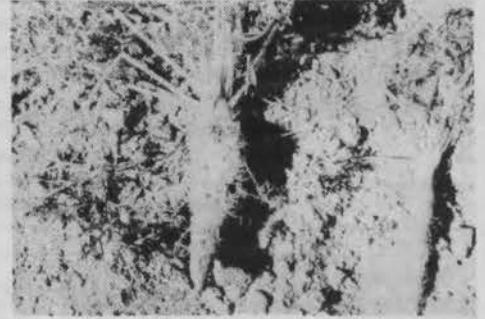
While adult aster leafhoppers cannot overwinter in northern areas they can overwinter as eggs on winter grains. Adult populations also migrate into our region from the south (Louisiana, Arkansas, Oklahoma, Missouri, Kansas). This migration usually occurs in the spring and is associated with southerly wind patterns and air temperatures above 60 degrees F. Often these migrating adults appear before local overwintering eggs have hatched or

developed. While not all aster leafhoppers carry the disease many migrating adults may be infected upon arrival. The number of migrating aster leafhoppers can vary from year to year depending upon the direction of the wind currents and migrating flight temperature.

Many different methods of control have been tried but none have been completely successful. Insecticide use to control the aster leafhopper vector is the most common method used today. Scientists from the University of Wisconsin have developed an Aster Yellows Index that depends on three things: the susceptibility of the crop grown, the number of aster leafhoppers present and the percent of aster leafhoppers actually infected with the disease. When the Aster Yellows Index reaches a certain level in the field, insecticide applications should begin. They also have evaluated the tolerance or susceptibility of several carrot cultivars to the disease. The way to use the Index and insecticide suggestions are published in the Commercial Vegetable Pest Management Production Guide for 1994 available from the Distribution Center, Room 20, Coffey Hall, 1420 Eckles Ave, St. Paul, MN 55108-6064. The publication catalog number is BU-1880-S and costs \$6.00 plus tax (make check payable to the University of Minnesota.)

In our carrot cultivar trials, we have been evaluating cultivars for their tolerance or susceptibility to aster yellows by evaluating foliage infection as well as root infection as judged by multiple crowns, root discoloration and hair root development. Table 1 shows the year to year variation in aster yellows infected roots, the number of cultivars evaluated, the least and most infection percentage, and a good level of tolerance for the season. In 1989 and 1990, no insect control was used to determine if any of the cultivars shows resistance to aster yellows. No cultivars were identified as completely resistant. Following the 1990 season when a good level of tolerance was 40 percent infected roots, it was decided to use insecticides to reduce leafhopper

populations so we could determine more reliable root characteristic and production information. The 1990 season was by far the worst infection season we have seen (Table 1) with the most tolerant cultivar showing about one-fourth (24 percent) infected roots. It should also be noted that since insecticide use started in 1991, the incidence of aster yellows infected roots has not been eliminated completely. Even in 1992 when the incidence level was at its lowest, some cultivars had over 70 percent root infection.



"Aster yellows infected roots showing secondary rooting and multiple stem development"

In evaluating the cultivars degree of tolerance or susceptibility, Table 2 was developed which can be used as a guide for choosing a cultivar. Table 2 emphasizes only percent of aster yellows infected roots, not yield or root characteristics. These factors are available elsewhere. In Table 2, the degree of tolerance or susceptibility is

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Aster yellows & carrot production, continued

divided into five levels with 5 being most tolerant and 1 being most susceptible. In addition, the number behind each cultivar is the number of seasons we have evaluated the cultivar. For example, Apache, Level 4, has been evaluated five years while Gold King, Level 5, has been evaluated only one year. The more years of evaluation allow for more dependability in our ratings.

While commercial carrot production shows great promise in northern Minnesota, management and control of aster yellows may prove to be a critical factor in its success. Our experience with aster yellows since we began evaluating carrot cultivars indicates the following:

- 1) Aster yellows infection rates vary greatly from year to year,
- 2) Careful monitoring of aster leafhopper populations can assist in the timing of insecticide applications,
- 3) An insecticide program can reduce the incidence of aster yellows,
- 4) An insecticide program will not eliminate the incidence of aster yellows,
- 5) No carrot cultivar is totally resistant to aster yellows,
- 6) Cultivars do show a difference in tolerance to aster yellows.

Results of all our 1993 vegetable cultivar trials, including carrot root and yield characteristics, are published in the Midwestern Vegetable Variety Trial Report for 1993, available upon request through our office for \$10 (price includes tax and postage). Make your check payable to the University of Minnesota. Likewise, small fruit and flower trials results are available for \$2 each.

Table 1. Yearly Carrot Cultivar Variation in Percent Aster Yellows Infected Roots.

Year	Cultivars Evaluated	% Aster Yellows Infected Roots		
		Least	Most	Good Level of Tolerance
1989	109	6	50	10
1990	58	24	60	40
1991	63	11	50	20
1992	69	2	71	8
1993	73	5	40	10

Table 2. Carrot Cultivar Tolerance or Susceptibility Based on Percent Infected Roots.

Level of Tolerance/Susceptibility				
5 ^a	4	3	2	1
Gold Pride(4) ^b VitaSweet 781(4) Nantes Fancy(3) Prima(3) Toudo(3) Nanco(3) Gold King(1) Royal Chantenay(1) Scarlet Nantes(1)	Apache(5) Golden State(5) Eagle(4) SixPence(4) SixPak(3) Bergamo(2) Condor(2) Discovery(2) SixPak II(2)	Caroprude(4) Orlando Gold(3) Huron(2) Legend(2) Prospector(2) Blaze(2) Carogold(2) Joba(2) Seminole(2) Tino(2) Danvers 126(1)	Cellobunch(5) Nassau(5) Earlibird Nantes(4) Kamaron(4) Orange Sherbit(3) Processor IV(3) Dawn(2)	Plato(5) VitaSweet 711(4) Apollo(3) Narova(3) Flaron(2)

^a 5=most tolerant; 1=most susceptible ^b ()=number of years evaluated in trials.

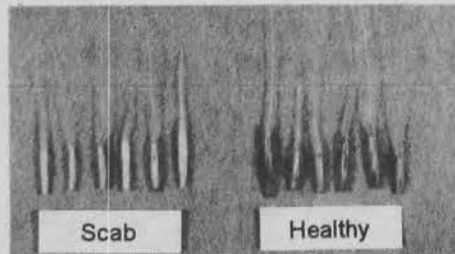
A New Disease of Wild Rice

Robert Nyvall, Professor/Plant Pathologist

Scab caused by the fungus Fusarium graminearum, has been discovered for the first time on wild rice in 1993. Scab is the same disease that caused the huge losses in the wheat crop in Minnesota and North Dakota. Scab causes losses two ways, by either producing light weight grain or empty hulls, or by producing toxins that render the grain unfit for consumption. The disease was found on both lake and cultivated wild rice with some of the greater incidences found on lake rice. Subsequently, attempted isolations of fungi from several thousand seeds in different samples from throughout Minnesota have been done. Fusarium graminearum has been found in all samples.

Infected kernels are light weight and vary in color from white to a pinkish discoloration if the fungus is present. Scab was originally discovered when Dr. Raymond Porter, Research Associate-Wild Rice, NCES, brought grain samples to me that had been left "dry" for a period of time after harvest. The grain was completely overgrown with a pink to red mold. Subsequent investigation of other samples revealed the widespread

occurrence of scab throughout the wild rice growing areas of Minnesota in 1993.



"Scab infested grain is white and light weight"

When hulls were separated from seed, the causal fungus was found in both with a larger incidence of fungi in the hulls. Scab was not found on grain that had either been processed or placed in water immediately after harvest. Grain submerged in water was remarkably free of fungi, probably due to the lack of oxygen to the microorganisms. The heat during processing likely also kills any fungi. However, it is not known what heating does to any toxin that may have been produced while grain was in the field.

The significance of scab to the wild rice industry is unknown; however, the causal fungus is very widespread and grows on several grasses and small grains. It would be surprising if wild rice was not also a host of this fungus. The overall effect will likely not be great but growers should be aware of scab and any future problems presented by toxins produced, if any. Samples of fungi isolated from wild rice are being examined by Dr. Chet Mirocha, Plant Pathologist, University of Minnesota, for the presence of toxins.



"Causal organisms isolated from diseased grain"

Choosing An Alfalfa Variety

Russell Mathison, Agronomist

Many farmers are faced with the complex decision of selecting alfalfa varieties of superior performance in Minnesota. Selecting a good variety can account for up to 10 percent of the management inputs necessary for maximum alfalfa productivity. Variety selection should be based on yield, quality, multiple disease resistance and fall dormancy. The Minnesota Agricultural Experiment Station assists producers in the selection process by testing alfalfa varieties at six locations (Rosemount, Waseca, Morris, Lamberton, Crookston and Grand Rapids.)

Alfalfa varieties differ in their performance in different areas of the state due to a number of factors. For example, the potential for winter injury is highest in northwest (Crookston) and west central (Morris) and lowest in southwest (Lamberton) and northeast (Grand Rapids). Root-lesion nematode damage is most likely to occur in the coarse-textured soils of northeast MN (Grand Rapids). Other areas of the state also have unique circumstances that affect alfalfa productivity. Therefore, a variety's performance at your farm is best predicted based on the average of all test locations and secondly based on its performance at the test location nearest you.

Alfalfa varieties at the same location can also differ in the length of time they remain productive. For example Vernal, the na-

tional check variety, is most productive during the first two years. Then its productivity declines due to susceptibility to multiple diseases. Accordingly, alfalfa varieties are tested both for Short Term Stand Performance (first two years after seeding) and Long Term Stand Performance (three to four years after seeding.)

Alfalfa variety selection should also be based on forage quality evaluations that are conducted at Rosemount on two-year-old alfalfa stands. Companies pay to have germplasm tested in a three-cut harvest

schedule. Entires are analyzed for crude protein, acid and natural detergent fiber, and percent leaves. Relative feed value and milk production estimates are calculated from forage quality measurements.

The following table shows information on alfalfa varieties available to producers in the University of Minnesota Agricultural Experiment Station Bulletin AD-MR-5615-F, Varietal Trials of Selected Farm Crops. It has more information on alfalfa and many other crops and can be obtained from your county extension office.

Ranking of Available Alfalfa Varieties: Long Term Tests at all Minnesota locations, 1967-1993	
Hay Yield and Percent of Vernal: Years 3 and 4 Averaged (Tons/A, 15% Moisture)	
5.2 (114)	Hi-Phy
5.1-5.0 (111-109)	Allegiance, Blazer, 120, 5364, Jade, RamRod, 630
4.9-4.8 (107-104)	Alpine, Dart, GH 715, Voyager, Crown II, Garst 636, Oneida, Profit, Surpass, 5262, Good as Gold, Oneida VR, Royalty, Webfoot, WL 320, *Majestic, 5432, Agate, Apollo, Arrow, Elevation, Envy, Iroquois, Legend, Magnum III, Terminator, Vector, <u>WL 322 HQ</u>
4.7-4.5 (103-98)	Agri-Boss, Crown, WL 317, 2833, Apollo Supreme, Flint, Wrangler, *Garst 645, Break-thru, Impact, Saranac, Sure, Thrive, WL 225, *Centurion, Agressor, Baker, Multi-plier, Ranger, Trident II, VERNAL (4.58), Husky, Milkmaker, <u>Teton</u> , Cutter
4.4-4.2 (97-92)	<u>Belmont</u> , Clipper, GH 747, Pro-Cut 2, *GH737, DK125, <u>Quest</u> , * <u>Asset</u> , 5333, Crystal, Verta+, Bronco, Chief, Pro-Cut, Renegade, Target II, * <u>Sabre</u> , Apollo II, DK 122, Cimarron VR, EMPRESS, 2841, <u>Travois</u>
4.1-4.0 (91-87)	Agri-MATE, Aquarius, *Alfagraz

*=New variety for 1994. Underscoring indicates limited (<4) tests. SOURCE: Adapted from MR-5615-F, 1994 Edition

Why are we redoing our mailing list?

Our mailing list contains 2780 names. We value all of our readers and appreciate the many comments we receive. We hope all of you will choose to continue to receive the Quarterly. Postage and printing costs for each issue exceed \$900. Budgets at our station are tight. We need to be sure all dollars are well spent. To continue receiving the Quarterly, fill in the information below (please print), cut on the dotted line and mail to: The North Central Quarterly, University of Minnesota, 1861 East Hwy 169, Grand Rapids, MN 55744-3396. THANKS!

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In order to receive mailings announcing special NC days/workshops/meetings, please mark an "X" by all the categories that pertain to you below:

<input type="checkbox"/> NC Alumni (Year _____)	<input type="checkbox"/> Commercial Grower:	<input type="checkbox"/> Farm/Ranch:	<input type="checkbox"/> MN Ext Office
<input type="checkbox"/> Former NC Employee	<input type="checkbox"/> Vegetable	<input type="checkbox"/> Beef	<input type="checkbox"/> UM Dept
	<input type="checkbox"/> Fruit	<input type="checkbox"/> Dairy	<input type="checkbox"/> Other (List)
	<input type="checkbox"/> Wild Rice	<input type="checkbox"/> Swine	
	<input type="checkbox"/> Other (List)	<input type="checkbox"/> Other (List)	

Alumni News

Tom Carpenter

The Alumni Committee met on January 12. After Lonny Ross updated us on all the latest local news, we got down to business! Members present: Vern Strom, Bud Lackner, Lonny Ross, Jim Dethloff and myself.

PLAN TO ATTEND OUR REUNION - the date has been set for July 16, 1994. The tentative agenda follows:

Open House at NCES starting at 9:00 a.m. - meet at the Horticulture Head House. Choices for later in the day: a pontoon ride around the Pokegama Lake shoreline (1½ hrs, 20 people at a time.) Captain Dethloff, Tour Guide Ross, Dock Boys Lackner, Strom and Hopkins will see that you have a good time plus the dock boys will also clean fish! Bus trips to Hill Annex Mine Tour (also Miners Day celebration). To end the reunion with an enjoyable evening together, a banquet at the Sawmill Inn has been arranged. I am still looking for a banquet speaker---any volunteers?! In May final reunion information and a reservation form will be sent to alumni.

We received a note from June Kassler stating that her husband Louis Leo Kassler (class of 1935) passed away on July 24, 1993. He originally was from Cohasset, MN. We extend our condolences to his family and friends.

Please write and let me know if you have information you would like to bring to the attention of alumni.

* * * * *

Remember, **MARK JULY 16 ON YOUR CALENDAR** to come and meet your alumni friends and/or co-workers at our reunion.

News from North Central

David L. Rabas

As I write this article the weather forecast is for temperatures of -20° F or colder. Hopefully by the time you receive this copy of *The Quarterly* temperatures will have improved considerably and spring will be in sight.

It seems as if this has been a colder than normal winter in northern Minnesota -- whatever normal is! We can tell that livestock feed supplies have been used up at a very rapid rate. Hopefully our hay and other feeds will last until pasture. Colder temperatures also require that we pay additional attention to livestock housed outdoors. Protection from the wind and adequate feed, water and bedding are increasingly more important as wind chills reach dangerous levels. With a little extra attention our livestock will survive even the coldest temperatures in good shape.

This winter marked the loss of a former employee and good friend of North Central - Richard B. Aakre. Mr. Aakre came to our station in 1946 after serving 15 years as a vocational agricultural teacher and supervisor of the St. Louis County school system and several years as a county agricultural extension agent in Kittson County. Dick, or "R.B." as he was known by many of you, served as a teacher and researcher at the North Central Experiment Station for 24 years until his retirement in June of 1970. I came to this station in May of 1970 and therefore, only had a chance to work with Mr. Aakre for a very short time. He will always be remembered as a very thorough, thoughtful teacher and researcher who made decisions carefully and wisely. Dick didn't just "walk out the door" on retiring in 1970. He came back often to help with the annual FFA Ag Mechanics contest and other station events. He will

be missed by all of his North Central friends.

Those of you who call our station will notice a new voice on the phone. Carolyn Frings, who would normally answer the phone, has taken a two-month leave of absence to spend some time in Florida working on her retirement home. Linda Erickson has joined us for a short time to fill in while Carolyn is on leave. We welcome Linda to North Central.

If you walk through our Administration Building you will notice a new face in one of the offices. Dr. Scott Enebek has joined the Aspen-Larch Genetics Co-op located on our campus to work on diseases of aspen, specifically Hypoxylon canker. Dr. Enebek is a plant pathology graduate from West Virginia University. We welcome Scott to our campus.

If budgets and other resources are adequate we will begin a search this spring for a livestock/forage research specialist to fill an open position at our station. We are in the process of increasing our angus beef herd to about 200 cows which should be accomplished in the next two years. The current herd is being used in a preliminary study to evaluate genetic factors relating to leanness and tenderness in beef. This project is being conducted in cooperation with Dr. Brent Woodward in the Department of Animal Science in St. Paul.

Please pay special attention to the mailing list form contained in this issue. We are in the process of updating our mailing list and we don't want to lose any of our regular *Quarterly* readers. Members of our advisory committee and contributors to our North Central Fund will automatically be retained on the list. We are asking our other readers to help us bring our list up-to-date.

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