Texas Agricultural Extension Service

Vegetable Production & Marketing NEWS

VOLUME 6, NUMBER 4 APRIL 1996

1995-96 Spinach White Rust Resistance Screening Results

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The 1995-96 spinach season was one of the best experienced in the Winter Garden in recent years. Environmental conditions were conducive to high yield and quality, and unfavorable for the development of white rust infection. A similar situation occurred in the TAEX screening nursery conducted at the Del Monte Research Farm near Crystal City. Consequently, an unusually high number of the 56 entries included in the 1995-96 screening nursery exhibited fair tolerance to the disease. The results obtained from this nursery can be found in the insert to this newsletter.

As a result of the low disease pressure, 19 of the entries were rated 6.0 or lower on the final indexing date (2/16) under the conditions of this test. The 6.0 value at the final indexing date was considered to represent good field tolerance to white rust. This value was lower than all of the resistant checks included in the nursery except DMC 66-09 (5.7). However, a rating of 5.3 or less was given to F88-380 O, 90-248, 91-227, 91-415, XF-94699, F88-380 N, and XPH 2393. When comparing savoy types, 6 lines (F 310, Samish, XF 94693, XPH 4394, CFX 3633 R, and Decatur) were indexed lower than Fall Green, the savoy resistant check. None of the entries of any type were indexed higher than the susceptible checks Vienna and Cascade.

The author would like to acknowledge the assistance provided for this trial of the spinach-seed industry and the Del Monte Corporation, especially Joe Torres, without whose efforts this trial could not have been conducted. For additional information regarding this trial, contact one of the following members of the TAEX spinach-improvement group: Drs. Larry Stein, Extension Horticulturist, and Mark Black, Extension Plant Pathologist of the TAMU-AREC @ Uvalde (210/278-9151); Mr. Kenneth White, Uvalde CEA-AG; or the author, Dr. Frank J. Dainello, at Texas A&M University (409/845-7341).

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Additional Considerations Regarding Biological Controls

*From the article "Considerations for purchasing and releasing biological control products" by Bastiaan M. Drees and Allen Knutson appearing in **Ent Notes**, Texas Agricultural Extension Service, Vol. 36, No. 6.*

Are biological control products regulated by any laws? Microbial insecticides (bacteria, fungi, viruses) are regulated like pesticides by the Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Multicellular animals (arthropod predators, parasites, nematodes, etc.) are ***not*** registered or regulated by the EPA under FIFRA. Complaints regarding product performance can be reported to the Federal Trade Commission (FTC) in Arlington, Virginia (202/326-2222).

The user of purchase-and-release natural enemies must be aware of legal and biological limitations of augmentative biological control methods. Just restricting frequent use of broad-spectrum insecticides often will allow a diverse group of naturally-occurring beneficial organisms to survive, sometimes profoundly impacting pest population densities. As the cost of natural-enemy products continues to decrease and delivery systems and methods are improved, the economic feasibility of using these methods in commercial pest control will undoubtedly improve.

Some commercially-available multicellular biological-control agents are listed below and on page 3.

PREDATORS

- **BEETLES**

Cryptolaemus montrouzieri - predaceous lady beetle for **mealybugs** but also preys on aphids, whitefly, scales and soft insects
Delphastus pusillus - lady beetle predator of **greenhouse and sweet-potato whitefly** eggs, larvae and adults
Lindorus lophanthae - predaceous beetle on many species of **soft and armored scales**

- **FLIES**

Aphidoletes aphidimyza - a gall-midge larval predator of **aphids**

- **LACEWINGS**

Chrysoperla carnea and *C. rufilabris* - Predator of **aphids, mealybugs, scales, spider mites, thrips, small caterpillars,** and many other pest insects

- **TRUE BUGS**

Orius spp. - predatory bug preys on larval and adult **thrips, mites, aphids,** and on **whitefly pupae**

- **MITES**

Amblyseius cucumeris - predatory mite feeds on hatching eggs and young larvae of **thrips**
Galendromus occidentalis (=*Metaseiulus occidentalis*) - predator mite of **spider mites**, tolerates wide range of humidities
Hypoaspis miles - predaceous mite of **shorefly larvae** and **thrips pupae** in the soil
Metaseiulus occidentalis and *Phytoseiulus persimilis* - predatory mite for **spider mites**
Mesoseiulus longipes (=*Phytoseiulus longipes*) - predator of **spider mites** that tolerates higher temperatures and drier conditions
Neoseiulus californicus (*Amblyseius californicus*) - predator mite of **spider mites** capable of surviving at lower spider mite densities and taking longer to suppress populations
Neoseiulus cucumeris & *Neoseiulus barkeri* - predatory mites of **thrips**
Phytoseiulus persimilis - predaceous mite for **spider mites**

Pollination and Fruit Set

*By Hunter Johnson, Jr., in **Vegetable Briefs for California Advisors**, No. 157, 1972*

Many people have a poor understanding of the importance of pollination on the development of the fruit portions of edible crops (tomatoes, cucumbers, melons, etc.). Pollination is defined as the transfer of pollen from the anther to the stigma of the same or another flower. A generalized interpretation is frequently utilized in which pollination refers to both the pollen transfer and the sexual fertilization process. Once the pollen has been transferred, it must then germinate, develop, and deliver its genetic material to the ovule and effect fertilization. The fertilization and subsequent embryo development stimulate the further development of tissues associated with the ovule, or ovules, which leads to the development of the "fruit."

The terms ovule and ovary need to be distinguished at this point. An ovule is defined as a structure composed of those tissues which, following fertilization, develop into the seed. The ovary is defined as the basal portion of the pistil which contains the ovules or seeds. There are simple types of fruits with single ovaries containing a relatively small number of ovules. In those fruits, a few pollen grains may effect fertilization, and the fruits subsequently develop. Then there are more "complex" fruits, such as tomatoes and watermelons, which have single ovaries but hundreds of ovules with the potential to develop into seeds. In this instance, a great deal of pollen is needed to insure fertilization of the ovules and to develop the seed potential. The development of the seed potential (pollination and fertilization) is important to the grower in terms of the final fruit quality (size and shape in particular). The fertilized ovule (developing seed) exerts a physiological "sphere of influence" on the tissues surrounding it in the developing fruit. Usually, in flowers having a large number of ovules, a certain number of them must be fertilized or the flower will abort. When less than optimal pollination and fertilization occurs, the developing fruit may be misshapen due to the lack of development of the tissues surrounding the unfertilized ovules. "Bottle-neck" watermelon is a good example of this phenomenon. If the watermelon is sliced lengthwise, it will be seen that the misshapen area of the fruit does not contain "seeds." Lacking stimulation from the fertilized ovules (developing seeds), the tissues did not develop to their expected potential in the affected area.

(Continued on back page)

Biological Controls (Continued from page 2)

PARASITES

- **WASPS**

Aphelinus abdominalis - Parasite wasp of the **potato aphid**, *Macrosiphum euphorbiae*, the **glasshouse aphid**, *Aulacorthum solani*, and others
Aphidius colemani - Parasitic wasp of **aphids**
Aphidius matricariae - Parasitic wasp of **aphids** (such as green peach aphids)
Aphytis melinus - Parasitic wasp of **oleander scale, California red scale, yellow scale,** and **dictyospermum scale**
Dacnusa sibirica and *D. isaea* - Parasitic wasps for **leafminer** larvae
Encarsia formosa - A parasitic wasp of the **greenhouse whitefly**, *Trialeurodes vaporariorum*, and the **tobacco whitefly**, *Bemisia tabaci*
Eretmocerus sp. nr. *californicus* - A parasitic wasp of the **sweet-potato whitefly**, *Bemisia argentifolii*, and the **greenhouse whitefly**, *Trialeurodes vaporariorum*
Leptomastix dactylopii - Parasitic wasp for the **citrus mealybug**, *Planococcus citri*
Metaphycus helvolus - Parasitic wasp of **hemispherical scale, black scale,** and **nigra scale**
Trichogramma spp. - Several species of parasitic wasps for **caterpillar eggs**

- **NEMATODES**

Heterorhabditis spp.and *C. rufilabris* - Predaceous nematodes for **vine weevil**
Steinernema carpocapsae - Parasitic nematode of **fungus gnats, grubs, black vine weevils**, and **wood borers**
Steinernema feltiae - Predaceous nematodes on **sciarid flies** (Sciaridae, dark-winged fungus gnats, root gnats)

The term "fruit set" is used to designate the success or failure of the process leading up to the visual appearance of the fruit. In the normal sequence of events, the fertilized ovules and their associated tissues will develop into the "fruit." If fertilization is not achieved, the unfertilized "flower" will wither and drop from the plant. There are situations which occur that result in fertilized "flowers" also dropping from the plant. The relative number of flowers that drop versus those that remain and develop into fruits is used to judge the "fruit set."

There are a number of factors which contribute to a poor fruit set or to the occurrence of misshapen fruit. Some of these are listed below.

It is important to consider that some of the conditions mentioned can be manipulated by the grower. A grower can set out bee hives to insure adequate pollen transfer, for example. Some conditions, primarily those relating to weather conditions, cannot be controlled by the grower and generally affect only those clusters undergoing pollination at that particular time. By maintaining bee hives (where needed), following recommended fertilization, and using proper cultural practices, the grower can influence those factors which affect the crop over the entire crop cycle.

*This article appeared in the PennState **Horticulture Vegetable Newsletter**, Vol. 8, No. 3, March, 1995.*

- **I. FAILURE OF THE POLLEN TO REACH THE STIGMA OF THE FLOWER**

A. Insect pollinated crops. Example, vine crops (squash, cucumber, melons)
   1. Inadequate pollination yields misshapen fruits (gourd shaped melons and cukes). A hive of bees should be placed every 5 acres in vine crops.
   2. Bees tend to be inactive at temperatures below 60 degrees F, and pollen transfer is thus reduced.
   3. Improper timing of pesticide application may reduce the bee population. Apply pesticides at times of day when bees are not active.

B. Wind-pollinated crops. Example, tomatoes

Under greenhouse conditions, pollination is a serious problem. Puffy and cat-faced fruit often result from poor pollination. Mechanical methods (electric vibrators, paddles, sticks, etc.) are used to shake the cluster and improve pollination.

- **II. FAILURE TO ACHIEVE FERTILIZATION**

A. Pollen "shed" may not correspond to the "receptive" time of the ovary

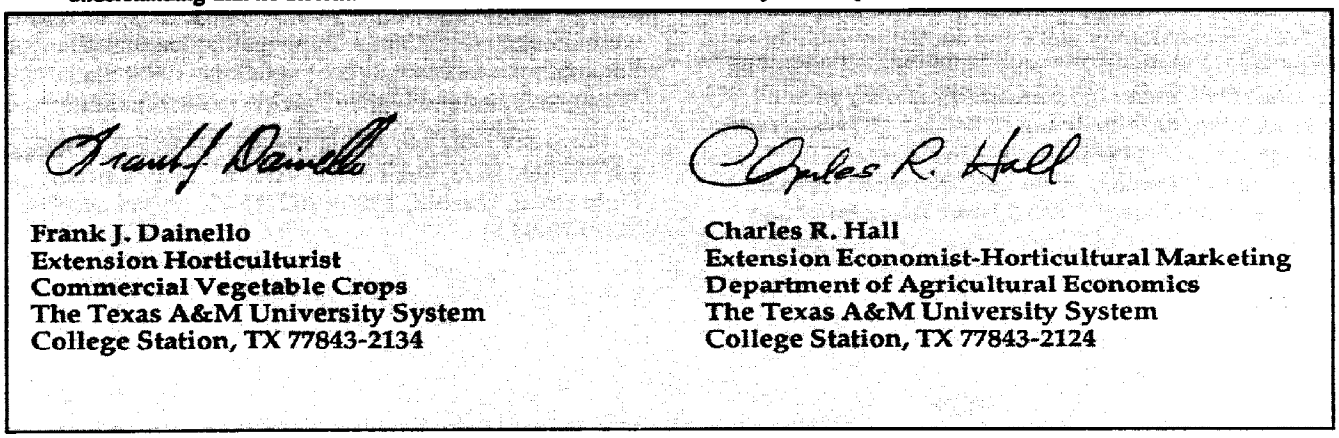
B. Pollen could be sterile or not viable
   1. Low temperatures reduce the growth of the pollen on the stigma
   2. Certain nutritional and physiological conditions can render the pollen not viable (low boron, for example)

C. Environmental conditions
   1. Excessive rainfall can wash pollen off the stigma or cause pollen to rupture due to osmotic potential differences.
   2. Temperature extremes can damage either the pollen grains or the ovaries, or both.
   3. High humidity can hinder the shedding ability of pollen.

- **III. FERTILIZATION IS ACHIEVED, BUT THE "FLOWERS" DROP**

A. Mechanical and physical damage to the flower by such items as hail, spray burn, and bruising can cause the flower to abort from the plant

B. Physiological imbalance due to nutritional problem or a carbohydrate reserve problem can also cause flower abortion.



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