LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

Sustainable grape production for the reestablishment of Iowa's grape industry

Abstract: Reviving the grape industry in Iowa requires development of improved sustainable production systems. This project used research, demonstration, and information transfer to educate and assist new and established Iowa grape growers.

Question & Answer

Q: Can grapevines be grown in Iowa and can they be grown in a sustainable manner?

A: This project was undertaken to determine if grapevines can be grown using sustainable production practices under Iowa environmental conditions and to identify cultivars adapted to these practices in Iowa. Researchers developed experimental vineyards and initiated studies that will continue in future years to gain further information on fruit yield, quality, and disease tolerance. To date, they found differences in grape cultivar adaptation and tolerance to important diseases, some insects, and 2-4,D drift injury. Growing grapes in a sustainable manner using best management practices allowed for excellent grapevine growth and development. A system using organic-approved practices and products showed that weed control, fall cold tolerance, and nutrient and disease management will be critical for future consideration under this system.

Background

There is a growing demand for both table and wine grapes in Iowa, combined with a fledgling state government effort to reestablish Iowa's grape industry. Grape production potentially may diversify Iowa's agriculture and can enhance Iowa's local food systems. Grape growing offers opportunities in fresh fruit sales, value-added processed products, and agri-tourism. New growers currently use conventional production and pest management recommendations, and these practices rely on multiple, often high, inputs to produce grapes.

The overall goal of the project was to develop a whole-systems management approach to sustainable grape production in Iowa. This meant researching adaptability of cultivars and pest and fertility management. Having this information available made it possible to develop an economic analysis for profitable sustainable grape production that will benefit Iowa consumers, grape growers, and the environment.

The project had three major objectives:

1. Evaluate whole-systems management practices related to cultivars, culture, and pest management that would promote sustainability of growing grapes under Iowa environmental conditions;

2. Determine management strategies for disease and insect management through field research, and develop recommendations for Iowa grape growers;

3. Disseminate information about sustainable grape growing practices and the project's research findings via on-site field days, demonstrations, workshops, newsletter articles, publications, and a web site.

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Budget:
$20,880 for year one
$15,176 for year two
$14,224 for year three

Young grapevine

Approach and methods

Objective 1: Duplicate experimental field plots were established in April 2002 and maintained at the Iowa State University (ISU) Horticulture Station (Ames) and at the ISU Armstrong Research and Demonstration Farm in southwest Iowa (Lewis) under differing soil and climatic states. The replicated plots used three management systems (calendar-based, conventional system; IPM/best management; and organic-approved) and 15 cultivars (10 wine grapes and five seedless table grapes) to produce grapes under two of Iowa's climatic and soil conditions.

The conventional and IPM/best management systems used pre- and post-emergence herbicides applied under the vines for weed control, urea as the nitrogen (N) fertilizer source, and inorganic pesticides. The organic-approved system used a combination of hoeing (2002 and 2003) and straw mulch (2003 and 2004) under the vines for weed control, corn gluten meal (10 percent N) as the nitrogen fertilizer source, and organically-approved pesticides whenever possible.

Data was collected on all management systems and cultivars and included grapevine growth and development, incidence of diseases, insects and mites, soil fertility, plant nutrition, vine growth, low temperature tolerance, and beginning in 2005, production yield, grape quality, and cost and returns.

Objective 2: Integrated pest management (IPM) strategies for management of black rot and powdery mildew, the two most common diseases of grapes in Iowa, were compared to a protectant spray program in field experiments at the ISU Horticulture Station near Ames. Demonstration trials for evaluating a weather-based IPM strategy for disease control were conducted in three commercial vineyards in southern, south central, and eastern Iowa. The cooperators managed 1) a production-age row or row segment of a selected cultivar according to a weather-based IPM timing strategy using appropriate systemic and contact fungicides, and 2) a nearby, same-age segment of the same cultivar according to their standard (protectant) schedule.

Objective 3: Various public events were held to publicize the work and findings of the project among grape growers. Outreach events and publications were coordinated with the Iowa Grape Growers Association, Iowa Fruit and Vegetable Growers Association, ISU Extension, and the Leopold Center. A new web site was created to share grape production information: http://viticulture.hort.iastate.edu/home.html.

Results and discussion

Objective 1: In 2002, precipitation levels at the two sites (Ames and Lewis) were quite different. Drought conditions persisted for much of the season at Lewis, while the ISU Horticulture Station had more frequent rainfall. By Septem-

Crawfordsville plot, 2004

Training the grapevine

ber, most of the vines at the Armstrong Farm had reached the mid-level wire while the majority of the Horticulture Station vines were at the top level. In early September, vines at the Horticulture Station were exposed to 2,4–D herbicide drift from an unknown source and differences in cultivar susceptibility were observed. In addition, the Horticulture Station vines were exposed to early fall freezes, and injury ratings showed differences in cold tolerance between cultivars.

Shoot positioning

In 2003, no insecticides or fungicides were required at the Horticulture Station planting, but carbaryl was applied at the Armstrong Farm in an attempt to control grasshoppers.

The vines were pruned in the spring and pruning weights were recorded. However, because of considerable cane dieback at each site, pruning weights were not a good indicator of vine growth in 2002.

Grape phylloxera galls were evident on the leaves at the Horticulture Station, but not at the Armstrong Farm. Differences between cultivar susceptibility were evident. Again in 2003, grasshoppers proved to be a problem at the Armstrong Farm. The seedless cultivar Vanessa was most susceptible to grasshopper feeding. Both sites were exposed to early fall freezes in autumn 2003. At both sites, the organic-approved treatments exhibited greater frost injury than vines in other management systems. This was attributed to trapping of energy by the mulch under radiation freeze conditions.

After pruning in 2004, the pruning weights were recorded. Because of drought conditions in the previous two years, vine growth as reflected by pruning weights was less at the Armstrong Farm than at the Horticulture Station. At both sites, vines in the organic-approved management system tended to have lower pruning weights.

During the growing season, a high incidence of crown gall was observed in the Horticulture Station planting with 'Chambourcin' being the most affected. Vines in the organic-approved management system had a higher incidence of crown gall than the vines in the conventional system. The IPM/best management systems results differed little from the other two systems in this area.

In 2004, all treatments received a dormant application of liquid lime sulfur to control grape anthracnose. For controlling other diseases, the conventional and IPM/best management systems were sprayed with captan, while the organic-approved plots were sprayed with fixed copper plus hydrated lime. At the Horticulture Station, sprays were applied on a weekly interval beginning in July, and at the Armstrong Farm sprays were applied beginning in August after the onset of disease symptoms. No insecticides were required in 2004.

Leaves and shoots on vines (no fruit is expected until 2005) in each of the plantings were rated for incidence and severity of anthracnose, powdery mildew and downy mildew. At the Horticulture Station, a higher incidence of anthracnose was detected on vines in the organic-approved management system than in the conventional or the IPM/best management system, while no differences among the management systems were observed at the Armstrong Farm. Fungicide sprays effectively controlled powdery mildew at the Horticulture Station. At the Armstrong Farm, fixed copper plus hydrated lime was more effective in controlling powdery mildew than captan when both were applied after the onset of the disease.

Objective 2: Investigators were looking at IPM strategies for disease management at two types of field locations.

At the ISU Horticulture Station, the goal was to analyze the efficacy of standard IPM strategies, such as weather-related models, in controlling common disease pests. Treatments consisted of 1) IPM using spectrum sensor weather data to time alternating sprays, 2) protectant sprays every 14 days, and 3) unsprayed control. The incidence of disease on leaves, shoots, and fruit was evaluated weekly for black rot, powdery mildew, and other disease incidence and severity. There was very low black rot and powdery mildew disease pressure in 2001 and this was reflected in the results which showed no significant differences among the treatments.

At the second location, the various disease management treatments were tested at the vineyards of three cooperators in 2001. There were no differences between conventionally sprayed rows and Black Rot Model-sprayed rows at these three locations.

In subsequent years, the third cooperator's portion of the experiment was not continued because there was very little disease pressure at his vineyard. The remaining two vineyards continued the two treatments but observed little difference in disease incidence between the two methods of spraying.

Conclusions

After studying the replicated research plots, investigators concluded that growing grapes in a sustainable manner using best management practices allowed for excellent grapevine growth and development. A system using organic-approved practices and products showed that weed control, fall cold tolerance, and nutrient and disease management will be critical issues for future consideration under this system.

Dr. Nonnecke (center) at Grape Field Day

Differences in grape cultivar adaptability are evident after three years of growth. There are differences in winter hardiness and susceptibility of common grape pathogens among cultivars. While it is premature to provide specific cultivar recommendations at this time, the project is ongoing and first yields will be obtained in 2005. Investigators anticipate valid cultivar recommendations after three years of yield and fruit quality measurements.

Grapevine pruning

Chambourcin grapes

There were no differences in incidence of disease using the Black Rot Model for black rot and powdery mildew control when compared with the grower practices. Researchers will continue to evaluate incidence of pest tolerance of cultivars and expect differences due to the diverse germ plasm of the fifteen cultivars in the on-going trial.

A new web site, developed in cooperation with ISU Extension, offers public access to information on the project results. Other features on the site include descriptions of viticulture practices, updated research findings, and a calendar of meetings, conferences, and field days.

Impact of results

Sustainable production systems will be developed for Iowa grape growers through the Leopold Center-funded research plots that were established at ISU. More than 1,500 new, current, and potential grape growers attended field days and meetings in which this project's progress and results were showcased and summarized. A new web site provides public access to information generated by the project.

Education and outreach

Seven research progress reports were published by the project investigators. They are available from the ISU research farms' web site (www.ag.iastate.edu/farms/reports) and at http://viticulture.hort.iastate.edu/home.html.

In 2001, two field days were held at each of the cooperating growers' vineyards. In summer 2002 a summer field day for 80 Iowa fruit and vegetable growers was held to showcase the new vineyard at the ISU Horticulture Station. In cooperation with the Western Grape Growers Association, a field day was presented to 35 participants at the ISU Research Farm near Lewis. Two field days occurred in 2004; one at the ISU Horticulture Station and the other at the Lewis farm.

The project organizers presented updates on their work at ten winter meetings and conferences; among them were the first three Iowa Grape Growers Association conferences (2001-2003), which were planned by Drs. Nonnecke and Domoto.

For more information, contact
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