Review of Critical Temperatures for Key Central Florida Crops

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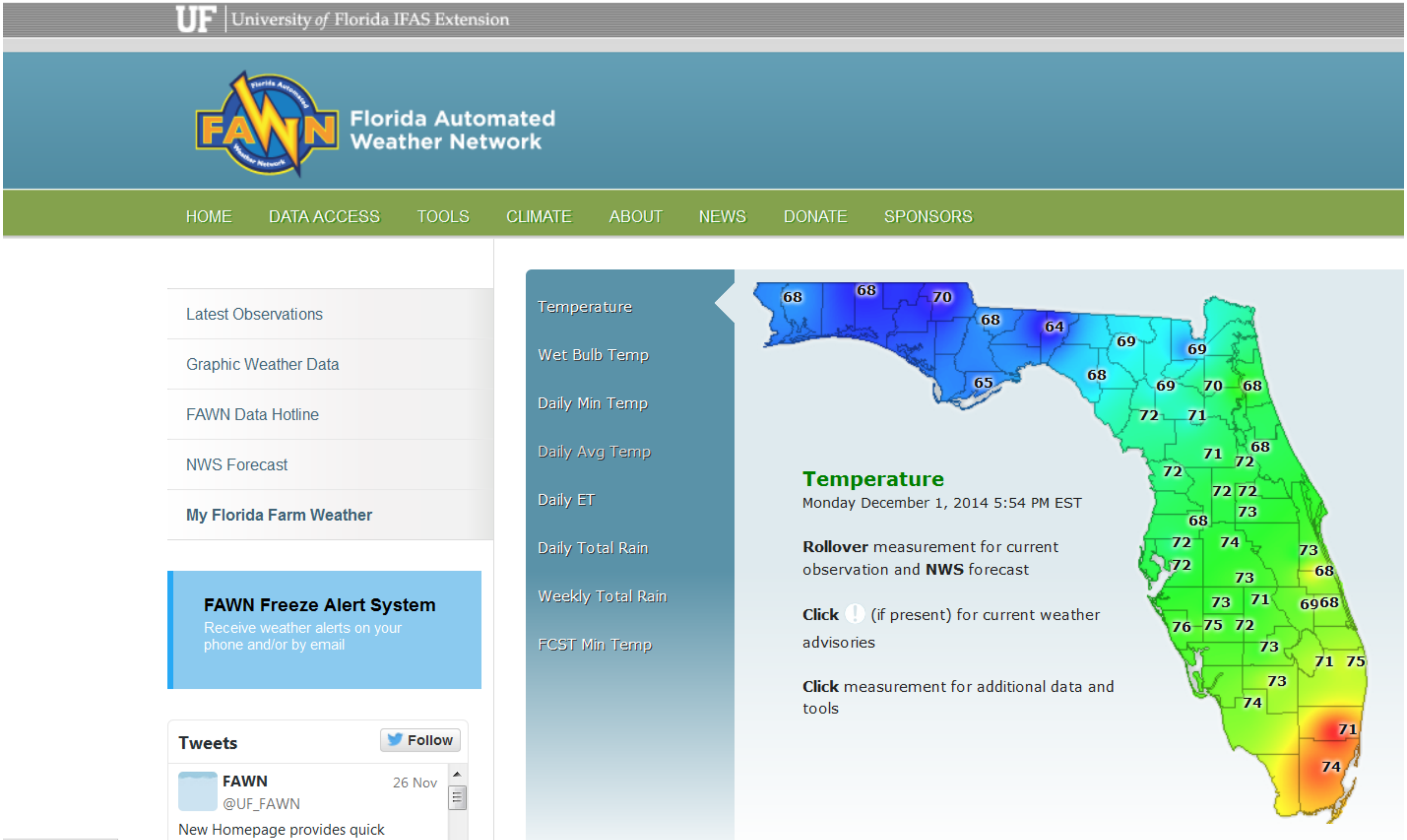
Review of Critical Temperatures for Key Central Florida Crops

- Florida Automated Weather Network (FAWN)
- Vegetables
- Ornamentals
- Strawberries
- Blueberries
- Citrus

BMPs

http://fawn.ifas.ufl.edu/



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http://fawn.ifas.ufl.edu/tools/coldp/crit_temp_select_guide.php

Tools➤Cold protection Toolkit

Determining Critical Freezing Temperatures for Plants in Florida

Introduction

John Jackson, County Extension Agent, UF/IFAS - John Jackson

Cold protection objectives may vary from grower to grower. Factors such as plant-type and size of a crop need to be considered; some may need to protect an individual plant, while others may want to protect an entire crop. The market value of a crop can play a role as well.

One of the key steps in a successful cold protection plan is to determine the critical temperature – the temperature at which cold air can begin to cause damage - for the plant that needs protection from freezing temperatures. For some plants and crops the critical temperature will not vary during the season or even from year-to-year. Other plants and crops, however, can acquire hardiness during the season. Therefore, the critical temperature for those may change as often as weekly.

The first step in utilizing the FAWN Cold Protection Toolkit requires the selection of the critical temperature for the targeted crop. The links below contain data and observations compiled by University of Florida researchers and Extension agents that may be useful in determining critical temperatures for

Vegetables

- Most plant tissue freezes at 28º F
- Vegetables like squash, tomato, eggplant, and snap bean will freeze at 30°F degrees
- he critical temperature for vegetables to turn on frost protection irrigation would likely be from 32°F to 34°F depending on whether fruit was present or not on the plants.
- "Freeze Protection for Vegetable Crops Grown in Florida in the BMP Era" http://lake.ifas.ufl.edu/agriculture/citrus/documents/FrostandfreezeprotectionintheBMPeraHS16800.pdf

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Ornamentals

- Leatherleaf Fern: During mild radiation freezes where temperatures drop slowly over the course of the night, growers can watch for the onset of frost formation on the crop and start irrigating when frost first starts to develop.
- During more severe freezes, irrigation water applications for cold protection should start when wet bulb temperatures in the shadehouse or hammock reach 34°F (1°C) and stop when wet bulb temperatures rise to that same temperature, or slightly higher if it is windy.
- Other ornamental species are mentioned

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Topics: Environmental Horticulture | Nursery Irrigation | Leatherleaf Ferns | Cut Foliage (florists' greens) | Cold Protection and Chilling Damage for Nursery Production | Stamps, Robert H | Irrigation Water Quality

Irrigation and Nutrient Management Practices for Commercial Leatherleaf Fern Production in Florida[1]

Robert H. Stamps[2]

This publication offers improved irrigation and nutrient management practices for use during the commercial production of leatherleaf fern. These mana practices are designed to reduce production costs and improve crop quality while at the same time protection ground water quality.

Introduction

Industry History

In 1895, a freeze devastated the central Florida citrus industry. Growers, struggling to survive the loss of their groves that were killed during the Februar freeze, began to look for alternative crops that they could produce on their land. That search led to the creation of Florida's cut foliage ("fern", florists' gr industry. The first crop produced by that industry was an ornamental asparagus called plumosus "fern" or fern asparagus (*Asparagus setaceus*, forme *Asparagus plumosus*).

Leatherleaf fern, *Rumohra adiantiformis* (synonym *Polystichum adiantiforme*), was first produced in Florida during the 1930s, but major plantings were started until the early 1950s. Leatherleaf is popular with florists because of its good keeping quality, low cost, ready and year-round availability, and vers design qualities—form, texture and color. These qualities have made leatherleaf the cut foliage most used by florists worldwide.

Despite foreign competition, mounting governmental regulations, soaring land prices and hurricanes, Florida continues to be a leader in production of leatherleaf fern with approximately 3,500 acres (1,415 hectares) in cultivation. The wholesale value of sales in 2005 was over 50 million dollars with Flo accounting for 96% of all U.S. production.

This publication provides information for commercial growers on how to manage their irrigation systems and nutritional practices to reduce costs, max

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Strawberries

- Strawberry crown tissue isn't usually injured until it reaches a temperature of about 20°F
- Damage to flowers and fruit can start to occur when tissue temperature reaches 30°F
- growers will generally wait to turn on their sprinkler irrigation system until the air temperature just above the plastic mulch, in an area open to the sky, is 31°F
- When an advective (windy) freeze is expected, and temperatures are predicted to drop into the low to mid 20s, it is common practice to use 11/64-inch nozzles

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Blueberries

Effects of freezing temperatures on blueberries

Michigan State University

Blueberry growth stages

Flower development				
Early pink bud	**Late pink bud**	**Early bloom**	**Full bloom**	**Petal fall**
				
Partly expanded flowers are readily visible and have separ-ated; corolla tubes (petals) short and closed. Can tolerate 23 to 25ºF (-5 to -4ºC).	Individual flowers fully developed and separated; corollas expanded but still closed. Can tolerate 24 to 27ºF (-4 to -3ºC).	Some corollas completely expanded and open; many flowers still closed. Can tolerate 25 to 28ºF (-4 to -2ºC).	Most flowers on the bush have opened and can tolerate 28ºF (-2ºC).	Corollas are falling off, revealing small green fruit; this is the stage most vulnerable to frost damage, which can occur at 32ºF (0ºC).

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Blueberry freeze protection methods

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HS968

Protecting Blueberries from Freezes in Florida[1]

J.G. Williamson, P.M. Lyrene, and J.W. Olmstead[2]

Introduction

Blueberries bloom in late winter or early spring in Florida, making the flowers and young fruit highly susceptible to freeze and frost injury. Killing freezes can occur as late as mid to late March throughout much of Florida, long after the initiation of bloom, especially for early-ripening southern highbush blueberry cultivars. This publication describes conditions that often occur in commercial blueberry fields during and after bloom when the potential for freeze damage exists. Practices that growers can use to minimize freeze damage are also discussed.

Dormancy and Cold Hardiness

Most temperate zone plants, including blueberry, enter a

Once fully dormant, a blueberry plant must be exposed to a period of cool temperatures before it will break dormancy and grow normally the following spring. This is a result of its chilling requirement. Each cultivar has its own characteristic chilling requirement. The amount of chilling that blueberry plants receive in Florida varies considerably from year to year. Temperatures needed to satisfy the chilling requirement are generally considered to be between 32°F and 45°F. However, estimating accumulated chilling is more complicated than merely recording the number of hours between 32°F and 45°F. Exposure to 1 hour of temperatures either slightly above or below the optimum chilling temperature can result in partial chill accumulation: the farther from the optimal temperature, the smaller the amount of chilling. For example, 1 hour of exposure at 42°F

Tuesday, January 03, 2012, 10:18:10 AM
(pre-freeze: cold air moving in)

According to Avalon FAWN Station:

- Temp - 40.5 F
- Wind - 11 MPH
- Wet Bulb – 31.4 F
- Dew Point – 11.3 F
- **Does this make you a believer in evaporative cooling?**

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What happened on February 11-13, 2012?

- Second major freeze event of the season
  - Night of 2/11 Advective Freeze
  - Night of 2/12 – Radiation Freeze
- Normally not a real problem for blueberries with the lows in the mid 20s at this date
  - Due to abnormally warm winter, blueberry development was 2-3 weeks ahead of normal
  - Most years CMTs 22-25 or lower but due to significant fruit set CMT was 32

What happened on February 11-13, 2012?

Ocklawaha FAWN Station

Time	Air Temp.	Wind	Wet Bulb
2/12/2012 1:00	**39.53**	**3.59**	**32.44**
2/12/2012 2:00	**36.39**	**3.61**	★ **29.79**
2/12/2012 3:00	**33.45**	**3.12**	**27.57**
2/12/2012 4:00	**31.84**	**3.07**	**26.26**
2/12/2012 5:00	**30.24**	**2.57**	**25.26**
2/12/2012 6:00	**29.54**	**2.8**	**24.54**

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What happened on February 11-13, 2012?

Okahumpka FAWN Station

Time	Air Temp.	Wind	Wet Bulb
2/12/2012 2:00	**39.29**	**8.84**	**32.75**
2/12/2012 3:00	**36.12**	**12.24**	**29.7**
2/12/2012 4:00	**33.56**	**10.25**	**27.74**
2/12/2012 5:00	**31.95**	**8.75**	**26.68**
2/12/2012 6:00	**30.51**	**7.13**	**25.91**
2/12/2012 7:00	**30.04**	**7.56**	**25.31**

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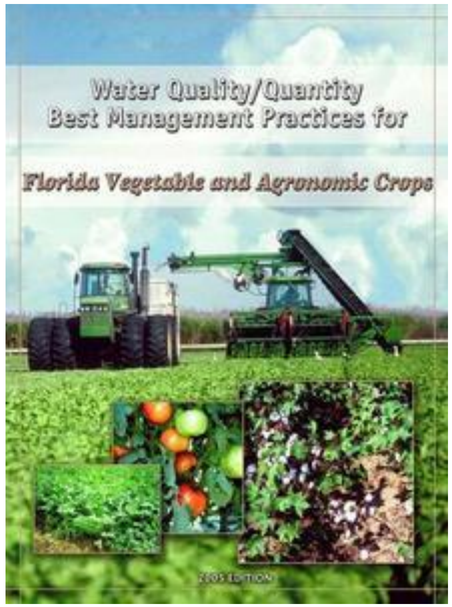
What happened on February 11-13, 2012?

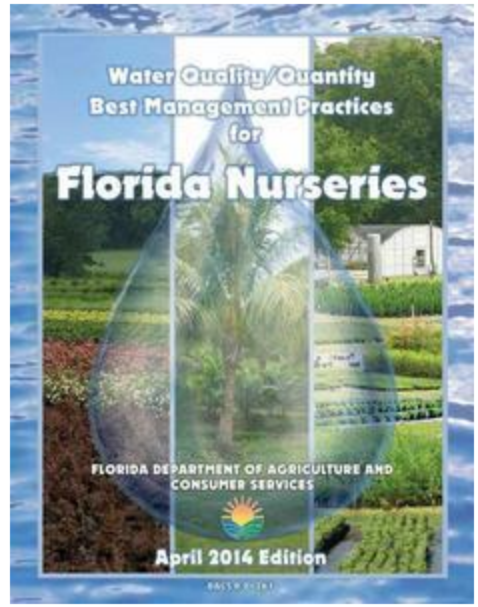
- Growers pondered course of action considering advective freeze 2/11-12
  - **Most realized their Critical Temperature was 32 F**
- Weather Watch recommended monitoring Wet Bulb Temperature as it approached Critical Temperature
- Growers that turned on overhead irrigation before wet bulb reached 32 (ambient around 38 F) had minimal damage (10%)
- Some growers turned on overhead when ambient temperature was 34 to 36 F and suffered 20 to 50% damaged fruit.

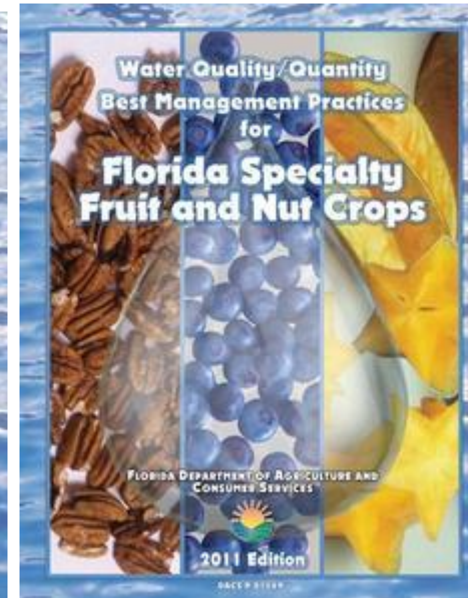
What happened on February 11-13, 2012?

- Growers with mechanical or water quantity that applied insufficient quantities or no overhead freeze protection suffered 50 – 80% loss of susceptible fruit
- Most farms suffered damage on northern margins of fields and blocks because heavy winds from the north prevented sufficient water coverage to adequately protect the crop.
- Many cultivars set a second crop that matured late or after completion of the season
  - Possibly related to relatively late freeze

Best Management Programs (BMPs)







Participation in BMPs are highly recommended considering the regulatory activities across the state where Basin Management Action Plans (BMAPs) are becoming a reality in most major watersheds.

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Evidence of freeze damage noted in areas of insufficient freeze protection

Citrus

- Citrus trees acclimated to cold temperatures have survive temperatures as low as 14°F
- Non-acclimated citrus leaves will generally survive to temperatures of 24°F
- New spring flush leaves formed in April will rarely survive temperatures of 31°F
- Citrus leaf killing points can range from 16°F to 24°F during the winter

Citrus Leaf Killing Temperatures for Florida Citrus

Location	Variety/Rootstock	11/18/2013	11/25/2013	12/02/2013	12/09/2013	12/16/2013	12/23/2013	12/30/2013	01/06/2014	01/13/2014	01/20/2014
Balm	Hamlin/Swingle	25	23	21.5	22.5	22	22.5	21	20	21	21.5
Ft. Meade	Valencia/Carrizo	24	23	21.5	23	22.5	23	22.5	22	21	21.5
Frostproof	Hamlin/Swingle	24	23	21.5	22.5	22	20.5	20	20	21	21.5
Green Swamp	Hamlin/Swingle	24	23	21.5	23	22	22	21.5	21	21	21
Lake Alfred	Valencia/Carrizo	24.5	23	22	22.5	22	21	21	21	20	21.5
Avalon	Hamlin/Swingle	24	23	22	22.5	23	20.5	20	20	20	21
Avalon	Valencia/Swingle	24	23	21.5	22.5	22	20.5	21	21	22	21.5
Umatilla	Hamlin/Swingle	24	23	21.5	22	22	20	20	20	20	21.5

Location	Variety/Rootstock	01/27/2014	02/03/2014	02/10/2014	02/17/2014	02/24/2014	03/03/2014	03/10/2014	03/17/2014
Balm	Hamlin/Swingle	20.5	20	20.5	20.5	22	22.5	22	22
Ft. Meade	Valencia/Carrizo	20	20.5	21.5	21	22	22.5	22	22.5
Frostproof	Hamlin/Swingle	19.5	20	21	20.5	22.5	22.5	22	22
Green Swamp	Hamlin/Swingle	20	20	22.5	21	22	22	22	22.5
Lake Alfred	Valencia/Carrizo	20.5	20	21.5	21	22.5	23	22	22.5
Avalon	Hamlin/Swingle	NA	NA	21.5	20.5	22	22	NA	NA
Avalon	Valencia/Swingle	NA	NA	22	20	22.5	22.5	NA	NA
Umatilla	Hamlin/Swingle	NA	NA	22	20.5	22.5	22.5	NA	NA

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Publication #HS931

Topics: Agricultural and Biological Engineering | Cold Protection and Chilling Damage in Citrus Production | Microirrigation or Drip Irrigation | Citrus REC - Lake Alfred | Citrus Irrigation | Parsons, Lawrence R | Irrigation for Cold Protection | Boman, Brian J

Microsprinkler Irrigation for Cold Protection of Florida Citrus[1]

L. R. Parsons and B. J. Boman[2]

Introduction

http://edis.ifas.ufl.edu/ch182

Millions of boxes of fruit and thousands of acres of citrus trees have been lost in freezes and frosts. Oranges are usually damaged when the fruit are exposed to temperatures of 28°F or lower for 4 hours or more. As the temperature gets colder or durations below 28°F get longer, damage to fruit, leaves, twigs, and eventually large branches increases. More than nearly any other factor, freezes have caused some of the most dramatic changes in fruit supply, availability, and price. Thus, any method that provides some cold protection can be of major importance to citrus growers.

Many cold protection methods have been used over the years. These methods include heaters, wind machines, fog generators, high volume over-tree irrigation, and low volume undertree microsprinkler irrigation.

High fuel cost has made grove heating during freeze nights prohibitively expensive except for high value crops. Wind machines are effective, but they require maintenance and need a strong temperature inversion for optimum effectiveness. Fog can provide cold protection, but light winds can blow the fog away from the grove and obscure nearby roadways. In south Florida where temperatures do not normally go far below freezing, high volume over-tree sprinkler irrigation has been used effectively on limes and avocados. In central and north Florida, temperatures are usually colder, and over-tree sprinklers should not be used on large citrus trees because the weight of the ice formed can break off limbs and cause tree collapse. With overhead systems, all leaves are wetted and susceptible to damaging evaporative cooling during low humidity or windy freezes. Many trees were killed in the windy 1962 freeze when overhead sprinklers were used because of evaporative cooling of wetted leaves.

Low volume undertree microsprinkler irrigation is an alternative method for partial frost protection and can be more affordable than other methods (Fig. 1). Microsprinklers have proven effective during several freeze nights in central Florida tests. In addition to frost protection, microsprinklers can provide effective year-round irrigation. Microsprinklers, or spray jets, are small, low volume irrigation sprinklers that discharge 5 to 50

Questions?

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