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Management Decisions Affecting Citrus Cold-Protection Practices: A 1996 Survey¹

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Although a major freeze has not affected the Florida citrus industry since 1989, growers on nonbedded or Ridge groves indicated in a 1992 survey that cold protection was their third most important information need after pest management and cost-effective chemicals. Growers on bedded groves ranked cold protection ninth out of 17 items. A moderate freeze in the 1995-96 season further emphasized the need to document current management decisions affecting cold protection.

A mail survey was therefore conducted in 1996, obtaining a sample population of 674 citrus growers from the mailing lists of extension agents in 27 Florida counties where citrus was commercially grown. Of the mailed surveys, 451 useable responses were returned (66% response rate) with an expected sampling error of $\pm 4\%$ at the 95% level. Data were analyzed on five different levels: 1) statewide, 2) production system, 3) production region, 4) grove size, and 5) ownership and management pattern. Ownership and management patterns included growers who owned but did not manage their groves (owners only), those who owned and managed their own groves (owners/managers), caretakers who managed the groves of others (manages others), and those who both owned their own groves and managed the groves of others (manages both). Production regions included the central Florida Ridge, the Indian River area (east coast of Florida), southwest Florida, west Florida, and a multicounty category that included respondents with groves in more than one county. Planting system referred to groves that

were bedded (primarily poorly drained, shallow soils in the Indian River area and southwest Florida) and nonbedded (primarily the deeply drained, sandy soils of the Ridge). Data were also analyzed in terms of grove size: 1-25 acres, 26-49 acres, 50-99 acres, 100-499 acres, 500-999 acres, and greater than 1,000 acres. In addition, cold-protection practices were compared within production systems, production regions, management patterns, and grove size. In some cases, growers could choose more than one response; in other cases, data from a series of questions (i.e., factors in choosing cold-protection methods) requiring a yes or no answer (for each factor) were combined into one graph, resulting in what appears to be a greater than 100% response. "N" values indicate the number of respondents answering a question.

Industry Characteristics

When the distribution of survey respondents was considered, the largest percentage of respondents were located on the Ridge (41%), followed by the Indian River area (26%), 10% in southwest Florida, and 19% in west Florida. Only 3% of respondents fell into the multicounty category. When asked about management patterns, the greatest percentage of growers (58%) indicated they were both owners and managers, with 18% and 16% saying they managed the groves of others and managed both their own groves and those of others, respectively. Only 8% said they were owners only. Fifty-eight percent indicated they produced citrus on bedded groves and 42% on

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nonbedded groves. These data were similar to those reported for groves in bedded (504,291 acres or 58%) and nonbedded (350,620 acres or 42%) counties in the 1996 Commercial Citrus Inventory. On a statewide basis, 30% of surveyed growers indicated that their groves were less than 49 acres, with 25% each saying their groves were in the 99 to 499 and greater than 1,000 acre range. Thirteen percent had groves from 49 to 99 acres, and 7% had groves from 499 to 999 acres.

Sources of Weather Information

Growers were asked about their sources for weather information during the 1995-96 season and in the future. On a statewide basis, the National Weather Service (NWS) and commercial radio/TV were the primary sources of weather information in 1996 (48% of growers), but with the discontinuance of the Weather Service reports after 1996, more growers indicated they would rely on commercial radio/TV (72%), private meteorologists (20%), and the extension service (32%) than in previous years. Sixteen percent of respondents listed other sources, including the Almanac, Florida Citrus Mutual, the Internet, water-management districts, and neighbors (Fig. 1).

During the 1995-96 season, bedded growers used the NWS (56%), commercial radio/TV (42%), private meteorologists (12%), and the extension service (18%), whereas nonbedded growers used NWS (37%), commercial radio/TV (55%), private meteorologists (4%), and the extension service (17%). After 1996 the use of commercial radio/TV increased dramatically for both bedded (68%) and nonbedded (78%) growers. Bedded growers used private meteorologists (26%) and the extension service (33%) more so than did nonbedded growers, 11% of whom used private meteorologists and 28% of whom used the extension service.

Use of the NWS and the extension service for weather information during the 1995-96 season generally increased with grove size, and the use of commercial radio/TV decreased with grove size. After 1996 a high percentage of growers with groves of all sizes (54 to 85%) said they would use commercial radio/TV. The use of private meteorologists and the extension service also increased with grove size.

During the 1995-96 season, the highest percentage of growers who used the NWS, the extension service, and private meteorologists were those that managed others' groves and managed both their own groves and those of

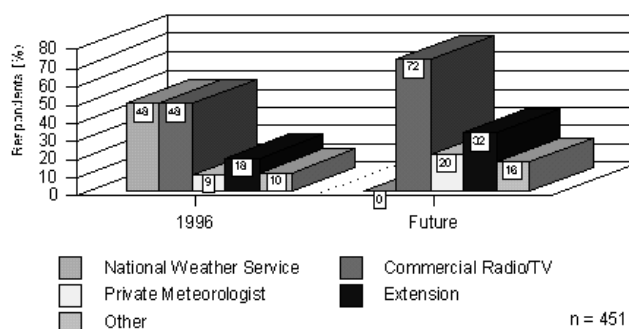


Figure 1. Sources of weather information.

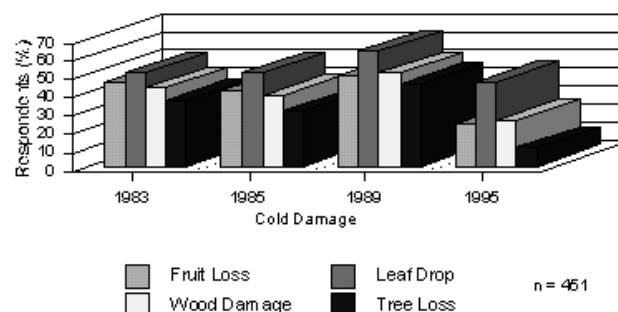


Figure 2. Cold damage in different freezes.

others. Those who were owners only and owners/managers relied more heavily on commercial radio/TV. After 1996, commercial radio/TV was the most commonly used source of information, with the extension service second. A higher percentage of those that managed others' groves and managed both their own groves and those of others used private meteorologists than growers in other categories.

Cold Damage

When respondents were asked to estimate the damage incurred by freezes on a statewide basis, a higher percentage of growers reported damage in all categories in 1989 than in other freezes. Fruit loss, wood damage, and tree loss were more widely reported in 1983, '85, and '89 than in 1995, but a higher percentage of growers consistently indicated leaf drop in all 4 freezes (Fig. 2). Comparing production systems, bedded growers suffered more fruit loss, leaf drop, and wood damage than nonbedded growers in all years cited, but nonbedded growers had greater tree losses in each year. Bedded growers appeared to have sustained more damage, except for tree loss, compared to nonbedded growers. However, these results may have understated the losses of nonbedded

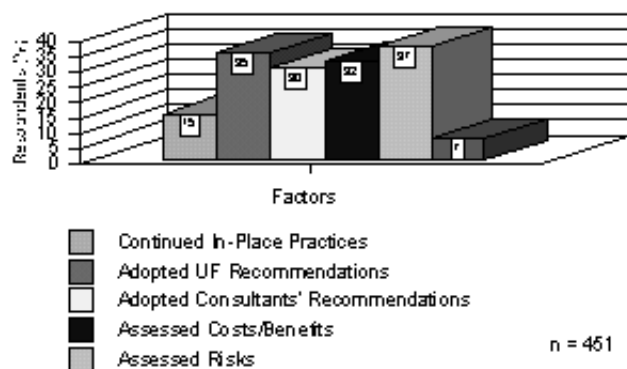


Figure 3. Factors in choosing cold protection methods.

growers because the sample was based on those still in business after the freezes of the 1980s rather than before. A sample based on those in business prior to the freeze might have indicated different losses for bedded and nonbedded growers.

Comparing production regions, Ridge growers suffered greater losses in all categories in each year than growers in other production regions. Comparing management patterns, those who managed both their own groves and those of others generally reported the greatest freeze damage in all categories in all years.

Choosing Cold-Protection Methods

When deciding which methods to use for cold protection, a similar percentage of growers on a statewide basis said they adopted University of Florida recommendations (35%) and assessed risks based on grove history (37%), with a lower percentage indicating they adopted consultants/suppliers' recommendations (30%) and assessed the costs and benefits of particular cold-protection methods (32%) (Fig. 3). Other factors mentioned included growers developing their own methods, equipment limitations, personal experience, recommendations by other growers, and water restrictions.

When factors were considered within production systems, the highest percentage of bedded growers indicated that adopting UF recommendations (36%) and assessing risks based on grove history were equally important (41%), while nonbedded growers rated the following factors equally: adopting UF recommendations (33%), adopting recommendations of consultants and suppliers (33%), assessing costs and benefits (36%), and assessing risks based on grove history (33%). When factors were considered within production regions, the

highest percentage of Ridge growers said UF recommendations (40%), assessing costs and benefits (38%), and assessing risks (39%), were the most important. Assessing risks based on grove history was the most important factor for growers in the Indian River area and southwest Florida. For west Florida growers, assessing risks based on grove history and adopting the recommendations of consultants were the most important factors.

Fifty percent of growers with groves greater than 1,000 acres were more likely to adopt UF recommendations than growers with smaller groves (26 to 36% of growers with groves from 1 to 25, 26 to 49, 50 to 99, 100 to 499, and 500 to 999 acres). The reverse was true for adopting consultants' recommendations, with 22% of growers with groves greater than 1,000 acres adopting consultants' recommendations and 28 to 37% of growers with smaller groves adopting those recommendations.

Those who were owners only were more likely to adopt the recommendations of consultants, while those who were owners and managers were more likely to consider a range of factors. Those who managed the groves of others and who managed both their own groves and the groves of others were more likely to adopt UF recommendations and to assess the risks based on the freeze history of the grove.

When deciding if and when to use irrigation for cold protection, a similar percentage of respondents on a statewide basis based their decision on predicted low temperatures (67%) and actual grove temperatures (62%), with 24% considering the history of grove cold damage. Other factors considered by 5% or less of the respondents included the cost of irrigation, available water, cloud cover, dew point, duration of low temperatures, experience, power source, and wind. Within each production system, predicted and actual temperatures were also the most important factors. When considering these factors according to grove size and management pattern, predicted and actual temperatures were again the most important factors.

Effectiveness of Cold-Protection Methods

When growers were asked about the effectiveness of their cold-protection practices at minimum temperatures of 28, 20 and 15° F for at least 4 hours, their confidence about the effectiveness of their cold-protection practices decreased as temperatures decreased (Fig. 4). Seventy-three percent thought their practices were very effective at 28° F, with 22% considering their practices somewhat

effective at this temperature. At 20°F, only 12% said their practices were very effective, and at 15°F, only 3% indicated so. At 15°F, 51% did not know if their cold-protection practices were effective or not.

Within production systems, 69% of bedded growers and 80% of nonbedded growers considered measures very effective at 28°F. When grove size and management pattern were considered, the highest percentage of growers with groves of all sizes said cold-protection measures were very effective at 28°F. An equal percentage of bedded and nonbedded growers considered measures somewhat effective at 20°F, with 17% of bedded growers and 10% of nonbedded growers considering these measures not effective. When grove size and management pattern were considered, the highest percentage of growers indicated that measures were somewhat effective. Within production systems an equal percentage of bedded and nonbedded growers (47 to 52%) said they did not know if cold-protection measures were effective at 15°F. When grove size and management pattern were considered, the highest percentage of growers with groves of all sizes and management patterns said they did not know if cold-protection measures were effective at 15°F.

Reasons for Not Improving Cold-Protection Methods

When respondents were asked why they thought their cold-protection practices were or were not effective, 46% indicated the cost of alternative practices prevented them from changing to other (presumably more effective) practices, 12% specified inaccurate weather information, and 13% stated lack of information about cold protection (Fig. 5). Reasons for not improving cold-protection practices within production systems were also considered, with the most commonly cited reason being that alternative practices were costly.

Considering production regions, a higher percentage of Ridge growers cited all of the above categories than growers in other regions. Costly alternative practices were the most commonly cited reason within production regions and among growers with groves of all sizes and all management patterns.

Grove Microclimate

Forty-one percent of respondents indicated they had analyzed their groves for microclimates in order to improve the usefulness of weather information, with 59% indicating they had not done so (Fig. 6). An equal percentage of bedded and nonbedded growers (41%) said

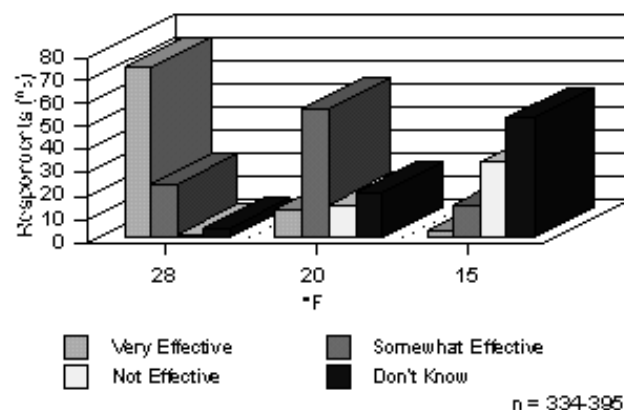


Figure 4. Effectiveness of cold-protection practices.

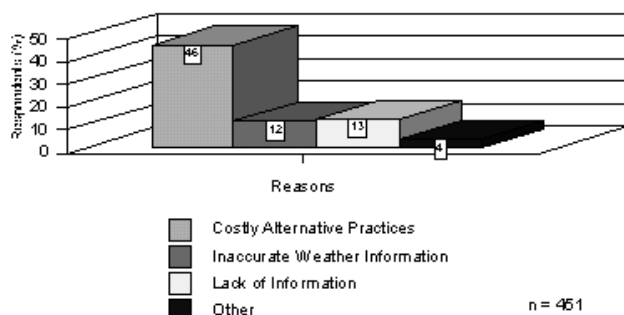


Figure 5. Reasons for not improving cold-protection practices.

they had considered microclimates. Within production regions, the highest percentage of growers who had considered microclimates were multicounty growers (85%), compared to Ridge growers (47%) and southwest Florida growers (49%). As grove size increased, growers were more likely to analyze their groves, with 22% of growers with groves from 1 to 25 acres doing so, and 60% of growers with groves greater than 1,000 acres doing so. Those who managed both their own grove and the groves of others were also more likely to analyze microclimates (64%), with those who managed others (48%), owner/managers (33%), and owners only (29%) following in decreasing order.

Conclusion

After the National Weather Service discontinued agricultural weather forecasts in 1996, commercial radio/TV was the most commonly used source of weather information, with the use of private meteorologists and the extension service increasing with grove size. When deciding which cold-protection methods to use, a similar percentage of growers depended on University of Florida

recommendations and assessed risks based on grove history. Predicted and observed low temperatures were also used by a similar percentage of growers to decide to use irrigation for cold protection. Grower confidence about the effectiveness of cold-protection methods decreased as temperature decreased from 28 to 15 °F. When asked why they did not improve their cold-protection methods, the most commonly cited reason was that alternative practices were costly. However, only 41% of growers said they had actually examined their groves for differences in microclimate.

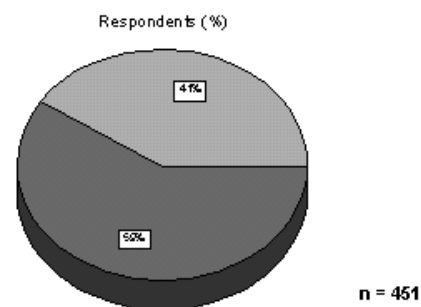


Figure 6. Grower analysis of grove microclimates.