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Influence of Winter Weather on Blueberry Production in Florida

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Weather plays a prominent role in yield and productivity of blueberry farms in Florida. The consecutive winters of 2010–11 and 2011–12 were very different with regards to chill accumulation and incidence of late winter freezes. During the 2010–11 winter, chill accumulation was above average and no severe freezes occurred after bloom initiation. Conversely, during the 2011–12 winter, chill accumulation was below average, especially in south Florida, and two back-to-back freezes occurred in mid-February after initiation of bloom and spring growth. Moreover, in 2011–12 most of the chilling occurred relatively late in the winter. By 28 Dec. only 16 h of chilling was recorded in Polk County, FL. Hydrogen cyanamide, a growth regulator used to assist in satisfying chill requirements, was more effective in north-central Florida than in south Florida. Hydrogen cyanamide is typically most effective when plants are fully dormant and significant natural chilling has occurred before its application, conditions which were more likely to have occurred in north-central Florida than in central or south Florida during the 2011–12 winter. The combined effects of below average chill accumulation and severe freezes reduced statewide production in 2012 compared to 2011. In north-central Florida freeze damage was highly variable depending on cultivar, location, and the freeze protection system employed. Generally, early-flowering cultivars, such as 'Snowchaser', 'Meadowlark', and 'Springhigh', sustained greater damage than later-flowering cultivars, such as 'Emerald' and 'Jewel'. In south Florida, most cultivars showed symptoms of insufficient chilling; bloom was delayed and protracted, and yields were below average. Generally, the best production occurred south of Ocala and north of I-4 where modest amounts of chill were recorded and freezes were not severe.

Variable winter chilling and late spring freezes are two weather-related factors that often have a major impact on commercial blueberry production in Florida (Lyrene, 2006; Williamson et al., 2012a, 2012b). The diverse winter weather patterns of 2010–11 and 2011–12 offer opportunities to compare the effects of winter weather on blueberry production in Florida. The 2010–11 winter was colder than usual and had above average chill accumulation yet below average incidence of late winter or early spring freezes. Although there were 23 freezes recorded at the Florida Automated Weather Network (FAWN) weather station between 15 Dec. 2010 and 12 Mar. 2011 (Alachua, FL), most of the freezes were in December and January during plant dormancy with no freezes below 28 °F after 24 Jan. (Florida Automated Weather Network, 2012). Conversely, the 2011–12 winter was warmer than normal with only eight freezes recorded at the FAWN weather station in Alachua, FL between 15 Dec. 2011 and 5 Mar. 2012. However, two severe back-to-back freezes occurred in mid-February in the north-central regions of the state. This article describes winter chill accumulation and severe freeze events that occurred during the winters of 2010–11 and 2011–12, and statewide blueberry production in 2011 and 2012 following these two winters.

Chill accumulation. Chill accumulation during winter dormancy is required for rapid and vigorous emergence of spring growth in temperate crops such as blueberry (Lyrene, 2006; Williamson et al., 2012c). While the Florida blueberry industry is comprised of low-chill cultivars released from the University of Florida, these cultivars typically enter dormancy during winter and benefit from exposure to temperatures near or below 45 °F to resume growth during the following spring (Williamson et al., 2012c). The 2011–12 winter was characterized by below average chill unit accumulation as compared to the 2010–11 winter, which was above average (Table 1). Chill unit accumulation differed during the 2010–11 and 2011–12 winters when compared to the long-term averages in Lake Alfred, FL (central Florida) and Alachua, FL (north-central Florida). Winter chilling in 2011–12 was well below the long-term average at both locations and was particularly low in early winter (December). The interaction of winter chill accumulation on the effectiveness of hydrogen cyanamide applications should be considered. Hydrogen cyanamide is a dormancy-breaking compound that is most effective when applied to dormant blueberry plants that have received a significant amount of winter chilling (Williamson et al., 2001, 2012c). Typically, a significant amount of chill accumulation occurs in December before application of hydrogen cyanamide and is generally considered to be more beneficial for breaking winter dormancy than chill accumulation that occurs in late January or February. In 2011–12, not only was the winter chill accumulation below average, the majority of chilling occurred in January and February after hydrogen cyanamide applications were made.

Conversely, not only was chill accumulation above the long term average at both locations in 2010–11 but a substantial amount of chilling occurred early (December) which is beneficial for hydrogen cyanamide applications. By 15 Dec. 2010, chilling in north-central Florida was almost twice that of the long-term

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Table 1. Chill accumulation (number of hours ≤45 °F) in north and central Florida beginning 1 Nov.[z, y]

	Long-term avg		Winter 2010–11		Winter 2011–12	
Date	Alachua	Lake Alfred	Alachua	Lake Alfred	Alachua	Lake Alfred
15 Dec.	182	46	346	146	139	15
31 Dec.	283	85	520	254	195	22
15 Jan.	384	127	664	307	275	81
15 Feb.	583	203	870	373	452	112

[z]Data taken from AgroClimate website.
[y]These data were originally reported in the Blueberry News, Vol. 1, Issue 3, Central Florida Media Group.

Table 2. Characteristics of the 12 Feb. and 13 Feb. 2012 freezes at three locations in Florida.[z, y]

	Min temp (°F)	Duration	Wet bulb (°F)	Wind speed (mph)
Alachua, FL				
12 Feb.	23.9	7 h 15 min	20.6	4–7, gusts to 12
13 Feb.	17.6	13 h	16.0	1–2, gusts to 2.5
Hastings, FL				
12 Feb.	27.8	5.5 h	24.8	3–8, gusts to 19
13 Feb.	27.0	10 h 45 min	26.6	0–0.7, gusts to 3.8
Lake Alfred[y]				
12 Feb.	31.7	45 min	27.3	1–2.5, gusts to 14
13 Feb.	32.7	NA	30.3	0.3–1.0, gusts to 5.7

[z]Data taken from the Florida Automated Weather Network (FAWN), University of Florida.
[y]Some of these data were originally reported in the Blueberry News, Vol. 1, Issue 3, Central Florida Media Group.

average and about three times the long-term average in central Florida (Table 1).

Spring freezes. In addition to winter chilling, freezes during bloom and early fruit development have historically had a significant effect on blueberry production in Florida (Williamson et al., 2012a). Table 2 describes the characteristics of two back-to-back freezes in Feb. 2012 at three FAWN station locations in Florida. Minimum temperatures were much lower at north-central Florida locations (Alachua, FL and Hastings, FL) than in central Florida (Lake Alfred, FL). During the first night, the combined effects of low temperatures and wind made cold protection difficult. Although minimum temperatures were lower the second night, the general consensus of most growers in north-central Florida was that the majority of damage occurred during the first night because of evaporative cooling and disruption of sprinkler patterns from gusty winds. Estimates of freeze injury in north-central Florida ranged from 10% to 50% depending on location, cultivar, and freeze protection system used. Generally, early flowering cultivars such as 'Snowchaser' and 'Springhigh' received more freeze damage than mid-season cultivars such as 'Emerald', 'Jewel', and 'Star'. In central Florida, freeze damage was considered to be minimal; however, symptoms of insufficient chilling were widespread.

Statewide production. The atypical and distinctively different consecutive winters of 2010–11 and 2011–12 illustrate the importance of winter weather conditions on blueberry production in Florida. Late winter and early spring freezes are often a major factor limiting production in Florida. However, it is unusual to experience consecutive winters that are so different with regard to freeze injury and chill accumulation. The 2011 production season had ideal winter weather with high chill accumulation and no severe freezes during or after bloom. This resulted in the largest production year on record of 21.6 million pounds (Fig. 1). Alternatively, in 2012, very low chill accumulation followed by two severe freezes in north-central Florida decreased statewide production and reversed an upward trend in annual production

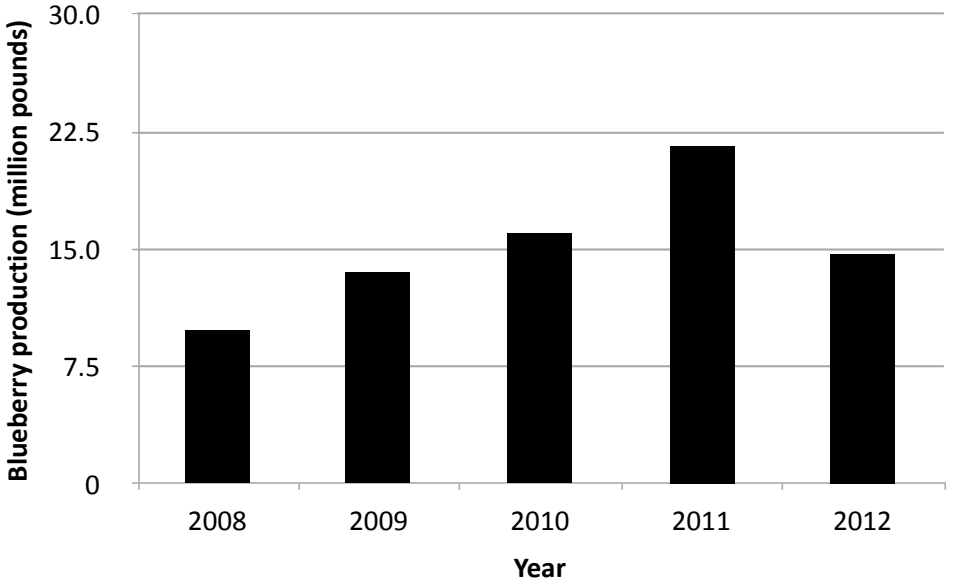

Fig.1. Florida blueberry production from 2008 until 2012. These data were originally reported in the Blueberry News, Vol. 1, Issue 3, Central Florida Media Group.

Table 3. Seasonal distribution of Florida blueberry harvests in 2011 and 2012.[z]

Year	1–15 Apr.	16–30 Apr.	1–15 May	16–31 May
2011	107[y]	1318	708	26
2012	713	577	146	34

[z]Data taken from USDA Agricultural Marketing Service.
[y]10,000-lb units.

that has been in place for several years. However, the lighter crop in 2012 resulted in earlier berry harvest with a larger proportion of the total crop harvested during the first half of April than in 2011 which likely had a positive effect on berry prices (Table 3).

There has been high interest in recent years for growing blueberries in south-central Florida with hopes of earlier harvests and less freeze damage. However, lack of sufficient chill accumulation often becomes problematic in south-central Florida with current cultivars and management systems. During unusually warm winters with low chill accumulation, as was the case in central and south-central Florida during 2012, production is almost always negatively impacted. The problem of exceptionally warm winter weather and inadequate chill accumulation is further compounded when hydrogen cyanamide is used since it is of limited benefit and may even result in some damage to plants if they are not fully dormant at the time of application. During 2012, the best production generally occurred south of Ocala and north of I-4 where there was moderate chill accumulation and freezes were not severe.

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