Assessing Chilling Conditions by Sites and Years for Perennial Fruit Production in Kentucky

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Introduction

- Temperate Regions of the World are characterized by seasonal rhythms of warm and cool temperatures.
- Cool temperature during the dormancy season enables perennial plants to undergo physiological processes essential for initiation of flowering and fruit bearing.
- Insufficient chilling results in reduced production or barren plants.
- Early completion of chilling results in greater likelihood of freezing damage.
- Chilling hour is defined as a clock hour of air temperature, between 32˚to 45˚F (0˚-7.2˚C).

Objective

- The present study was conducted to determine the levels and variability in chilling hour production and annual distribution by different Kentucky environments.

Materials and Methods

- Kentucky Mesonet provided 5 years of weather data for 50 counties.
- The data were converted to chilling units using the Chilling Hours Model.
- Temperature recording began September 1 and continued through April 30 for years 2010-2011 through 2014-2015.

50 Selected Mesonet Sites

ID	county	ID	county	ID	county
01	Adair	18	Fayette	35	Marshall
02	Allen	19	Franklin	36	Mason
03	Barren	20	Fulton	37	McCreary
04	Boone	21	Graves	38	McLean
05	Breathitt	22	Grayson	39	Mercer
06	Breckinridge	23	Hardin	40	Metcalfe
07	Bullitt	24	Harrison	41	Morgan
08	Caldwell	25	Henderson	42	Nicholas
09	Calloway	26	Hopkins	43	Ohio
10	Campbell	27	Jackson	44	Owen
11	Carroll	28	Johnson	45	Owsley
12	Casey	29	Knott	46	Rowan
13	Christian	30	Knox	47	Taylor
14	Clark	31	Lewis	48	Trigg
15	Clinton	32	Lincoln	49	Union
16	Crittenden	33	Logan	50	Warren
17	Cumberland	34	Madison		

Results

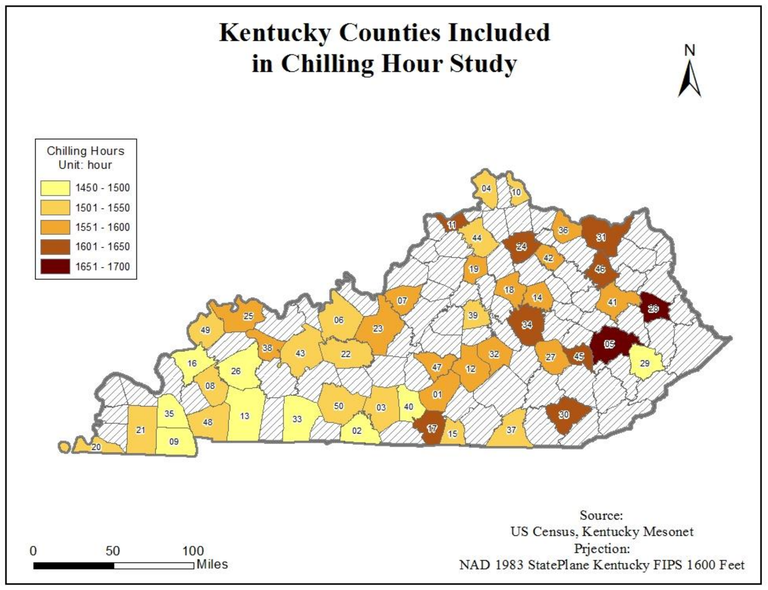

Figure 1.Average accumulated chilling hours over 5 years at 50 Mesonet sites

Table 1.Sorted chilling hours in selected sites

ID	county	elevation (m)	ppt(cm)	mean temp (°F)	freezing hours (< 32 °F)	**chilling hours (32-45°F)**
13	Christian	222.2	87.7	49	977	**1463**
26	Hopkins	180.4	84.4	49	966	**1464**
02	Allen	249.3	85.4	50	874	**1465**
33	Logan	201.2	93.6	49	972	**1466**
29	Knott	474.3	77.6	48	1037	**1474**
…	…	…	…	…	…	**…**
11	Carroll	143.9	84.8	46	1632	**1633**
17	Cumberland	167.9	86.0	48	977	**1636**
46	Rowan	259.4	83.3	46	1223	**1649**
28	Johnson	230.1	92.2	46	1190	**1662**
05	Breathitt	209.7	86.1	47	1032	**1681**

Table 2. Average monthly distributed chilling hours at sites

Year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
2010-11	2	89	275	184	259	243	347	73	1473
2011-12	1	135	203	377	309	302	107	102	1537
2012-13	18	146	315	266	250	328	371	148	1842
2013-14	1	120	255	267	224	182	287	88	1424
2014-15	4	87	267	404	283	151	233	80	1506
Mean	5	115	263	300	265	241	269	98	1556
%	0	7	17	19	17	16	19	6	100

Table 3. Chilling hour requirement of various Perennial fruits grown in Kentucky

Species	Approximate number of hours from 32° to 45°F (0° to 7.2°C)
Apple	800 to 1700
Pear	600 to 1400
Peaches	400 to 1200
Grapes	200 to 500
Blueberries	650 to 1200

Conclusions

- Kentucky environments are producing more chilling units than required by its fruit crops, thereby providing a temporary buffer against global warming.
- Selection of cultivars of crops with higher chilling requirements would delay bud break and provide greater protection against late winter freezing temperatures.
- The preliminary study needs to be extended as more weather data become available.

Acknowledgements

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References

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