CROP FORECASTING

PAST - PRESENT - FUTURE

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In the fall of 1989, Ocean Spray launched a program to improve the accuracy of cranberry crop estimates. The objective was to supplement the traditional visual survey methods with quantitative measures of key crop characteristics. For the past three years, in the fall and in the spring, the density of reproductive and vegetative uprights of four varieties was determined to indicate crop potential for the following harvest. In addition, in early August, the number and weight of fruit per square foot was sampled.

Upright density has not yet provided a usable indication of the size of the coming Wisconsin harvest. However, for individual growers, beds with low numbers of reproductive and total uprights relative to the state average consistently produced the lowest crops. The relationship between fruit number per square foot and actual yields in 1990 was used to accurately predict the 1991 crop from fruit number per square foot sampled in August 1991. The predicted Ocean Spray crop was 1,284,000 barrels compared to an actual crop of 1,308,665 barrels, a 2% difference. This same approach employed in Massachusetts, but with half as many observations, underestimated the large 1991 crop by 15%. The relationship between fruit size in August and final size at harvest is not clear, and therefore not yet used in the estimates.

Future improvements include the development of a more comprehensive forecasting system combining critical yield factors and conditions with information from research reports, crop literature, growers, and others with special expertise. A forecasting framework of this kind can improve the accuracy of crop estimates and identify research gaps relevant to understanding yield.

Key components from our experience of crop estimating are discussed below. Note that the procedures described were designed to estimate the entire State's cranberry crop, although individual farms can apply the same principles.

SITE SELECTION AND SAMPLING

Choose Indicator Beds

Within one Management Area, select individual beds of the same variety and age which yield about the same as the average for the entire area. The number of these "Indicator Beds" needed varies with the number of acres and the uniformity of production. The higher the number of acres and variability, the more indicator beds required.

Select Sample Number and Location

The more samples taken per Indicator Bed, the more accurate the estimate will be. Six samples per Indicator Bed are good, four are acceptable.

To select sample locations, first walk and observe the entire Indicator Bed. Mark with flags those areas that appear average. Avoid both barren and unusually productive areas. The skill of selecting average yielding areas is the most important component of the entire crop estimating process.

Harvest Samples

Next, walk the same path again and revisit flagged areas. Harvest samples only from flagged areas that you still feel are representative of the entire bed. Being consistent in site selection is critical to accurate results.

Hand pick all healthy fruit that have obviously grown since bloom and should make it to harvest; no pinheads.

PREDICTING NUMBER AND SIZE OF FRUIT AT HARVEST

Count and Weigh

Fruit number per square foot is the most important number. Fruit size in August may indicate fruit size at harvest, but we have not yet been able to confirm this relationship. Therefore, August fruit weight is not used to estimate now, but may be in the future.

For each sample, count and then weigh all fruit. When finished, calculate average berry number and the average sample weights for each Indicator Bed. To determine the average berry weight, divide the average berry number by the average sample weight.

Summarize Data

Calculate the average overall berry number and weight per berry averages for each Management Area.

CROP ESTIMATION CALCULATIONS

Calculated Estimates

Method 1: For each Management Unit, calculate the projected change in yield from the previous year.

$$\frac{\text{(last year's yield in bbl/acre)}}{\text{(last year's fruit/sq.ft.)}} \times \text{(this year's fruit/sq.ft.)} = \text{this year's est. yield in bbl/acre}$$

Example: From Table 1, using Ben Lear

$$\frac{\text{(155 bbl/acre in 1990)}}{\text{(153 berries/sq.ft. in 1990)}} \times \text{(189 berries/sq.ft. in 1991)} = \text{191 bbl/acre est. yield (24\% increase)}$$

If you do not have any data from a previous year, use the numbers from Method 1. Each Management Unit may be different, so calculate separately.

To obtain total production figures for each Management Unit multiply the estimated yield times the number of acres in the Unit.

Method 2: More complicated and no obvious advantage over Method 1. Included for your information only.

Actual Yields

Finally, be sure to complete the estimation process by adding actual harvest data this fall for each Management Area.

UPRIGHT DENSITY DATA (Table 2)

Although not yet an accurate method to predict yield potential, Fall upright data gives valuable feedback on the impacts of cultural practices and the general reproductive potential of these marsh. Trends over several years showing increasing or decreasing upright density, fewer numbers of reproductive uprights or decreasing proportion of reproductive uprights can provide early warning signals that should not be overlooked. Study will continue on how to incorporate these fundamental cranberry characteristics into future estimates.

Table 1. 1991 Wisconsin Crop Estimation
Based on Sample Group Extrapolation to All Growers

Method 1. When weighted by acres, the average % difference in berry numbers between 1991 and 1990 indicates a 6.5% increase. Therefore, the Wisconsin crop is estimated to 1,284,000 barrels in 1991.

Cultivar	Actual Yield	1990 No. Berries	No Obs.	Berry Wt.	No. Berries	No. Obs.	1991 Berry wt.	Berries % Diff.
Ben Lear	155	153	18	0.69	189	25	0.88	+24
McFarlin	167	144	15	0.61	156	17	0.63	+8
Searles	178	155	37	0.54	154	45	0.7	0
Stevens	200	168	22	0.68	180	29	0.89	+7

Average % increase weighted by acres per cultivar = +6.5

Method 2. 1990 Actual Yield and berry numbers were used to formulate the regression equations below. The 1991 number of berries were plugged into the equations to estimate 1991 yields. The estimated yields were compared to 1990 yields and a weighted average difference calculated as done above for numbers of berries. Using the regression method, the 1991 Wisconsin crop is estimated to be up 4.8% or 1,263,620 barrels. The results are very close to the estimates above based only on numbers of berries. However, the fit of the regression lines (R^2) does not allow for a high degree of confidence in the regression estimates.

Cultivar	Regression equations: Yield = M(# berries) + b	R^2	1991 Est. Yield	1990 Est. Yield	Yield % Diff.
Ben Lear	Y = 1.21 (189) - 33	0.75	196	155	+26.0
McFarlin	Y = 1.17(156) - 0	0.59	182	167	+9.0
Searles	Y = 1.03 (154) + 19	0.51	178	178	0
Stevesn	Y = 1.06 (180) + 10	0.24	201	200	+.05

Table 2. Wisconsin cranberry crop estimate data.

Cultivar	1989 Fall Uprights/sq. ft. # beds	Repr.	Veg.	Total	1990 Aug Fruit/ft²	1990 Actual Yield Bbl/A
Searles	18	173	225	398	169	211
Stevens	12	264	174	438	196	309
McFarlin	6	220	170	390		
Ben Lear	9	192	189	381	166	201
Overall Mean		212	190	402	177	240

	1990 Fall Uprights/sq. ft. # beds	Repr.	Veg.	Total	1991 Aug Fruit/ft²	1991 Actual Yield Bbl/A
Searles	14	141	212	353	159	153
Stevens	8	200	157	357	176	242
McFarlin	4	136	237	373	118	143
Ben Lear	4	203	158	361	220	246
Overall Mean		170	191	361	168	196

	1991 Fall Uprights/sq. ft. # beds	Repr.	Veg.	Total
Searles	16	172	171	343
Stevens	9	201	118	319
McFarlin	4	195	172	367
Ben Lear	4	167	104	271
Overall Mean		184	141	325

August Fruit/ft² = 4 samples per bed.