Evaluation and Growing of Honeycrisp in New England

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Presented at the 44th Annual IDFTA Conference, February 17-21, 2001, Grand Rapids, Michigan.

Apple variety evaluation and assessment in Massachusetts have focused on identifying superior varieties that are uniquely suited to grow in New England. We have evaluated many varieties over the past 20 years. Honeycrisp is the only variety to emerge that has the quality and storage potential to seriously challenge McIntosh as the primary variety grown in our region.

HONEYCRISP ATTRIBUTES

Honeycrisp has many attributes that make it an excellent apple for extensive planting in New England.

Pleasing Taste

Honeycrisp has a unique taste that is refreshing and sprightly, but certainly not strong or assertive. The mild flavor, subtle volatiles and an appropriate balance of sugars and acids appeal to most individuals who taste it.

Explosive Crispness

The crispness of Honeycrisp is like none that we have evaluated before. If any variety deserves to be described as having explosive crispness, it certainly is Honeycrisp. It is the most distinctive feature of Honeycrisp.

Flesh Firmness on the Tree

In general Honeycrisp maintains firmness and crispness on the tree better than most varieties. We determined flesh firmness of Honeycrisp at several harvest dates over three seasons. In 1998, we harvested Honeycrisp over a 19-day period between 3 Sept. and 22 Sept. Over that period of time the firmness of Honeycrisp did not change (Table 1). Harvest of Honeycrisp took place over a 10-day period in 1999, starting on 7 Sept. and ending on 17 Sept. While there was a numerical reduction in flesh firmness, the reduction was not statistically significant. There were six harvests of Honeycrisp in 2000 starting on 5 Sept. that occurred over the next 3 weeks. There was a highly significant reduction in flesh firmness on successive harvest dates. The magnitude of the reduction in firmness is similar to what we might expect for varieties such as McIntosh or Empire. We have confirmed that in some years Honeycrisp can remain on the tree and lose little or no firmness. However, we conclude that it is unwise to depend upon Honeycrisp to remain on the tree without losing firmness, because in some years loss of firmness on the tree can be substantial and similar to firmness loss with other varieties.

Flesh Firmness and Taste Changes in Storage

Honeycrisp has a reputation for storing well and maintaining firmness in regular air storage. We harvested Honeycrisp on 3 Sept. and 16 Sept. 1998 and stored them in regular air storage at 32˚F for 18, 26 and 39 weeks. Over that storage period stored fruit lost no firmness (Table 2). This apparent lack of firmness loss in storage confirms observations that we have made over the past 6 years. It appears that the firmness of Honeycrisp going into storage is essentially the firmness of fruit that you can expect to come out of storage, provided that the temperature is at 32˚F. We have not thoroughly evaluated firmness of Honeycrisp stored at higher temperature, a strategy used in other areas in an attempt to reduce the development of soft scald in storage.

We suggest that growers educate customers that redder is not necessarily better when it comes to quality of Honeycrisp.

Firmness of fruit in storage as determined by the Effegi penetrometer does not decline with time in storage. However, most other parameters that are associated with fruit quality and taste decline with duration of storage (Table 3). In particular the acidity and astringency which are major contributors to the character and complexity of Honeycrisp taste decline substantially. The decline in crispness is probably associated with water loss, which occurs from

most apples during storage. The absence of firmness loss in Honeycrisp might be interpreted as proof that Honeycrisp can be stored for months without loss of quality. However, the significant decline in characteristics that define taste and flavor over time strongly suggests that Honeycrisp does lose quality in storage and that flesh firmness provides a false sense of security when evaluating storage potential.

PROBLEMS GROWING HONEYCRISP

The culture of Honeycrisp poses a number of challenges. While the severity of these challenges may vary from region to region, they all must be addressed to some degree by all who successfully grow Honeycrisp.

Honeycrisp Chlorosis

Honeycrisp trees develop yellow chlorotic areas on their leaves, giving the tree an unthrifty appearance. This malady was originally attributed to potato leafhopper injury. However, the prevailing opinion now is that potato leafhoppers are not the primary cause of chlorotic leaves since symptoms can appear on trees where potato leafhoppers have not fed.

Soft Scald

Honeycrisp has the potential to develop soft scald. This disorder develops in storage and afflicted fruit are rendered unsaleable. The severity of this disorder is associated with the geographical area where Honeycrisp is grown, storage at low temperature (32°F), late harvest and prestorage manipulation. Honeycrisp grown in Massachusetts can develop soft scald. However, its occurrence and the severity of the disorder are always attributed to harvesting the fruit later than is recommended for our area. It is our opinion that this disorder can be controlled by avoiding late harvest.

Aldehyde or "Off" Flavor Development

An "off" and very undesirable taste can develop in Honeycrisp while on the tree. If it does develop, it does not dissipate in storage, and it can make the fruit unsaleable. It does not develop every year, and we do not know the environmental conditions that favor its development. The development of this undesirable flavor is always associated with late harvest. Therefore, our recommendation to avoid this problem is to harvest fruit at the proper stage of maturity. Since the "off" flavor cannot be identified visually, an entire lot of fruit might have to be sacrificed.

Bitter Pit and Cork Spot

Honeycrisp develops bitter pit and cork spot in all areas where it has been tested. These are calcium-related problems that we have been able to control largely with the use of a regular calcium chloride program. While these disorders are not totally eliminated by calcium sprays, the severity is reduced to the point where economic losses are not great.

Biennial Bearing

Honeycrisp displays biennial bearing. This is particularly true of but not restricted to young trees that are just coming into production. Appropriate thinning is necessary to establish annual flowering and to minimize biennial bearing tendencies.

Red Color Development

Honeycrisp is not a high coloring variety. It does develop good red color in New England if it is allowed to remain on the tree. It is our opinion that it would be unwise to allow Honeycrisp to remain on the tree specifically to develop more red color if the delay put fruit at increased risk of developing an "off" flavor on the tree or increased susceptibility to soft scald in storage. We suggest two solutions to the red color problem. First, we suggest that growers fully employ all horticultural techniques at their disposal to improve red color on the tree. These include vigor control where appropriate, tree training to improve light penetration, appropriate dormant pruning and annual summer pruning. Second, we suggest that growers educate customers that redder is not necessarily better when it comes to quality of Honeycrisp.

Variability in Growth and Red Color

Honeycrisp in the field displays a great deal of variability in growth, the extent of fruit red color and the type of red color. Honeycrisp is considered a moderate to weak growing variety. We have experienced

TABLE 1

Flesh firmness of Honeycrisp as affected by harvest date and year.

Harvest date	Flesh firmness (lb)
1998	
September 3	15.5
September 8	15.3
September 11	15.0
September 16	15.5
September 22	15.2
Significance	NS
1999	
September 7	18.8
September 13	17.2
September 17	17.8
Significance	NS
2000	
September 5	17.1
September 11	16.0
September 14	16.0
September 19	15.4
September 21	14.4
September 26	14.2
Significance	1***

TABLE 2

Effect of length of time in regular storage on flesh firmness of Honeycrisp.

	Flesh firmness (lb)(weeks in storage)		
Harvest date (1998)	18	26	39
September 3	16.4	16.7	16.5
September 16	15.5	16.1	15.8

TABLE 3

Influence of storage duration on quality of Honeycrisp stored in air at 32°F (means of all harvests).

	Time of removal from storage			
Parameter	18 weeks	26 weeks	38 weeks	Significance[Y]
Soluble solids (brix)	12.3	11.9	11.3	*
Firmness (lb)	15.9	16.5	16.1	*
Firmness (1-5)[Z]	3.9	3.7	3.5	*
Crispness (1-5) [Z]	4.3	4.0	3.7	*
Acidity (1-5) [Z]	3.1	2.7	1.9	*
Flavor (1-5) [Z]	4.0	3.9	3.4	*
Astringency (1-5) [Z]	3.3	3.3	2.1	*
Skin color (1-5) [Z]	2.1	2.2	2.6	*
Desirability (1-5) [Z]	4.1	4.1	3.5	*

[Z] Rated on a scale of 1-5 where 1=lowest rating of the parameter and 5=the highest rating.
[Y] The effect of storage duration was significant at P=0.05 for all parameters.

vigorous, moderate and weak growth of trees. Generally this variability is not within a group of trees arriving from a nursery but between lots of trees ordered. The differing vigor has not been explained by soil or soil preparation. It is difficult to plan spacing of a planting if the scion vigor is not predictable.

There is variability in the extent of red color of fruit at harvest and whether that red color is blush or striped. Changes from year to year in color make marketing difficult and it will confuse consumers in identifying Honeycrisp if the amount, intensity and pattern of red color are changing. Resolving growth and red color variability should be a high priority.

Large Fruit Size

Honeycrisp is naturally large. This situation will be partially self-resolving since fruit size on trees generally goes down as trees mature and settle into more annual production. However, it remains a large-fruited variety, and marketing should take advantage of that fact.

Decay on the Tree and in Storage

Honeycrisp develops more decay on the tree than most mainstream varieties. When placed in storage it also has a tendency to have a larger percentage of fruit develop decay (Table 4). Therefore it is quite important to maintain a good fungicide program and to dip fruit in fungicide before placing it in storage.

Fruit Cracking Near Harvest

Fruit will crack, especially in the pedicel end, in some years. Increased cracking is associated with rain just prior to and during the harvest season.

Crop Load Adjustment

The first attempt at crop load adjustment is usually with the use of chemical thinners. The effectiveness of chemical thinners is influenced by many factors which frequently do not coincide. If crop load is not reduced enough with chemical thinners, we feel that adjusting crop load by hand thinning is appropriate. While hand thinning may aid only marginally in increasing return bloom, it can help substantially in improving fruit quality and taste. Fruit from trees with light, optimal and heavy crop loads in 1998 was evaluated out of regular air storage at 32˚F (Table 4). As suspected, fruit weight was related to crop load. Fruit soluble solids were dramatically lower on heavily cropped trees. Quite unexpectedly, firmness on heavily cropped trees with small fruit was also lower. We evaluated fruit for taste and other organoleptic qualities. Fruit from heavily cropped trees was judged to be less crisp, have lower acids and astringency and have lower flavor and overall desirable rating. It would be quite unwise to attempt to reduce bitter pit, cork spot and large fruit size by allowing trees to carry a heavy crop load, not only because of the risk of reduced return bloom but also because of the damaging effect that it would have on taste, color development and fruit quality.

Uncertainty about Time of Harvest

We have evaluated most of the parameters used to determine optimal time of harvest of Honeycrisp. Ethylene evolution, which signals the onset of the ethylene climacteric, is generally considered to be the most accurate method for determining the time of ripening. However, with Honeycrisp the onset of the ethylene climacteric frequently occurs before significant red color develops and before fruit has developed the flavor characteristic of Honeycrisp. The amount of ethylene generated appears to have little relationship to the stage of maturity and the appropriate time to harvest. Good red color development often lags the appropriate time to harvest by a week or two. Therefore, it is an inappropriate indicator of the time to harvest.

TABLE 4

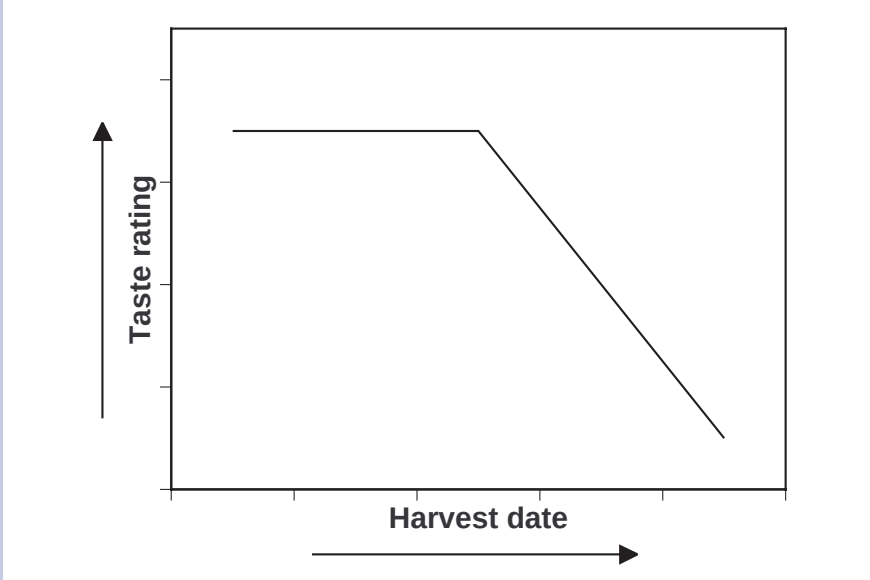
Effect of crop load on poststorage quality of Honeycrisp, 1998.

	Crop load		
Parameter	**Light**	**Optimal**	**Heavy**
Fruit weight (g)	252.0	229.0	158.0
Soluble solids (%)	14.1	12.1	10.6
Firmness (lb)[Z]	17.6	16.2	15.5
Crispness[Y]	4.3	4.0	3.9
Sweetness[Y]	1.8	1.8	1.7
Acidity[Y]	3.0	2.7	2.4
Flavor[Y]	4.3	3.8	3.4
Astringency[Y]	3.5	2.8	2.7
Desirability[Y]	4.2	4.1	3.8
Bitter pit[X]	33.0	21.0	6.0
Decay[X]	22.0	18.0	4.0

[Z]Firmness measured on cold fruit immediately after removal from storage.
[Y]Rated on a scale of 1-5 where 1=lowest rating of the parameter and 5=highest rating.
[X]Denotes percent of fruit affected.

FIGURE 1

Schematic illustration to show the relationship between harvest date and taste, starting when fruit has an average starch rating of 5 to 6 on the Cornell Generic Starch Chart.



The amount of starch in fruit and the pattern that is left as starch breaks down have emerged as the best indications of the time to start harvesting Honeycrisp.

It has been our experience that, when the average starch rating reaches between 5 and 6 on the generic starch chart developed at Cornell University, it is appropriate to start to harvest Honeycrisp. At this time starch rating of individual fruit may vary widely, with ratings as low as 2 and as high as 8. Honeycrisp will require an additional 1 or 2 harvests within the next 5 to 10 days. If fruit is allowed to stay on the tree for a long period of time after, it will start to lose the characteristic Honeycrisp taste and flavor (Fig. 1).

The time after initial harvest when taste starts to decline varies from year to year, but we generally have noted a reduction in taste on the later harvests. The fruit that is harvested late generally shows a ground color change from green to yellow-green or yellow.

It is our opinion that growers should resist the temptation to delay the start of harvest or make subsequent harvest based solely upon the development of red color. A delay in harvest once starch ratings reach 5 to 6 may jeopardize fruit in three ways. A delay in harvest increases the likelihood that fruit will develop soft scald in storage and develop an "off" flavor on the tree. Further, late harvested fruit may have reduced flavor, and taste will decline more rapidly in storage.