Managing Pruning and Fertilization of Honeycrisp to Balance Growth, Cropping and Fruit Quality

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Bitter pit in Honeycrisp is affected by tree vigor which in turn is affected by both pruning and fertilization levels. Thus, to achieve a balance between vigor and fruit quality we must manage both pruning and fertilization in a coordinated manner. When deciding how severely to prune a Honeycrisp tree, we should consider flower bud number per tree and also leaf nutrient levels and the peel sap nutrient values, which we have been collecting statewide over the last 2 summers.

From leaf analysis data we often see that some blocks are high in nitrogen (N) and others are closer to our recommendation. With potassium (K) some blocks are high and should receive reduced or no K fertilization. With calcium (Ca) most blocks need additional lime or gypsum. The fruit peel sap data we have collected indicates that many blocks have too high of a ratio of K/Ca and N/Ca indicating the need to better manage all three nutrients. We have recently published a Fruit Quarterly article (Cheng and Sazo, 2021 Fruit Quarterly Winter Issue) where we have suggested modified leaf nutrient targets for Honeycrisp compared to other varieties such as Gala.

First let us address suggested fertilization strategies for Honeycrisp. The recommended levels of N, K, and Ca for Honeycrisp are different than the suggested levels on the standard leaf analysis we use for most other varieties. For N we recommend a leaf level of 2.0% (this is similar to what we recommend for McIntosh). For hard varieties like Gala, Delicious, Empire, Rome's etc. we recommend a leaf level of 2.25% but for Macs we have always recommended a lower level of 1.9-2.0. Honeycrisp should be managed like Macs in terms of N. If you have leaf analysis results from last summer (leaf samples take in early to mid-July) then use the following three rules to determine N fertilization rates.

-For blocks with **leaf N lower than 2.0%** we suggest 20 to 50# of N per year to keep the tree vigor from falling too low. If tree vigor falls too low then no new renewal shoots develop from limb renewal pruning cuts.

-For blocks with a **leaf N level between 2.0 and 2.25%** we suggest slightly lowering the rate of N from last year's to allow a gradual lowering of leaf level to the 2.0% target.

-For blocks with a **leaf N level >2.25%** we suggest no ground applied N.

K fertilization of Honeycrisp is often tied to increased bitter pit; therefore K fertilizers must be applied with caution and only when leaf analysis results suggest additional K is needed. Based on our recent work published in the Quarterly winter issue 2021, we developed a new recommended leaf K levels of 1.0%. This is lower than other varieties such as Empire and Gala where we strive to elevate leaf K levels to 1.35-1.8%. This high K level for those varieties helps give large fruit size but with Honeycrisp that high of K gives excessive bitter pit. Based on leaf K levels, we suggest you use the following three rules to determine K fertilization rates.

-For blocks with **leaf K lower than 1.0%** we suggest 60# of K_20 per year to keep fruit size from being too small.

-For blocks with a **leaf K level between 1.0 and 1.2%** we suggest 30# of K_20 per year to maintain good fruit size.

-For blocks with a **leaf K level >1.2%** we suggest no K fertilization until leaf level drops below 1.2%.

Ca fertilization is achieved by additions of lime before planting and at bi-annual intervals after planting. Honeycrisp requires higher levels of Ca than other varieties and we recommend a level of 2.0% which is on the high end of the recommended range for Ca level in the leaf. We have been suggesting for the last 2 years to add lime even if soil pH is in the recommended range (between 6.5 and 7.0). In a survey we did, the best performing blocks had pH of ~7.2 and about 5000# of Ca per acre from a soil test. Based on leaf Ca levels, we suggest you use the following four rules to determine lime fertilization rates.

-For blocks with **leaf Ca lower than 1.3%** we suggest 4 tons of lime every other year to raise soil calcium level even if pH goes to 7.1 or 7.2. If soil pH goes above 7.2 then add gypsum instead of lime.

-For blocks with a **leaf Ca level between 1.3 and 1.8%** we suggest 2 tons of lime every other year to raise soil calcium level even if pH goes to 7.1 or 7.2. If soil pH goes above 7.2 then add gypsum instead of lime.

-For blocks with a **leaf Ca level between 1.8 and 2.0%** we suggest 1 ton of lime every other year to maintain soil Ca.

-For blocks with **a leaf Ca greater than 2.0%** we suggest no lime but add gypsum until soil Ca level is ~5000 lbs. per acre.

Next let us address pruning, vigor and bitter pit. Excessive pruning does stimulate vigor and excessive vigor results in more bitter pit. We judge vigor based on length of shoot growth.

- If shoot growth on the ends of Honeycrisp branches is **more than 15 inches long** then vigor is too high, and this is associated with more bitter pit. In this case light pruning is suggested. If flower bud load is high (due to the on-year) then prune lightly but remove buds by spur pruning to get down to the required flower bud number.

- If shoot growth is **between 8" and 12"** then vigor is moderate, and with proper management of N, K and Ca, this level of shoot growth is expected to have little effect on bitter pit incidence. In this case normal pruning is suggested. If flower bud load is high (due to the on-year) then prune by removing 1-2 branches and by columnarizing the remaining fruiting branches and then remove spurs to get to the required flower bud number.

-If shoot growth is **less than 8"** then vigor is low and we get almost no renewal shoots from limb renewal cut even if we leave long stubs. In this case, increased N fertilization is suggested and a reduction in flower bud number through spur pruning is needed to stimulate a little more shoot growth.

The effect of both pruning and fertilization levels are manifested in bitter pit incidence but also in biennial bearing. Thus, we must manage both pruning based on tree vigor and fertilization based on leaf nutrient analysis to achieve a balance between vigor and fruit quality. The rules for N, K, and Ca fertilization and pruning severity we have suggested should be considered for each block based on both the tree vigor level (shoot length) and the leaf and fruit nutrient data.

This year where flower bud numbers are expected to be high since it is an "on year", precision pruning will be essential to controlling biennial bearing but it must be done without increasing tree vigor by excessive pruning. Nevertheless the precision pruning strategy to a specific target bud number will be essential to overcome biennial bearing. This strategy is warranted as long as

vigor was not high last year (greater than 12” of shoot growth). The pruning severity in the “on year” should be coupled with the proper amounts of N, K, and Ca as suggested from leaf analysis. The precision pruning protocol requires the grower to first calculate the number of flower buds to leave after pruning (target fruit number X 1.8) followed by the removal of 2-3 large limbs, columnarizing the remaining branches and the reduce flower bud number to the target by spur pruning.