Precision Crop Load Management

Terence Robinson
Dept. of Horticulture, NYSAES, Cornell University
Geneva, NY 13345

Crop load management is the single most important yet difficult management strategy that determines the annual profitability of apple orchards. The number of fruit that remain on a tree directly affects yield, fruit size and the quality of fruit that are harvested, which largely determines crop value. If thinning is inadequate and too many fruits remain on the tree, fruit size will be small, fruit quality will be poor and flower bud initiation for the following year's crop may be either reduced or eliminated. Consequently, poor or inadequate thinning will reduce profitability in the current year and result in inadequate return bloom in the following year. Over thinning also carries economic perils since yield and crop value the year of application will be reduced and fruit size will be excessively large with reduced fruit quality due to reduced flesh firmness, reduced color and a much-reduced postharvest life. Thus, management of crop load is a balancing act between reducing crop load (yield) sufficiently to achieve optimum fruit size and adequate return bloom without reducing yield excessively (Fig. 1).

Economic Impacts of Crop Load

Calculations of crop value at various crop load levels using fruit size and yield as the main variables has shown in a number of experiments to that the relationship of crop value to crop load is curvilinear (Fig. 1). At very high crop loads (unthinned Gala trees) fruit size is often very small but yield is very high. Crop value in this situation is almost zero since the value of the fruit is often exceeded by the packing and storage costs. When crop load is reduced to more moderate levels through thinning, then crop value rises dramatically even though yield is lower due to larger fruit size, which has greater value. At some point crop value peaks and then with further reductions in crop load crop value declines due to lower and lower yield. Although fruit size continues to increase it does not compensate for the loss in yield. It is striking how narrow the crop value peak is in many situations. Identifying and then achieving this optimum crop value is often very difficult for apple growers. It is difficult for fruit growers to know the economic impact of not achieving the optimum crop load without having various levels of thinning each year to construct the curves shown in Fig. 1. The difference between the optimum crop load and under thinning or over thinning can sometimes be a difference of thousands of dollars per acre. Thus growers often fail to capture the full crop value possible without knowing how much "money they left on the table". More precisely managing crop load will help growers achieve the optimum crop load and maximize crop value.

Management Approaches to Precisely Managing Crop Load

There are 3 management practices that have a large effect on crop load: 1) pruning, 2) chemical thinning and 3) hand thinning. In recent years growers have relied primarily on chemical thinning to adjust crop load with a lesser reliance on hand thinning to reduce labor requirements. In other countries hand thinning is still the primary means of adjusting crop load. A few progressive growers have also begun to view pruning as a means to adjust crop load.

Precision crop load management utilizes all three management approaches to adjust crop load. It begins with precision pruning to leave on the tree a preset bud load, followed by

precision chemical thinning to reduce initial flower number per tree to as close as possible to a preset fruit number per tree and ends with precision hand thinning to leave a precise number of fruits per tree.

The economic impacts of achieving the proper crop load each year are large and justify a more intense effort to manage crop load to the optimum fruit number each year. In the next sections we will consider each of the three management tactics to precisely manage crop load.

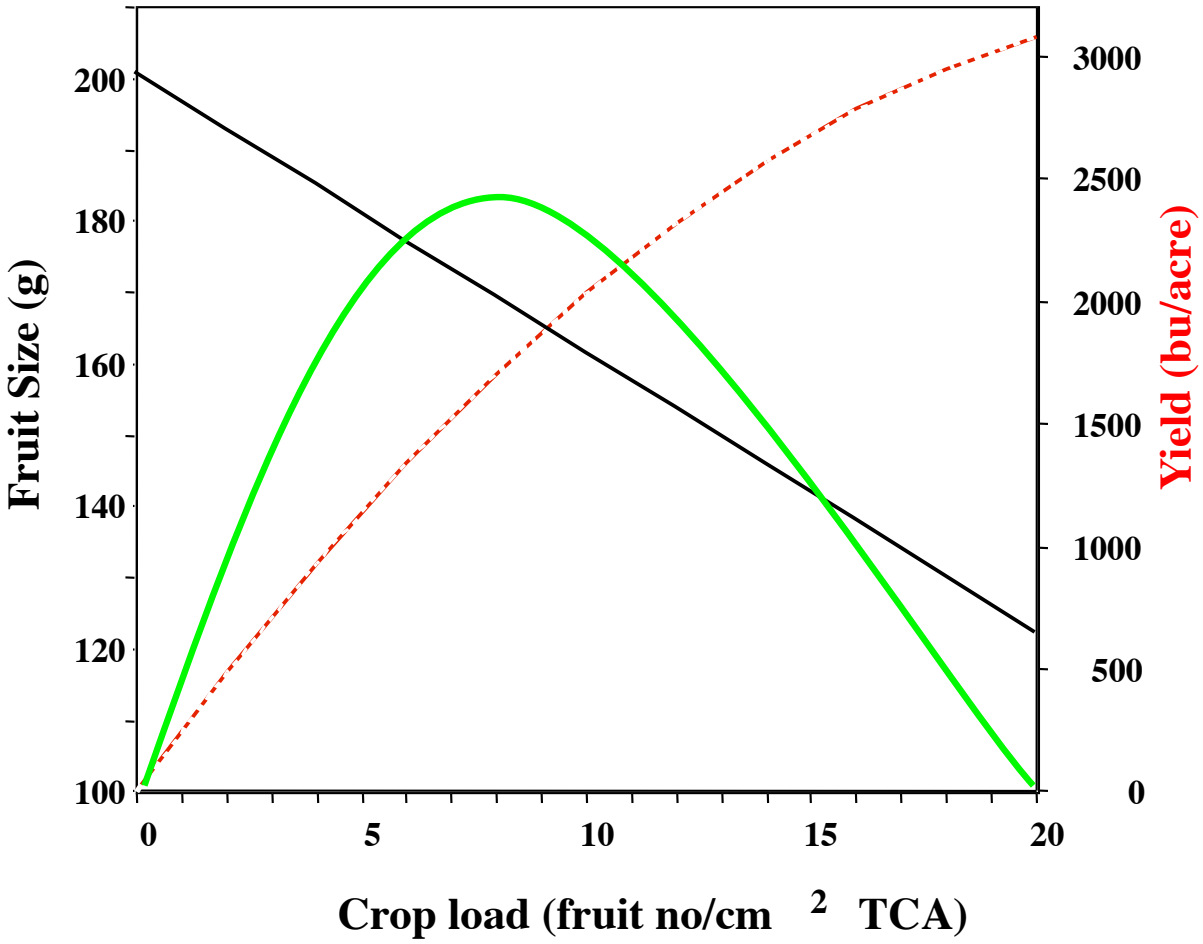

Fig. 1. Counter balancing responses of Gala fruit size and yield to crop load with the curvilinear response of crop value to crop load showing an optimum crop value at a crop load of ~8-9 fruits/cm^2 TCA.