FACTORS AFFECTING FRUIT SET IN PEAR

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As with apple, fruit set of pear can be low and unpredictable. Many factors are involved in determining how many fruit will set and these include the weather, bloom date, pollinator activity, flower attractiveness, pollinizer choice, tree health and nutrition, and light penetration into the tree canopy. Poor set results when any of these factors is less than favorable. Understanding how each of these factors contributes to fruit set can remove some of the unpredictability.

How much fruit is needed for a good sized crop load? A good level of fruit set is 30 fruit for every 100 flower clusters when bloom is heavy. More than this is needed when bloom is light. Another way to measure set is on a limb cross-sectional area basis. When there is one fruit for every cm^2 limb cross-sectional area, crop load is light. A moderate crop load has 2-3 fruit per cm^2 limb cross-sectional area and a heavy one has 4-5 fruit per cm^2 limb cross-sectional area. To measure fruit set, tag a limb at bloom and count the number of flower clusters. After June drop, count the number of fruit on the same limb. Also count the number of seeds per fruit in several fruit. A seed count of 4-5 per fruit indicates good set. Less than two per fruit indicates poor pollination. When fruit set and seed count are greater next to pollinizers, poor set is most likely due to pollination problems. When set is uniformly low throughout the orchard, non-pollination factors such as deficient N or Zn, or winter injury, may be the cause.

Early Bloom and Temperature

Because pears bloom earlier than apples, weather during bloom is typically more unfavorable for pollination. Temperatures are generally cooler during pear bloom. As a consequence, bee activity may not be enough for adequate set. Honey bees are not active when temperature is below 50°F, so hives should be protected from wind, but in the sun so that they warm up quickly. Small orchards near uncultivated land may have plenty of feral bees, but populations vary from year to year making them unpredictable. Large orchards or orchards with no feral bees should have at least one strong hive per acre in the orchard during bloom. High populations of bees increase the size of the bee's working area which improves the chance of cross pollination.

Fertilization is also favored by warmer temperature. Once pollen is transferred to the flower, it must germinate and grow through the style of the flower to reach the ovule where fertilization takes place. This happens very slowly when the temperature is cold. At 40°F, it takes 12 days, but at 60°F, it happens in two days. This is important because the ovule will live an average of 11 days after the flower opens. So, at cold temperatures, the ovule will die before the pollen tube reaches it, so there is no fertilization.

Flower Attractiveness

Pear flowers are not very attractive to nectar-collecting bees. This is because their nectar is lower in sugar than that of flowers of many other plants. Consequently, pollination depends on pollen-collecting bees.

Pollinizer Trees

Pears are self-sterile, like apples, so they require cross pollination with another variety. In some instances, parthenocarpic (seedless) fruit set occurs without pollination. This occurs when the average temperature during bloom is 70-85°F. These temperatures do not normally occur in New England during pear bloom, so parthenocarpic fruit set does not normally occur. Pollinizer trees are required for good-sized crops.

When selecting a pollinizer variety, it is important to be aware of two problems: varieties that have sterile pollen, and incompatibility. Two varieties that are known to be sterile are Magness and Waite. They are useless as pollinizer trees. In addition, Bartlett and Seckel are incompatible and will not be pollinated by each other. They will pollinate other varieties, however. In addition, varieties that bloom at the same time should be used so that pollen is available when flowers are open.

In regions where bad weather occurs frequently during bloom, close spacings of pollinizer trees can increase set. A recommended spacing is making every third tree in every third row a pollinizer tree.

Nutrition

All essential nutrients are important to fruit set when they limit tree health, but N, B, Zn and Cu deficiencies appear to be the most important when it comes to fruit set. Boron deficiency lowers fruit set since it is essential for pollen growth. Zinc deficiency interferes with normal bud development and leads to poor flowering. The role of copper in fruit set is not clear, but is essential for all energy-requiring processes. Both flower and fruit growth are energy-requiring processes and this may be why Cu is involved in fruit set. Deficient levels of nitrogen reduce the life span of ovules so there is a greater chance that they will die before being fertilized, particularly when it is cold during bloom.

Pears require nitrogen every year, but the amount to be added depends somewhat on how much N is already in the soil. Infertile soils can supply 30 lbs. actual N/acre to pear trees, so 30 lbs/acre actual N should be applied to pear trees growing on them. Soils that supply 50 lbs/acre should have 20 more lbs/acre added. Soils that supply 65 lbs/acre should have 10 lbs/acre added. Soils that supply 80 lbs/acre should have 3 lbs/acre added. The amount of N in soil is somewhat related to the amount of organic matter. In general, for each percent of organic matter present in soil, there is a supply of 20 lbs N/acre. Soils with more than 4% organic matter need little or no added N. Deficiencies or excesses of N, as measured by foliar analysis, will alter the amount of N that should be added.

Foliar levels that should be maintained are similar to levels recommended for apple. A N level below 2.6% is recommended due to pear's susceptibility to fireblight. The ratio of N/K should be near 1.2, but not above 1.4 in orchards with shoot blight problems.

Optimum Foliar Levels of Nutrients for Pear (From Shear and Faust, 1980).	
Nutrient	Sufficiency Range
N	1.8 - 2.6%
P	0.12 - 0.25%
K	1.0 - 2.0%
Ca	1.0 - 3.7%
Mg	0.25 - 0.90%
B	20 - 60 ppm
Mn	20 - 170 ppm
Zn	20 - 60 ppm
Fe	100 - 800 ppm
Cu	6 - 25 ppm

Crop Load

This year's crop load can influence next year's in two ways. Heavy crops lead to a hormone imbalance that causes biennial bearing. Pear is biennial for the same reason as apple. Seeds release a hormone, gibberellin, that moves into buds and prevents them from forming flowers, so they remain vegetative. With a heavy crop there is more of this hormone moving into buds, so fewer of them develop flowers. The other way a heavy crop reduces fruit set is by depletion of stored carbohydrates and nutrients. This weakens the tree and leaves less resources available for early fruit growth. Since there is only a very small leaf canopy present at bloom, early flower and fruit growth depend on stored nutrients until the leaf canopy develops.

Light Penetration into the Tree Canopy

Sufficient fruit set depends on an adequate supply of light. About 60% of full sun is needed for maximum fruit set. Areas of the tree canopy that are shaded by other limbs generally have poor set. Light penetration is maintained by annual pruning of unproductive shoots and limbs, and by avoiding pruning cuts that overstimulate regrowth. Dwarfing rootstocks improve light, but the ones that are available are not well tested in New England growing conditions.

Mite Damage

A heavy mite infestation can lower next year's fruit set for the same reason that heavy crops and excessive shading do. They weaken the tree and reduce stored reserves. Mites damage leaves, which decreases photosynthesis. When heavy mite damage occurs early in the season, it does more damage to the tree than when it occurs later.

Summary

Some of the factors that influence fruit set, such as the weather, are beyond our control. However, several factors are within our control and can be managed to promote fruit set. Bringing in enough bee hives and good selection of pollinizer trees can favor pollination. Managing tree nutrition, pruning to maintain light and controlling the level of insect damage to foliage are practices improve tree health and favor fruit retention.