

Important Steps to Orchard Replant Success

Many factors influence orchard replant success and these can be divided into two very broad categories that include economics and orchard renovation.



The economics of orchard re-establishment include a number of issues that need to be decided before the trees are even ordered including cultivar, rootstock, training system, trees per acre and method of orchard renovation (e.g., soil fumigation, rotation crops, etc.). Major factors that influence the economics of orchard re-establishment include prices, yields and costs. Interactive computer programs are available to help make orchard replacement decisions.

What is a Replant Problem?

The performance of a replanted orchard is determined by the site, cultural practices and soil-borne factors that affect tree growth and productivity. Unfortunately, many replanted orchards do not perform to their full potential because soil conditions are not optimal and the term “Replant Problem” is frequently used to explain the poor performance of new orchards. In order to make informed decisions on how best to prepare or renovate a replant site it is first necessary to have some understanding of what causes replant problems.

The term “replant problem” is actually an umbrella that covers a host of soil-borne factors that negatively affect tree growth and performance. These factors develop over years of previous orchard production and result from cultural practices and changes in soil ecology. Many factors associated with replant problems are understood but some are not. Some replant

problems are caused by a single or primary agent (e.g., stem pitting) while others result from a combination of several factors (e.g., pH, nutrient imbalance, soil compaction).

Orchard Replant Problems

- Poor Tree Establishment
- Stunted Growth
- Reduced Yield
- Shortened Productive Life

Biotic Factors

A replant problem caused by a biotic agent is often referred to as a replant disease. The agents responsible include pathogenic fungi, bacteria, parasitic nematodes and virus. Some organisms such as the fungus *Armillaria* and the root-lesion nematode are highly pathogenic and will infect healthy seedlings while weaker pathogens often require conditions that predispose trees to disease such as cold injury, poor nutrition or wounds caused by nematode feeding. Several complex diseases require pathogen interaction such as virus transmission by dagger nematodes.

A few diseases such as stem pitting and root rot are lethal but most are debilitating resulting in trees that simply can not grow or yield to their full potential. Replant diseases are insidious because they may occur on sites where the previous orchard appeared healthy. This can happen because mature trees with an extensive and well-developed root system can tolerate a low level of disease and pathogen populations can build up undetected. It is when the old orchard is removed and new trees are replanted that the pathogens overwhelm the small root system of the young trees.

Abiotic Factors

The abiotic factors that contribute to replant problems develop slowly over the life of one or more previous orchards on the same site. Part of the problem can be traced to soil degradation due to the repeated use of herbicides in the tree row. Without a living ground cover, the level of soil organic matter declines with a concomitant increase in soil compaction. This not only negatively affects the growth of young roots but also makes the site more prone to erosion.



There are also problems of a chemical nature and while some are well documented, others are not. It is known for example that years of orchard production can result in nutrient imbalances and less than optimum soil pH. These issues can easily be detected by standard soil tests. However, other potential problems include residual herbicides and the release of allelochemicals from decomposing old roots that may inhibit root growth of young trees. These problems are not easily identified or corrected.

Remediation of a Replant Site

Remediation of a replant site is an attempt to re-establish optimum soil conditions for healthy tree growth. Therefore, once the decision to replant has been made, every available resource should be used to identify potential biotic and abiotic problems so proper corrective measures can be employed. A replant site evaluation should include a nematode assay, a soil test (including organic matter and pH), a review of the cropping history, an evaluation of future cropping plans and consultation with a specialist.

Soil samples for both the nematode assay and nutrient analysis can be taken at the same time but need to be handled differently. These tests can be performed before the old orchard is removed and the sooner the results are known the more time a grower has to consider options for renovating the site. It may be worthwhile to have the soil tested even if the decision to replant is one or two years in the future. All replant sites should be tested for both nematodes and fertility.

Review of Cropping History and Plans

An evaluation of the cropping history can also help reveal the potential for certain replant problems. For example, assays to detect pathogenic fungi in the soil are not readily available but by knowing if an orchard has a history of soil-borne fungal disease a level of risk can be estimated. If the risk is unacceptably high, fungal control needs to be incorporated into the orchard remediation plan such as crop rotation with wheat, rapeseed or other annuals. Compost is also being evaluated for its ability to suppress soil fungi.

A review of the future cropping plans is an integral part of the site evaluation process. The crop to be planted, the rootstock selected and the spacing of trees may all play a role in determining the need for site remediation. A few examples will illustrate this point: (i) A site infested with root-knot nematode is a serious threat to peach but not to apple. (ii) An apple orchard infested with dagger nematode is at risk for union necrosis only if the rootstock is susceptible to tomato ring spot virus and the scion is resistant. (iii) If the spacing of a new orchard puts some trees in the old tree row and some in the old drive row, it is likely that trees in the old tree row will be stunted.



Aerial photo showing pattern of missing and dying trees. Pockets of affected trees are suggestive of a disease agent.

Important Renovation Steps

Orchard renovation begins with the removal of the old trees. At this step it is important to pull up as much old root debris as possible. Root fragments that are infected with fungi, nematodes or virus serve as reservoirs and carry disease over into the new planting. Root sections can survive for long periods and may send up suckers. In some cases it may be necessary to treat with herbicide to eliminate problems.

It is important that growers tailor their renovation plans to meet specific orchard needs. It is recommended that a replant site remain out of tree fruit for at least two years with several crop rotations. A period under crop rotation will help with the addition of organic matter and also provides an excellent opportunity to incorporate fertilizer and lime, get weeds under control and eliminate virus reservoirs. Depending upon the specific cover crop or green manure, the rotation crop can also help control plant-parasitic nematodes and soil-borne fungi. Leaving a site fallow is not recommended because of the weed, nematode and virus pressure that can develop.

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Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

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