



Use of Legumes in Pecan Orchards

Becky Carroll

Sr. Agriculturist
Extension Fruit & Pecan

Oklahoma's approximately 80,000 acres of managed pecans contribute about \$17 million each year to the state's agriculture economy. Acreage estimates of unmanaged native pecans in Oklahoma vary but are conceded to be in excess of 100,000 acres. Most of Oklahoma's pecans are from improved native groves, most of which also support livestock during part of the season.

A mature pecan orchard consists of two separate but interrelated ecosystems. The orchard floor provides a working surface for orchard operations and influences activities in the tree canopy which produces the pecan crop. Oklahoma's planted pecan orchards usually consist of native vegetation on the orchard floor with a clean strip 6' to 12' wide along the tree row. Vegetation weed-free strips are normally maintained with herbicides while the vegetation in row middles is maintained by mowing. The mowed sod middle prevents or reduces erosion, improves wet weather trafficability for spraying and other orchard operations and can provide forage for grazing livestock. Due to irregular tree spacing improved native groves often utilize sod culture throughout.

A good orchard floor cover does not compete excessively with trees for moisture or nutrients and is compatible with orchard insect populations. The importance of vegetation management in the orchard floor is documented. Weed competition with tree roots is significant throughout the tree life. Weed competition in newly planted pecan orchards decreases survival and severely retards tree growth. Weed competition even with mature trees can reduce tree growth and yield as well as contribute to alternate bearing. Pecan trees have an extensive root system including a tap root which penetrates as deep as the soil structure and water table will permit. The bulk of the pecan's nutritional needs, however, are met by small feeder roots which are located near the soil surface. It is these roots which come into direct competition with vegetation on the orchard floor. An effective orchard floor management program integrates the needs of the cover with the needs of the trees with respect to rooting depth, extent of rooting and time of year when water and nutrient demand peak.

Sod-free culture in pecan orchards is discouraged due to increased erosion, decreased wet weather accessibility in the orchard and a poor harvest surface. A vegetation-free orchard floor also loses moisture faster than a properly managed sod and is dusty during harvest. Tillage equipment is prone to inflict injury to trunks and frequently damages shallow feeder roots which provide nutrients and water to trees. A well managed orchard floor cover facilitates harvest and provides grazing for livestock.

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Nitrogen Needs of Pecans

Mature pecan trees require 100 to 150 lbs. of nitrogen (N) per acre annually to grow and produce properly. Adequate N must be available at budbreak to support vegetative growth and leaf expansion which occurs immediately and relatively rapidly after budbreak. The nutritional needs of the orchard cover crop as well as the trees must be in concert. Ideally, peak demands of each would occur at different times of the year.

Insects

Hundreds of species of arthropods, i.e. insects, mites and spiders, are present in pecan orchards. Fortunately, most are noninjurious to the pecan and many are beneficial; feeding on those which inflict damage to pecan tree leaves, twigs or nuts.

Harmful insects include various kinds of aphids, caterpillars and true bugs as well as phylloxera, mites, spittlebugs and weevils.

Nature provides some natural pest control by the presence of insects which feed on other arthropods. Some of the most common predators include various species of lady beetles, lacewings, assassin bugs, spiders, and others. See Extension Fact Sheet EPP-7307 for additional information on beneficial insects.

An effective orchard pest management program manages the orchard ecosystem to attract beneficial insects to the orchard and retain them in numbers sufficient to combat infestations of harmful insects. This usually involves provision of a food source, e.g. aphids. The beneficials must then follow the food source, e.g. aphids, up into the trees as the ground cover growth slows or goes dormant.

Benefits of Legumes

Legumes as the ground cover in pecan orchards offer two advantages over typical grass ground covers. First, N is fixed, i.e., removed from the air by bacteria associated with the legume roots and utilized by the legume. When the legume root and top decompose, stored N in the legume is released and available to the pecan tree. Second, certain legumes harbor large aphid densities which attract beneficial insects that feed on aphids and other insects. When the aphid densities on the legume decline or the legumes senesce, the beneficial insects associated with the legumes seek another food source such as aphids and other pests in the pecan canopy. Therefore, proper selection and management of legumes as the orchard floor cover may reduce or eliminate the need for supplemental

N fertilization and may reduce the number of pesticide applications necessary for pecan production.

Characteristics of Legumes

Certain characteristics of legumes are more compatible with pecan production. First, a cool season legume is less competitive with the trees for soil moisture than a warm season legume, plus the cool season legume would stimulate an earlier increase in the beneficial insects. The legume should be tolerant to both sun and shade. Many pecan orchards are prone to flooding; therefore, flooding tolerance is desirable. Also, the legume must not cause an increase in undesirable insects, such as stink bugs, while attracting beneficial insects. The legume should also be capable of fixing large quantities of N. Additionally, the legume must be capable of withstanding the traffic associated with orchard maintenance and harvesting.

Legume Selection and Establishment

Arrowleaf is a heavy forage producer, while 'Dixie' crimson and 'Kenland' red clovers produce more N. Larger scale tests indicate total N production from some legumes exceeds 100 lbs/A. Aphid densities tend to be higher on crimson, arrowleaf, subterranean and red clovers. Beneficial Lady beetle adult and larval densities are higher on crimson, red, and arrowleaf clovers. Other prominent beneficials found in clovers include green lacewings, soldier beetles, predacious stink bugs, damsel bugs and hover flies. As the legumes decline with the onset of hot weather in June the beneficials move up into the trees and feed on aphids.

White clover are more flood tolerant than red and annual clovers.

Perennial legumes, e.g. red and white clover, also appear to be better adapted over a wide range of soils including relatively heavy silt loam soils than are annuals. Perennial legumes may attract stink bugs, which can damage pecans by feeding on the nuts. To avoid damage, legumes should not be mowed between August 1 and shuck split. This should retain stink bugs in the ground cover rather than forcing them into

the trees. Also, trees should be scouted carefully to determine if stink bug control becomes necessary.

Effective legume mixtures for pecan orchards are shown in Table 1. Due to seed size differences between legume species, separate seeding operations for each legume are required to achieve the recommended seeding rates. Legume seed should be inoculated with the appropriate *Rhizobium spp.* prior to planting. Soil, seed contact, and moisture are essential for successful establishment. Existing stubble should be mowed or grazed closely prior to seeding. Seeding with a pasture drill is generally the most dependable. However, light disking prior to broadcast seeding followed by rolling can also result in acceptable stand establishment. Growers should soil test and ensure adequate phosphorous and potassium prior to seeding. Additional information on legume establishment is contained in Fact Sheet PSS-2585, "Forage Legumes for Oklahoma."

Either annuals or perennials can be used. Vetch usually lasts longer than the clover. Reseeding of crimson clover may be needed each fall. In the perennial mix, the white clover produces more N while the red clover attracts more beneficial insects. Close mowing or grazing in late summer improves stand return in most cases.

Grazing livestock on orchard legumes reduces N availability to the pecans, but legumes provide a high quality forage and rapid weight gain for cattle. Growers who choose to graze should exercise due caution with respect to bloat prevention. Consult your county extension educator in this regard.

Whether or not orchards are grazed, a leaf sampling program should be followed to ensure that the legumes are meeting the N needs of the trees. Broadcast N applications on actively growing legumes tend to reduce the legume stands and decrease the amount of N fixed by the legume. If the trees require supplemental N applications, it should be broadcast in early June when legumes begin to senesce or become inactive during the summer. Information on pecan leaf sampling is in Fact Sheet HLA-6232, "Fertilizing Pecan and Fruit Trees." Legumes must also be utilized in conjunction with a good insect scouting program to determine the need for pesticide applications.

Table 1. Recommended annual and perennial legumes for use as pecan orchard cover crops.

Legume	Habit	Seeding rate (lb/A)	Approximate seed cost (\$/lb)	Seeding time
'Dixie' Crimson Clover	Annual	10	2.50	early Oct.
+ Hairy Vetch	Annual	8	2.00	early Oct.
'Kenland' Red Clover	Perennial	8	2.25	early Oct.
+ 'Louisiana S-1' White Clover	Perennial	2	3.80	early Oct.

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