

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**ALLEY CROPPING**

(Ac.)

**CODE 311**

**DEFINITION**

Trees or shrubs are planted in sets of single or multiple rows with agronomic, horticultural crops or forages produced in the alleys between the sets of woody plants that produce additional products.

**PURPOSE**

- Enhance microclimatic conditions to improve crop or forage quality and quantity.
- Reduce surface water runoff and erosion.
- Improve soil quality by increasing utilization and cycling of nutrients.
- Alter subsurface water quantity or water table depths.
- Enhance wildlife and beneficial insect habitat.
- Increase crop diversity.
- Decrease offsite movement of nutrients or chemicals.
- Increase carbon storage in plant biomass and soils.
- Improve air quality.

**CONDITIONS WHERE PRACTICE APPLIES**

On all crop and hay land where trees, shrubs, crops and/or forages can be grown in combination during the life of the system. Crops and/or forages **are not** grazed in this system. The Oklahoma NRCS Silvopasture Establishment (381) standard will be used when livestock grazing is desired.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Combinations of crops or forages and woody plants shall be compatible and complementary.

Select pest resistant plant varieties.

Select crop, forage, tree/shrub varieties based on their tolerance to agricultural chemicals that will be used at the site.

Plants shall be adapted to the climatic region and the soil resource.

Supplemental watering shall be provided for plant establishment and/or plant growth where natural precipitation is too low for the selected species. Refer to the Oklahoma NRCS Irrigation System standards (441, 442, and 443) for guidance on designing supplemental watering systems.

Soil erosion will be controlled by vegetative or other means until the alley cropping design is fully functional. Refer to the Oklahoma NRCS Cover Crop (340) standard for guidance on establishing temporary cover.

Refer to the Oklahoma NRCS Tree/Shrub Establishment (612) standard for guidance on care of tree planting stock, site preparation for tree planting, planting trees (using bare root, containerized, or seed), and care after tree planting.

Refer to the Oklahoma NRCS Tree/Shrub Site Preparation (490) standard for guidance on preparing the site for establishing trees and shrubs.

Refer to the Oklahoma NRCS Forage Harvest Management (511) standard for guidance on forage management.

For guidance on crop residue and tillage management, refer to the Oklahoma NRCS Residue and Tillage Management (329, 344, 345, and 346) standards.

When pest management is required, refer to the Oklahoma NRCS Pest Management (595) standard for guidance in applying pesticides.

Follow the guidance in the Oklahoma NRCS Nutrient Management (590) standard when a nutrient budget is needed for the system.

When pruning of trees is needed for maintenance or increasing the amount of sunlight for alley crops, refer to the Oklahoma NRCS Tree/Shrub Pruning (660) standard for guidance.

### **Tree/Shrub Selection**

Tree species selected for the system should be based on the following characteristics:

- Produce a high value product – wood, nuts, and/or fruit
- Be relatively fast growing
- Have a growing season that complements the alley crop
- Provide wildlife benefits when desired

Tree species should remain the same in row but may vary in adjoining rows as long as species are compatible.

In Oklahoma, trees such as pecan, black walnut, ash, oaks, and pine are favored species and can provide high-value lumber or veneer logs as well as nut crops. Alley systems can also be used for specialty and biomass tree plantings (dogwood, redbud, poplar, maple, birch).

For guidance on adaptation of tree and shrubs, refer to the Oklahoma NRCS Tree/Shrub Establishment (612) standard, Table 1 and Table 2.

### **Crop/Forage Selection**

Annual crops such as small grains, soybeans, sorghums, and corn can be used in the alley ways between the trees. Other annual crops may be used in the alley ways provided they produce the desired result.

Perennial grasses and legumes may also be used in the alley ways of the system. For species selection, adaptations, and establishment, refer to the Oklahoma NRCS Pasture and Hayland (512) and Range Planting (550) standards for guidance.

### **Tree Spacing and Alley Row Width**

#### ***Tree Spacing***

Trees may be planted in single rows or in multiple row designs (example: 2 rows of pine trees spaced 10' apart with a 40' alley way between then 2 more rows of pine trees etc. or a single row of pecan trees with a 70' alley way then another row of pecan trees etc.). Using single tree rows or multiple rows will be determined by the tree product desired. If nut production is the desired product then a wide single row spacing is needed. If straight log or saw timber is desired then multiple tree rows spaced closely together for natural tree pruning will be needed.

When tree stand thinning is needed, refer to the Oklahoma NRCS Forest Stand Improvement (666) standard for guidance.

Refer to the Oklahoma NRCS Tree/Shrub Establishment (612) standard for guidance on tree and row spacing. Row spacing listed in the above standard for planting *Pine, Hardwoods, Christmas Trees, and Orchards* will be used as minimum spacing. Row spacing will need to be widened to accommodate crop/forage production in the alley ways.

#### ***Alley Row Width***

Alley row width will vary depending on management decisions.

- ***Crop light requirements*** - For nut trees, wider row or alley spacing will be needed to allow sufficient tree crown development for nut production.
- ***Length of time crops/forages are expected to be in the alley ways*** - To grow shade intolerant crops in alley ways for more than the first few years, wider alleys will be required to allow for expanding tree crowns. A 40' alley way generally allows enough sunlight for crop production (corn, soybeans, sorghums,

and small grains) for 5 to 10 years depending on the growth of the trees. An 80' alley spacing may allow as much as 20 years of crop production. When trees mature and sunlight becomes restricted, the alley crop can be changed to shade tolerant species or perennial forages (bluegrass, fescue, ryegrass, and brome). Alley ways will be no wider than 100'.

- **Trees will compete for moisture with the alley crop** - Occasional tree root pruning/ripping may be needed to improve alley crop production. Root pruning is normally done to a depth of 24" and approximately 2' outside the drip line of the tree. Root pruning should only be done on one side of the tree or tree row at a time. Allow at least 3 years before root pruning the other side of the tree or tree row. Once root pruning is started, it will need to continue on a 5 to 8 year cycle.
- **Machinery widths and turning areas** - Consider the width of farming equipment in alley width designs and allow for maximum utilization of planting, tillage or harvesting equipment.

#### **Additional Criteria to Reduce Surface Water Runoff and Erosion**

Tree or shrub rows will be oriented on or near the contour to reduce water erosion.

To reduce surface water runoff and erosion, herbaceous ground cover will be established in conjunction with the tree or shrub rows.

To reduce wind erosion, tree or shrub rows will be oriented as close as possible perpendicular to erosive winds.

Selected species of trees and shrubs will be relatively deep rooted to encourage infiltration.

All forms of erosion will be reduced to the planned soil loss objective.

#### **Additional Criteria to Increase Carbon Storage**

Select plants that will maximize the utilization and cycling of soil nutrients and plant residues to maintain soil organic matter content.

Select tree/shrub species with rapid growth rates.

Plant/manage the appropriate density for the site that will maximize above and below ground biomass production.

Minimize soil disturbance through use of no till methods. Refer to the Oklahoma NRCS Residue and Tillage Management No Till\Strip Till\ Direct Seed (329) standard for guidance.

#### **Additional Criteria to Improve Air Quality**

Tree/shrub rows will be oriented as close to perpendicular as possible to the prevailing erosive wind direction.

Residue from the alley crop shall be left on the surface. Refer to the Oklahoma NRCS Residue and Tillage Management (329, 345, and/or 346) standards for guidance on managing crop residues to control wind erosion.

Select and maintain tree/shrub species with foliar and structural characteristics that optimize interception, adsorption and absorption of particulates.

#### **CONSIDERATIONS**

Species diversity including use of native species should be considered to avoid loss of function due to species-specific pests or enhance wildlife needs.

Avoid selecting tree or shrub species, which provide habitat to pests of the accompanying crop or forage.

High value trees or shrubs should be selected to maximize economic returns.

Select crops, forages and woody plants for water requirements not to exceed available soil water.

Select crops, forages and woody plants with compatible rooting depths to better utilize available soil moisture.

Consider modifying microclimatic conditions and habitat to enhance biological pest management.

#### **PLANS AND SPECIFICATIONS**

Plans and Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets,

job sheets, technical notes and narrative statements in the conservation plan, or other acceptable documentation.

#### **OPERATION AND MAINTENANCE**

The trees, shrubs, crops and/or forages will be inspected periodically and protected from adverse impacts including insects, diseases or competing vegetation. The trees or shrubs will also be protected from fire and damage from livestock or wildlife.

All other specified maintenance measures and techniques of tree/shrub establishment will continue until plant survival and establishment are assured. This includes replacement of dead and dying trees or shrubs, pruning of dead or damaged branches for safety reasons, periodic pruning of selected branches for control of product quality, and control of undesirable competing vegetation.

Any removal of tree or shrub products, use of agricultural chemicals, and maintenance operations shall be consistent with the intended purpose of the practice.