

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

ALLEY CROPPING

(Acre)

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 cropland and hayland where trees, shrubs, crops and/or forages can be grown in combination.

CRITERIA

General Criteria Applicable to All Purposes

Trees or shrubs will be protected from fire and livestock damage.

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

Plants shall be adapted to the climatic region and the soil resource, marketable and suited to the landowner's equipment and management capabilities. Tables 1a, 1b, and 1c list selected woody species that may have potential within an alley cropping system.

Crop or forage sequence and woody species selection shall be determined using an acceptable nutrient balance procedure. Select crops, forages and woody species to maximize the utilization and recycling of soil nutrients, livestock manure's and plant residues and to maintain soil organic matter content.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Select pest resistant plant varieties.

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

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

The distance between the sets of trees or shrubs will be determined by:

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resource Conservation Service or download the standard from the electronic Field Office Technical Guide for Missouri.

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311-2 ALLEY CROPPING

- Tree or shrub management objectives;
- Light requirements and growth period of the crops or forages in the alleys;
- Erosion control needs;
- Machinery widths and turning areas.

Avoid planting trees or shrubs where they will interfere with structures and above or below ground utilities.

See TREE/SHRUB ESTABLISHMENT (612) for further spacing guidance.

Soil erosion will be controlled by vegetative or other means until the alley cropping design is fully functional.

Refer to TREE/SHRUB ESTABLISHMENT (612) for further guidance on planting trees and shrubs.

Site preparation shall be sufficient for establishment and growth of selected species and appropriate for the site. See TREE/SHRUB SITE PREPARATION (490).

Additional Criteria to Reduce Excess Surface Water Runoff and Erosion

To reduce surface water runoff and erosion, herbaceous ground cover will be established in conjunction with the tree or shrub rows. Use the CONTOUR BUFFER STRIPS (332) as a guide for determining the spacing distance between woody plant rows.

A herbaceous strip (follow CONTOUR BUFFER STRIPS - 332) will be developed immediately upslope and parallel to each woody planting row set.

Use multi-row woody planting sets.

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

Tree or shrub rows will be oriented on or near the contour or perpendicular to the prevailing wind erosion direction to control wind erosion or wind damage.

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

Additional Criteria to Alter Subsurface Water Quantity or Water Table Depths

Choose woody species that are deep rooting and have rapid growth rates such as hybrid poplar, cottonwood, black willow, green ash, and silver maple.

Alley crops and woody plants shall be selected for compatible rooting depths and water requirements not to exceed available soil water.

Use multi-row woody planting sets.

Additional Criteria to Increase Carbon Storage

Select tree and shrubs species with rapid growth rates such as hybrid poplar, cottonwood, black willow, green ash, and silver maple.

Plant/manage the appropriate density for the site that will maximize above and below ground biomass production. Increase the number of rows in the tree/shrub set to increase the potential for carbon sequestration.

Establish plant species that enhance the biomass collection opportunities.

Minimize soil disturbance when planting intercrops through use of no-till methods.

Additional Criteria to Provide Food and Cover for Wildlife Habitat

Maximize plant diversity. Use multi-row woody planting sets with plants of different sizes, growth forms, and densities.

Maximize wildlife food availability. Leave edge rows between the woody planting and intercrop for wildlife food. Use plants with food-bearing capabilities.

See WILDLIFE UPLAND HABITAT MANAGEMENT (645) for additional woody species recommendations.

Additional Criteria to Improve Air Quality

Use plant species in the alley that provide full ground coverage during establishment and harvest operations.

Residue from the alley-crop shall be left on the surface.

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

Tree or shrub rows will be oriented as close to perpendicular as possible to prevailing wind direction during the critical air period.

CONSIDERATIONS

Select alley crops and tree/shrub varieties that are tolerant to herbicides that will be used in the management of the crops, forages, trees or shrubs.

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

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

Consider the interaction between tree, crop, and forage including maintenance, size of farming area, and impacts on wildlife.

Coppice ability of selected species of trees and shrubs should be considered when they are to be pruned or harvested periodically.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

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

All other specified maintenance measures and techniques of tree/shrub establishment will be continued until plant survival and establishment are assured. This includes replacement of damaged, dead and dying trees or shrubs and control of undesirable competing vegetation.

Any removals of tree or shrub products and use of fertilizers, pesticides, and other chemicals shall be conducted in a manner that maintains the intended purpose.

The type, use and timing of maintenance equipment will be appropriate to accomplish operation and maintenance tasks while not damaging or degrading the site, existing crop species, and soil conditions.

After the fifth year following establishment, woody lateral roots may need to be pruned. See TREE/SHRUB PRUNING (660).

REFERENCES

North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy. 2000.

Alley Cropping: An Agroforestry Practice. Agroforestry Note 12. National Agroforestry Center. 1999.

Inside Agroforestry. Alley Cropping 20/20 Vision for Farming's Future. Fall 2001/Winter 2002. National Agroforestry Center. 12 p.

311-4 ALLEY CROPPING

Table 1a. Examples of potential hardwood tree species for use in alley cropping

Common Name	Wood Products	Biomass/fuelwood	Food Products¹	Wildlife Food	Leaf² Initiation	Leaf Drop³	Canopy Shade	Comments
Basswood	X				early	mid	full	Wood used for carving
Black locust		X			mid	mid	light	Excellent fuelwood
Black walnut	X		X	X	late	early	light	Deep well-drained sites
Bur oak	X			X	late	late	full	Drought and flood tolerant
Chestnut	X		X	X	mid	mid	medium	Use disease resistant varieties
Ginko			X		late	mid	light	Herbal/medicinal uses
Hybrid poplar	X	X			mid	early	light	Rapid growth; deep rooting
N. red oak	X			X	late	late	full	Widely used for wood products
Paulownia	X	X			early	early	medium	Wood prized in the orient
Pecan	X		X	X	mid	mid	medium	Use native stock for grafting
Sugar maple	X		X		early	mid	full	Maple syrup and quality wood
Sycamore	X	X			late	mid	medium	Tolerates wet sites
White oak	X			X	late	late	full	Fine hardwood; deep rooting
Yellow poplar	X				mid	mid	medium	Fast growing

¹ Includes fruits, nuts, jellies, jams, wine, syrup, honey, herbals, etc.

² Start of leaf growth. **Early:** by mid-April; **Mid:** mid-April to May 1; **Late:** after May 1.

³ Begin of leaf drop. **Early:** before mid-October; **Mid:** mid-October to Nov 1; **Late:** after November 1.

Table 1b. Examples of potential shrub/small tree species for use in alley cropping

Common Name	Human Products	Wildlife Food	Showy Flowers	Plant size (feet)	Comments
American plum	X	X	X	15 to 20'	Jellies, preserves, and wine
Apple/pear/cherry	X		X	Variable	Use commercial varieties
Blackberry/Raspberry	X	X		6 to 8'	Use commercial varieties
Blueberry	X	X	X	6 to 8'	Use commercial varieties
Crabapple		X	X	20 to 25'	Jellies, preserves
Hazelnut	X	X		3 to 10'	Sweet nuts
Pawpaw	X	X		Up to 30'	Large, edible, nutritional fruit
Serviceberry		X	X	20 to 30'	Excellent for wildlife
St. John's Wort	X		X	Up to 6'	Herbal remedies; nectar source
Witch hazel	X			Up to 30'	Numerous medicinal uses
Apple	X	X	X	6 to 25'	Use cultivars that are disease resistant

Table 1c. Examples of potential conifer species for use in alley cropping

Common Name	Wood Products	Christmas Trees	Wildlife	Nursery Material	Windbreak Value	Comments
Concolor fir		X		X	X	<i>Beautiful foliage color</i>
E. redcedar	X	X	X		X	<i>Adaptable to a wide range of sites Alternate host for cedar-apple rust</i>
Loblolly pine	X					<i>Tolerates wet sites</i>
Shortleaf pine	X		X			<i>Native pine. Tolerates dry sites</i>
White pine	X	X	X	X	X	<i>Needs well-drained sites. Should be protected from deer browse during early growth.</i>