Tree Pattern

Tree pattern is very important for silvopasture success. Trees should be established or spaced to optimize growing space and light penetration and are typically pruned to increase light penetration and develop high-quality saw logs. Sites may require thinning and some tillage to provide a favorable seedbed for germination and growth of selected forages. On rangeland or pasture sites, weed/forage suppression (through herbicides, tillage, mulch, etc) may be required for 2-3 years to establish tree seedlings, but suppression methods must be carefully selected to avoid damaging desirable plants.

If a crop other than hay is to be managed between tree rows (alley-cropping), appropriate management considerations must be made such as suitable width of alleys (for planting/harvesting equipment), chemical compatibility of herbicides, pesticides, etc.
Tree Planting Considerations

When planting tree seedlings into an existing pasture there are several operations that should be considered for good tree survival. Mowing or close grazing of grass residue is helpful to remove debris that may hinder planting, especially machine planting.

After planting, exclude livestock until the trees grow beyond the browse line. In the South, that is generally 3-4 years depending on productivity of the site. Livestock do not consider Southern pine a preferred food, however, if pasture is not adequate or they are deprived of minerals, browsing on trees will occur. Also make sure main stem is resistant to breakage. This may be a problem especially with longleaf pine and the livestock may need to be deferred for an additional year.

Spacing and Stand Density

For commercial conifer plantation establishment, four to six times as many trees are planted than will be harvested at the end of the rotation. This practice traditionally provided close spacing that encouraged self-pruning. By planting in clusters or rows in a silvopasture system, shade and root effects are concentrated, which provides larger open spaces for pasture production and facilitates mowing, grazing, and other management operations with little sacrifice in tree growth. Trees planted in rows often perform poorly if they do not have at least one side in full sun. Therefore, single or double rows are generally preferred over triple or multiple rows of trees.

The planting arrangement for the tree component of silvopasture may change depending upon the landowner’s objective in achieving timber and forage growth and wildlife habitat. It can also influence production costs and equipment accessibility for both managing forages and trees. However, a healthy tree stocking range for silvopasture is typically between 200-400 trees per acre. There have been individuals that started with only 100 trees per acre and with good survival for a silvopasture system that emphasizes forage production and still provides tree cover for shade, wildlife habitat and timber production.

The number of trees per acre will dictate the number of thinnings that will need to be carried out and the types of products that will be produced—i.e. poles, chip-and-saw lumber, or sawtimber. At 150-200 trees per acre, only one thinning may be necessary well into the rotation (20 years) to remove poles or saw/veneer quality logs and provide additional space for 10 more years of growth for the high quality saw logs that are left.

For landowners managing hay or other crop between rows of trees, the type of tractor or harvest equipment that they wish to use determines spacing between rows.
Double-row, rectangular spacing of pines work well for a silvopasture system. One recommended configuration is an 8x8-40 feet arrangement (i.e. 8 feet between trees within a row, 8 feet between tree rows, and 40 feet for forage alleys between tree row sets). This configuration yields 226 Trees Per Acre and due to the lower stocking, would likely produce knots that are slightly larger (on average) than a more dense square spacing (i.e. 10 by 10 foot). For example, a rectangular spacing of 24 feet by 6 feet (303 TPA) might produce limbs (at age 9 years) with a diameter of 0.94 inch while a closer spacing of 10x6 foot (726 TPA) might produce branches that average 0.7 inches (Adams and Clason 2002). At a given stocking, rectangular spacing might not affect other traits of loblolly pine (Sharma et al. 2002). (From David South: Tree Growth in Silvopasture Systems)

Higher Survival
One aspect of planting pines at 226 TPA is that final survival of unthinned stands is higher at age 25 years than for stands planted at 600-800 TPA. This is because interspecific competition is greater when stands are planted thickly. The risks of beetle attacks and disease are lower when planting 200 TPA.

Another tree spacing of 4' x 8' x 40' (4' between trees within a row, 8' between rows, and 40' between row sets) allows 454 trees per acre and is an adequate stocking rate for good forest production and leaves enough sunlight penetration for forage production.
Common Types of Planting Arrangements:

**Single row plantings**
with trees spaced about 8 to 12 feet within the row and 16 to 30 feet between the rows. At the closer spacing this restricts some equipment accessibility and potentially reduces forage production. The wider row spacing tends to favor forage production over tree spacing.

**Double row plantings**
of trees on staggered rows. 8-10 feet between trees and rows. Once established, both forages and trees co-exist and can contribute to a highly productive silvopasture systems. When setting the alley width consider the width of the equipment that will be used in the management of the forages and plant the width of the alleys accordingly.
Multiple row spacing has 2 to 3 rows of trees at fairly close spacing (8X10 or 10X10) with an alleyway of 20 to 40 feet between sets of tree rows for forage production. Some feel this system tends to favor ease of forage and timber management and favors forage production systems.

While triple and quadruple rows have been used in this type of system, it has been found that trees in the middle rows typically grow more narrow and have poorer quality as competition from the outer rows of trees out compete them for sunlight and soil nutrients. Thus, double row systems are considered optimal.

Lewis, Tanner, and Terry (1985) found that there seemed to be no disadvantage to planting in double rows compared to single rows, although single-row plantings seemed to exhibit less tree-to-tree competition. Their study also showed that legumes under the pine canopy performed better than legume forage in open areas.

With more rows of trees, once tree canopies start to fill out, forage corridors or alleys between and within the tree rows receive more shade, which reduces available sunlight to forage.
**Block planting** is a traditional planting arrangement with wider spacing than traditional forest planting. A typical planting would be a 12X12 or 15X15 spacing. Some feel this system favors timber production. However, the landowner should take into consideration the type of production desired between tree rows.

The first 2 to 4 years, forage can be used for hay. Therefore it is important that the row spacing is planned to fit the haying equipment that will be used. So be patient with the establishment of the system and it will function and be a productive system throughout the whole rotation.