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Planning and Design Considerations for Hybrid Poplar Timberbelts

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Introduction

The demand for wood products and wood fiber has led to the development of a production system based on fast growing trees known as Short Rotation Woody Crops (SRWCs). Traditionally, SRWCs are grown in large, intensively managed blocks, but the technology may also be used on agricultural lands in integrated applications such as timberbelts. Timberbelts are multiple row windbreaks that are planted with commercially valuable trees to produce wood products. Trees such as hybrid poplar (typically cottonwood and to a lesser extent aspen), hybrid willow, hybrid pine, paulownia, etc., are particularly suited for use in timberbelts because of their rapid growth, expanding array of marketable products, growing demand for alternative sources of wood fiber, and generation of earlier investment returns.

Timberbelts can improve net farm income, sequester carbon, enhance wildlife habitat, and improve water quality. They serve as windbreaks to reduce soil erosion, increase crop yields and improve public safety through enhanced snow management. Other benefits include diversifying farming systems and agricultural landscapes, improving soil quality, reducing the input and transport of agricultural chemicals and fertilizers, and improving local air quality. Because of their multi-purpose objective including protecting adjacent crops from the wind and producing wood products, timberbelts are an agroforestry practice that is also a profit center for the farm. Trees can reach between 50 to 80 feet in height at age 10, depending on site conditions, irrigation, and management. Rotation age can range from 10 to 20 years. Producing a direct income from these windbreaks diversifies sources of farm revenue and reduces overall financial risk.

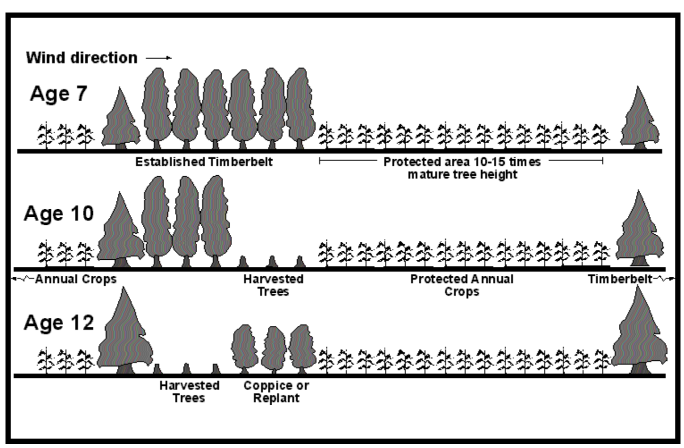

Figure 1 illustrates the timberbelt concept. In this example, an evergreen row is placed on the windward side of each timberbelt for year-round protection. All poplar rows could be harvested at the end of the rotation (7 to12 years), or some rows could be left for crop protection until the harvested rows regrow and are of sufficient height to provide effective wind reduction. For maximum wind protection, timberbelts should be spaced across the field at 10 to 15 times the height of the timberbelt at the age it is to be harvested. Specific spacings between timberbelts should be at even multiples of the width of the largest agricultural implements (e.g., sprayers).

Planning and Design Considerations

Planting for Multiple Purposes: Timberbelts are a good example of "productive conservation"; that is, a conservation practice that integrates the agroecological, environmental, and economic functions of an agricultural enterprise. They create a new source of income, while enhancing the crop environment and protecting and conserving resources. Because of the rapid growth of SRWCs, crop yield increases (and net farm income) due to wind protection that is achieved much sooner than with the typically slower growing species used in windbreaks.

Wood Markets: Timberbelts are best suited in areas where there are existing markets for the type of wood produced. Markets include those for wood fiber, either as pulp or oriented strand board, for energy production, or for dimension lumber or veneer. Distance to market and the planting size are important factors. Very small plantings of 10 acres or less in agricultural areas may not be financially attractive to harvest contractors, especially if they are far from the mill. Farm cooperatives have successfully been used to coordinate the marketing of small wood volumes among farms in an area. Product quality also affects how far wood can be transported profitably. Logs that can produce high value products such as dimension lumber can be profitably hauled further than low value pulpwood.

The anticipated end use determines the planting spacing of the trees within the timberbelt. Spacing for energy production is closer than for other products. Growing trees for pulpwood or chips generally is around 8 feet x10 feet. Wider spacings (12 x 12 feet or greater) are required to produce larger trees for sawn timber products.

The width of the timberbelt depends on the complex interplay between the returns from crops or trees. Factors affecting these returns include crop and wood prices, land productivity, and expected crop yield increases. If trees provide net returns that exceed those from annual crops (per equivalent unit area), then wider timberbelts and larger acreages in trees will be more profitable. Conversely, if net returns from crops exceed those from trees per unit area, then the area planted to trees might be reduced to the minimum required to provide adequate crop protection. However, since both crop and wood prices change continuously, a diversification strategy may be to maintain a greater area in trees than current prices would warrant to serve as a hedge against future crop or wood price changes (declines in crop prices or increases in wood prices) or total loss of annual crops.

Financial Considerations: From an agricultural point of view, timberbelts are a long-term investment, generally spanning seven to fifteen or more years. Because these tree/crop interactions lead to potential crop yield increases, any financial analysis must include costs and revenues from the whole farm, not simply the land occupied by the trees. Ultimate profitability depends on a host of factors, including land prices, wood and crop yields and prices, and production costs, to name a few. Further, any financial analysis of timberbelts must include discounting - factoring in all costs and returns over the entire rotation and calculating the net return in today's dollars.

To improve profitability, conditions need to be maintained that optimize tree growth to minimize the number of years it takes to produce the desired end-product, while keeping establishment and maintenance costs as low as possible. Shortening the rotation length shortens the length of time money is invested, and may improve net returns.

Site Requirements and Management: Most SRWCs grow very rapidly on good to excellent soils. Soils need to be relatively fertile and well drained. Some SRWCs, such as hybrid poplar, are sensitive to high pH soils (above 7.5 or so), and will not perform well on such soils. Because SRWCs are sensitive to weed competition for light and water, areas planted to trees need to be kept relatively weed free for the first two to three years until the crowns of the trees close over. This can be accomplished by tilling and/or herbicides that are compatible with tree production. Because SRWCs use large amounts of water to achieve maximum growth, irrigation may be necessary throughout the life of the planting, depending on local site conditions and soils.

Plant Material Selection: Considerable research with some SRWCs such as hybrid poplar have produced a number of clones that are particularly suited for specific geographic areas. For example, clones appropriate for use in the Pacific Northwest are not cold hardy enough for use in the Midwestern US. It is best to check with individuals in your state who have knowledge of which clones are best adapted to your area. Clone suitability can be obtained from US Forest Service research stations, university research & extension centers, nurseries, state forestry agencies, conservation districts, USDA Natural Resources Conservation Service and RC&D offices, and private timber companies. In addition to a species or clone's growth and performance, potential markets for the wood products produced will dictate which species are selected.

Harvesting: Landowners may harvest the trees themselves, or contract with a logging enterprise. Tree harvest costs can be reduced and stumpage prices (the price a logging contractor pays a landowner for standing trees, prior to cutting) increased by joining forces with other landowners in cooperative marketing arrangements. Some wood buyers may enter into forward contract purchase arrangements with landowners, providing annual income as well as a payment upon harvest, in return for guaranteed access to the wood at harvest age. This reduces the landowner risk, but may result in a lower stumpage price than that which could have been obtained on the open market.

Other Considerations: Despite all the benefits of timberbelts, they also present some of the same risks as traditional agricultural production, including ecosystem simplification and habitat loss with monocultures and the potential for chemical, nutrient and soil runoff to water bodies during the establishment phase.

Carbon Sequestration

Timberbelts are a form of afforestation that can store additional carbon on the farm. For example, a ten-year-old, irrigated hybrid poplar plantation in the Pacific Northwest, located on pivot corners, and with good management, could store 184 to 294 metric tons of carbon dioxide per acre, with an additional 150 metric tons of CO_2 per acre accumulated in the soil within the timberbelt. The wind protection provided by the timberbelt may also afford the adjacent crop the potential to store more carbon due to increased crop production.

Another potential opportunity for landowners planting timberbelts is obtaining carbon sequestration credits, which could help offset planting and establishment costs. Tree planting is being recognized as an effective method to sequester CO_2 and would give an immediate carbon storage gain. Producing solid wood products from timberbelts would increase long-term carbon storage and have more carbon credit potential than would paper or fuel which are quickly converted back to CO_2.

Special Applications

The timberbelt concept could also be applied to the following situations:
Center pivot corners: SRWCs such as hybrid poplars and/or high value hardwoods could be grown in pivot irrigation corners (generally five to seven acres/corner).

Besides producing wood, the trees also provide wind protection to a portion of the annual crop, increasing crop yields and quality. In drier areas, trees should have their own water source separate from the cropland to maximize growth and performance. Because of their longer growing season, trees need water before irrigation starts for crops and after the annual crop is harvested. In higher rainfall areas (25" or more), corner irrigation may not be needed.

"Nurse Crops:" Shade-tolerant, high-value hardwoods could be interplanted between the hybrid poplar. The faster growing poplar would serve as a "nurse crop", providing the needed shade and encouraging straight stem form of the hardwoods. Shingle oak, a valuable shade-tolerant bottomland hardwood species in the southern US, may be well adapted to interplanting within fast growing hybrid poplar timberbelts.

Understory Specialty Crops: Medicinal plants such as ginseng and goldenseal, decorative florals such as beargrass and ferns, and some nuts and fruits could be intercropped between the rows of the timberbelt. Most cropland soils have slightly acid to neutral pH (5-7), which is also ideal for specialty crops. Timberbelt tree row spacing and pruning need careful consideration to provide adequate light for the understory specialty crop.

Summary

Timberbelts - multiple row windbreaks planted with commercially valuable, fast-growing trees - are a new and improved way for producers to protect crops and soils, while at the same time make profitable use of the land. This sustainable land use system is a profitable marriage of the proven benefits of windbreaks with the rapidly increasing importance of short rotation woody crops to produce commercially valuable wood products. They are an excellent example of how to introduce greater diversity and stability into agricultural production and financial systems.

Additional Information

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