POTENTIAL TREE CROPS FOR THE PRODUCTION OF STAPLE NUTRIENTS AND ALCOHOL FUEL ON HILL LANDS

G. Williams and M.L. Merwin
International Tree Crops Institute
Gravel Switch, KY 40328

SUMMARY

Tree crops could produce potentially high yields of feed, food or alcohol on hill lands with less energy inputs and soil erosion risk than annual crops. The most promising species that could be developed as staple crops for marginal lands include honeylocust (Gleditsia triacanthos), persimmon (Diospyros spp.), and mulberry (Morus spp.).

INTRODUCTION

Increasing food exports, fuel alcohol production from grain and non-agricultural development of prime farmland are expected to encourage the future conversion to cropland of millions of hectares of pastureland, rangeland and forestland in the United States. Most of this agriculturally marginal land is subject to severe soil erosion hazard or affected by problems such as poor drainage, rocky soils or excessive evapotranspiration. The cost of converting such marginal land will be great, with a high probability of locally severe environmental degradation from intensive cultivation of annual crops.

Although perennial crops might be better adapted to these marginal sites, trees capable of competing with conventional annual crops with respect to yields of staple nutrients (proteins, carbohydrates and oils) are undeveloped for temperate climates. If perennial species could be developed as staple crops, they may prove to be an economical and environmentally sound means of increasing the agricultural productivity of marginal lands.

POTENTIAL STAPLE PERENNIAL SPECIES

In a survey of potential staple perennials, honey-locust (Gleditsia triacanthos), persimmon (Diospyros spp.), and mulberry (Morus spp.) were identified to be among the most promising (Williams, 1980). These species appear competitive with annual crops, e.g. corn

(Zea mays) in yields of proteins, carbohydrates and fuel alcohol (Table 1). Significant long-term savings in production energy inputs also are predicted for staple perennials relative to annual crops. While these savings result in part from reduced annual soil preparation and pesticide requirements, perhaps the most important is the large reduction in energy inputs embodied in nitrogen fertilizer possible wherever N-fixing legumes can be grown under staple perennials (Williams and Merwin, 1983).

Table 1. Estimated nutrient and ethanol yields for corn and selected staple perennial crops.

	Corn	Honey-locust	Persimmon	Mulberry
	---------- X 10^3 ----------			
Protein (kg/ha)	0.6	0.4-2.3	-	-
Sugar and starch (kg/ha)	4.5	2.6-15.0	1.3-10.3	1.6
Ethanol (l/ha)	2.8	1.5-9.0	0.8-6.0	0.9

Honeylocust

In many ways, the honeylocust is the most promising staple perennial crop for marginal land in temperate areas of the U.S. Projected yields of both proteins and carbohydrates are high for selected cultivars (e.g., 'Millwood' and 'Calhoun'). Honeylocust tolerates poor site conditions well. Its foliage is open, allowing grass and N-fixing legumes to grow underneath. It appears that the pods can be harvested easily by livestock or machines. Pods and seeds can be separated for different uses, i.e., pods for livestock energy feed, seeds for high-protein dietary supplement for humans. Fermentation and distillation of pods with seeds yields fuel alcohol; the stillage by-products are fed to livestock.

Persimmon

The common persimmon is extremely adaptable to poor site conditions, particularly acidic and droughty sites. Production begins at an early age and most trees show only a slight tendency to alternate high

and low yields. Carbohydrate yields are very high, particularly from superior cultivars (e.g., 'Early Golden,''John Rick,' and 'Garretson'). Long-term storage of the fruit can be difficult, but some cultivars have fruit that dries easily without molding. Fruit can be harvested by livestock in fall or winter, or mechanically for fuel alcohol conversion. Nutritional value of stillage by-products is expected to be low.

Mulberry

Mulberries grow and fruit well on extremely poor sites, withstanding low fertility and drought. Production begins at a very early age and yields are high. However, loss of fruit to birds can be severe. Seedlings are acceptable, but there are cultivars with exceptionally long productive seasons (e.g., 'Hicks,' 'Stubbs,' and 'Illinois Everbearing'). Canopies are fairly dense and pruning is unnecessary. Livestock (especially pigs) may be run under the trees in midsummer to harvest the fruit for 2 to 4 months or longer. Alternately, the fruit can be harvested with a shaker-catcher machine for immediate conversion to fuel alcohol.

LITERATURE CITED

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