**1. Multi-purpose windbreaks for protection of vegetable crops and production of fruit and/or nut crops (FNE 00325)**

2. I wanted to put in a windbreak planting at our farm because we are situated in a very windy spot. The valley in which we farm forms a wind tunnel for the wind coming off of the Holyoke Range. I have extreme difficulty, especially in spring and fall, with row covers, plastic mulches, signs and other mobile objects being blown around by the wind. I've also noticed damage to young vegetable plantings from the wind. With this project, I hoped to find some species which provided some economic, amenity, or other types of benefits besides merely providing shelter from the wind. The hope is that if the windbreak can provide enough economic value to offset the cost of planting, then the wind protection is free or at least cheaper than otherwise.

3. I rent an eleven-acre (4-5 tillable acres) parcel of land from the New England Small Farm Institute (NESFI) in Belchertown, MA. The land is part of a larger parcel of land which is owned by the Commonwealth of Massachusetts and managed by NESFI. 1999 was my first year of production; I had been working on vegetable farms or studying agronomy (I finished my M.S. in Plant, Soil and Environmental Science from the University of Maine in spring 2000) for seven years previous. I cultivated about 4 acres in 2002. The soil is a Woodbridge sandy loam soil which is excellent for vegetable production, particularly after several years of rock-picking and build-up of organic matter. My primary crops are mixed vegetables. I have been certified organic by NOFA/MA since 2000. I manage a marketing cooperative of the farmers at NESFI; together we operate a farm stand on the site and go to the Amherst, MA and Cambridge, MA Farmer's Markets.

4. Eric Toensmeier was the most actively involved with the project. He helped me with species selection, and general design. Bruce Wight and Lisa Krall both looked over the design. Their participation in the project was hampered by their geographical distance from Massachusetts. Kathy Ruhf helped ensure that the siting of the planting conformed to NESFI's long-term goals and site-use restrictions.

5. The main vegetable production area at Simple Gifts Farm is a long, skinny 10-acre field, which is oriented with the long axis running between WNW and ESE. Prevailing winds are mostly from the West. The windbreak is planted along the short side to the WNW and the long side to the SSW. We had two main concerns with the design: one was to make the windbreak somewhat porous. Windbreaks which let no wind through are subject to damaging turbulence on the lee side. The other concern was for the eventual height of the windbreak. Since the wind runs parallel to the long side of the field, we needed a fairly tall windbreak. The rule of thumb is that the windbreak provides protection for 10-20 times its height downwind. Since the field is about 1000 feet long, we needed a 50-100 feet tall windbreak. Obviously this doesn't occur overnight, so we choose some fairly quick-growing trees for the back bone of the windbreak. Further tips on windbreak design can be found at the National Agroforestry Center website http//www.unl.edu/nac/windbreaks.html.

The general design of the planting had three rows of trees and shrubs on the short side, since that side receives the heaviest wind pressure, and two rows on the long side. The rows are ten feet apart, to allow easy mowing access (even after the trees get bigger), and also to allow a single bed of vegetable production between trees in the early years. The first row is a shrub row. The shrubs will form a solid screen and will block wind that would go between tree trunks as the trees get tall. The shrubs are mostly low-maintenance fruit-bearing shrubs, with fruit that have some commercial potential. The second row is the tree row. These trees are rapid-growing hybrid poplar trees that will form a tall barrier quite quickly, interspersed with slower-growing trees that have some nut or fruit crop. The final row (present only on the short side) is higher-value fruit crops on wide spacing that provide some additional wind protection in conjunction with the first two rows, but which would probably provide only limited protection on their own.
6. All of the trees established well and are growing vigorously. It is not possible at this time to assess their contribution either in terms of economic value or wind protection, due to the fact that they are still small. The hybrid poplars did grow astonishingly quickly—they are at least 15 ft. tall by the end of their first season.

7. We did have drought conditions both in the early spring and late summer of 2001. The irrigation system was invaluable in assuring that the trees made it through those times. We did not water at all in 2002, but the trees seemed to grow fine, in spite of a long dry spell in July and August.

8. Economic analysis

**Overall Establishment Costs**

Following are the costs that were common to the whole venture

| | | |
|---|---|---|
| Labor | | |
| Planting, mulching | 42 hrs. X $10/hr. | $420 |
| Irrigation | 31 hrs. X $10/hr. | $310 |
| Mowing First year | 6 hrs X $10/hr. | $ 60 |
| Equipment & Materials | | |
| Irrigation lines | | $510 |
| Compost | 3 yds @ $25/yd | $ 75 |
| cardboard and wood-chip mulch | Free for us—estimated cost | $ 75 |
| | total | $1450 |
| | % 2900 feet= | **$0.50/ft** |

**Shrub Row**

Following are the cost per foot of the plants for the shrub rows, along with some of their characteristics. The shrubs were selected for interesting fruit, low maintenance, and minimal pest pressure. The fruit fall into two categories: potential for commercial harvest or for "grazing"--recreational harvest which adds a site amenity for visitors, but which do not offer direct commercial benefit. Some of the "grazing" fruits could be useful in a pick-your-own context. Particular care was taken to avoid shrubs susceptible to black knot fungus, which is present next to the field. Shrubs were planted approximately 6 feet apart.

| Species (common name) | Commercial potential | Grazing | Cost/ft. | Comments |
|---|---|---|---|---|
| Amelanchier sp. (Juneberry) | x | x | $1.00 | ornamental flower and bark |
| Prunus armeniaca (Manchurian Apricot) | x | x | $0.92 | |
| P. japonica x jacquemontii (Bush cherry) | x | | $1.67 | |
| P. americana (American plum) | | x | $0.20 | |
| Salix viminalis (Basket willow) | x | | $0.67 | sell as pussy willow or craft item; good for wet areas |
| Corylus sp. (Hazelbert) | x | | $1.00 | nut crop |
| Ribes sp. (currants and josta berries) | x | x | $1.00 | only white pine blister rust-resistant varieties used |
| Sambucus canadensis (elderberry) | | x | $0.75 | good for wet areas |
| Lonicera caerulea (edible honeysuckle) | | x | $1.25 | |
| | | | | |

**Tree Row**

Following is the costs per linear foot of the plants in the tree row. Trees were planted every 10 feet, in a pattern of two hybrid poplars for every one slower-growing tree. The cost per foot includes the cost of the poplars, since it is assumed that poplars will be used for the initial windbreak (in other words, the cost assumes a spacing of 30ft. between trees, with two poplars between each tree). The slower trees included black walnut, pawpaw, persimmon, and mulberry. I have categorized the species again by those which might be harvested for sale and those which have "grazing" potential for increasing the amenities of the site.

| Species (common name) | Commercial potential | Grazing | Cost/ft. | Comments |
|---|---|---|---|---|
| Juglans nigra (Black Walnut) | x | | $0.28 | Nuts and very valuable wood |
| Asimina triloba (Pawpaw) | x | x | $0.27 | Unusual fruit |

| | | | | |
|---|---|---|---|---|
| Diasporyus spp. (American persimmon) | x | x | $0.12 | |
| Morus spp. (Mulberries) | | x | $0.47 | Prolific fruit |

**Orchard Row**

The final row consisted of Asian pear trees at a 15-foot spacing, with four gooseberries interplanted between each set of pears. This row was intended to add some higher-value trees which would provide some additional wind protection, but whose primary purpose is to produce valuable crops. The price of the gooseberries varied by variety, with an average cost of $1.92 per foot. The price of the Asian pear trees was $0.47/ft.

**Summary**

Establishment costs of a windbreak planting can vary widely depending on the intended side benefits of the windbreak planting. Hybrid poplars can provide a very economical windbreak at pennies per foot. Adding diversity, value and longevity to a tree row with walnuts, pawpaws and persimmons still keeps the total cost under a dollar per foot. A second shrub row can be added at costs ranging from $0.70 to $2.27 per foot. Most shrub species with commercial value are in the range of $1.50 per foot. The orchard row planted on the downwind side of the windbreak had considerably higher cost, but should yield more valuable crops. All trees established well, but it is still to early to find out what the economic value of the crops will be, since none of the trees have started bearing yet.

9. The next step in the project will be to assess the economic value of the windbreak, once the trees start fruiting and are tall enough to provide protection.

10. N/A

11. The trees were shown at two farm tours that we hosted this year: one in conjunction with the Northeast Organic Farming Association's (NOFA) Summer Conference, and another as part of UMass Extension's Twilight Tour series. I plan to have the NOFA tour every season. We also have frequent visitors as part of NESFI's education program.

12. Jeremy Barker Plotkin December 10, 2002