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DEER-PROOF FENCES FOR ORCHARDS: A NEW LOOK AT ECONOMIC FEASIBILITY

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ABSTRACT: Woven-wire fences, 2.4-m-high, have proven to be deer-proof and economically feasible for some apple orchards planted to semi-dwarf and dwarf trees, under high-density planting systems. The factors included in a benefit-cost analysis are described, and a formula is given to facilitate a decision about the economic feasibility of investing in a fence of this type.

A paper on the general topic of barrier fencing was presented at the 5th Vertebrate Pest Conference held here in Fresno, in 1972 (Fitzwater 1972). This included diagrams of the three most widely used wire fences which have been designed to prevent entry by deer (Odocoileus spp.) -- the eight-foot high mesh-wire fence, the California sloping-wire fence, and the New Hampshire electric fence which has three wires strung on outrigger crossarms. The 1972 paper reviewed the work of others in some detail, including experiments in Michigan with 20 types of electric fences, none of which proved to be "deer-proof" (Bartlett and Boyce 1954). The author then concluded that "the best fence against deer seems to be the eight-foot high wire mesh".

Since 1972, four Conference papers have dealt with the topic of deer control. In one, the manufacturer of a sound-producing device pointed out that the use of sound is less effective in deer control than in controlling some other animals (Stewart 1974). Two other papers have dealt with the need to control deer populations in reforestation areas of the southern pine forest (Campbell 1976) and in the Douglas-fir region of the Pacific Northwest (Crouch 1976). In the 1978 Conference, a paper dealt with the seeding of forbs in clearcut areas to reduce deer damage to young conifers (Campbell and Evans 1978). Barrier fencing is generally considered to be too expensive for use in reforestation programs; the costs involved in fence construction and maintenance have not been recoverable. The value of the tree crop produced, per hectare, has been too low.

To protect other privately-owned crops in the United States, some state governments issue permits to destroy damaging deer. Some states reduce the economic effects of deer damage by making payments to farmers; Colorado, Massachusetts, New Hampshire, Vermont and Wisconsin are examples. Maine does not give direct remuneration, but provides fencing materials to farmers. Wisconsin is phasing out financial settlements, based on 80% of the loss, but is continuing its program of providing the use of fencing materials, under 20-year contracts with landowners.

New York state has no such programs, even though it usually ranks first or second in the nation in apple production and has a deer (Odocoileus virginianus) herd of about 400,000, Since apple buds and twigs are a favorite winter deer food and each deer consumes about a ton of food per year, some of our orchards have sustained heavy deer damage. Although there were no deer in agricultural areas of New York state at the turn of the century, in the last 50 years they have become common throughout the state. Since about 1960, many orchardists have had to protect their newly-planted standard-size trees with individual chicken-wire cages until the trees outgrow the height to which deer may reach, when browsing. Today, however, the deer problem is much more serious, and increasing. Anyone who has visited apple orchards recently has seen the "new-look" in apple trees. The new look is small trees of the so-called semi-dwarf and dwarf varieties. The largest of these small trees are about four meters high at maturity, so they never outgrow the height to which deer might browse during our periods of deep snow. The other striking difference in new orchards is the close spacing of trees. They are no longer planted 10 meters or so apart, resulting in about 100 trees per hectare, but are crowded together in closely-spaced rows with only two meters or so between trees in the row. These plantings are called high-density plantings; in these new systems, there may be 300 to 2,000 trees per hectare instead of 100. The potential loss from deer damage is therefore much higher now than ever before, per unit area. In addition, plant physiologists have found that deer browsing retards tree growth more severely on the very common M.9 dwarfing rootstock than on other apple trees (Cummins and Norton 1974). Since 1958, the percentage of semidwarf and dwarf apple trees in western New York has increased from 5 to 54%, and our pomologists predict a continuation of this trend toward these small trees. Our deer have remained the same size.

In view of these developments in tree size and spacing, we have recently re-examined the economic aspects of constructing deer-proof fences around apple orchards, and have found that fencing is economically feasible for some orchards. We have constructed three such fences and followed their costs and benefits for about four years. The fences are eight feet (2.44-m) high and are constructed according to Cornell University recommendations (Caslick and Decker 1978), using two widths of hog-wire fencing. This is the four-foot high mesh fencing with rectangular mesh, having smaller mesh at the bottom. When erected as a deer fence, we turn the lower width of wire upside down, so the smaller mesh is on top, thus strengthening the fence halfway up the posts. Based on four years of use, we project fence life to be at least 10 years under New York conditions, before major repairs will be required. They have proven to be deer-proof for the four years of use.

Since the fence cost per unit area protected depends upon the perimeter of the area enclosed, it has been difficult to decide whether to build a fence, even for those orchards for which estimates of deer damage had been made. To assist in making this decision, we have developed a simple arithmetic-formula to compute the estimated annual cost of protecting one tree, when that tree is within an orchard surrounded by a deer-proof fence (Caslick and Decker 1979). Only simple multiplication and division are required to solve the equation.

This formula includes a constant factor (2.06) to take into account fence depreciation, 10% interest on investment, 8% for maintenance and repairs, 1.8% real property taxes, and 1.5% insurance. These percentages are commonly used for estimating costs on agricultural enterprise investments in our area. This constant factor in our formula would vary somewhat by region, but it is available for all U.S. locations from agricultural economists at Land-Grant universities. Substituting your local constant in our formula would yield a more accurate estimate for your locality. The formula also assumes a 10-year fence life, but a different number may be substituted directly if your local conditions or experience prove otherwise.

The formula for computing the annual protection cost per tree (C) is a simple fraction. The numerator is the product of the constant just described, (2.06) for our state, times the unit cost of fencing and labor (F, in cents/m), times the perimeter of the area (P, in meters). The denominator is the product of the size of the area enclosed (A, in hectares), times the density of trees (D, in trees/ HA), times the fence life (in years).

$$C = \frac{(2.06)(F)(P)}{(A)(D)(10)}$$

If the annual cost of protecting a tree is less than the expected average annual damage, a deer-proof fence would be economically feasible. For example, using our construction costs for a 20 hectare orchard having a perimeter of 1829 meters, we found that at a tree density of 299 trees per hectare (which is a low density under the new planting system), a fence would result in savings if the trees would otherwise suffer an average annual loss of $.33 from deer damage. At the higher end of the tree density scale (1,957 trees/HA), a deer fence would be economically feasible if deer damage would exceed $.05 per tree. This relationship exists because the annual cost of the deer fence remains at $2,024 per year for this 20 hectare orchard, regardless of tree density within.

Research is now underway to improve the precision of deer damage estimates. Such estimates must include tree loss and replacement costs, fruit losses, tree-growth losses and other investment cost losses during the tree replacement period, the extra pruning costs on trees not replaced, and a number of less apparent real costs. As more precision is developed in loss estimation, our formula will become more precise. In the meantime, it is a useful new tool which orchardists themselves may use to help make orchard management decisions. Specifically, it provides a benefit-cost basis for deciding whether to build a deer proof fence around an orchard.

In New York, at $5.35 for fencing and labor, fence costs for a 20 hectare orchard are about $7500 for materials and $2300 for labor, making an initial cost of $9800. At an estimated life of 10 years, this $9800 investment would appear to cost $980 per year, by simple division. Please note, however, that this cost rises to $2,024 per year when interest, maintenance, taxes and insurance are computed. These real costs should be used when determining the economic feasibility of fencing. Our new formula, as described today, takes all of these costs into account.

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