
Trees and Sustainable Agriculture

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American Journal of Alternative Agriculture / Volume 4 / Issue 3-4 / December 1989, pp 173 - 179
DOI: 10.1017/S0889189300003039, Published online: 30 October 2009

COMMENTARY

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Abstract. *In the United States, trees constitute an element in agriculture whose importance has been inadequately appreciated. In actuality, they are highly important in several ways. From the time of the earliest settlements, they have served as a source of building materials and energy. They protect the soil against erosion by wind and water. When used as windbreaks adjacent to crop fields, they protect crops against the damaging effects of wind on crop yields. As windbreaks for livestock, they increase feed conversion efficiency, improve weight gains, and increase the survival rate of newborns. They provide habitat for wildlife and contribute aesthetically to the appearance of the countryside. They protect water resources. Trees need to have the story of their great benefits more widely and emphatically told.*

Key words: building materials, energy source, soil erosion protection, crop yield increase, livestock protection, wildlife habitat, aesthetic landscape enhancement

Introduction

The importance of trees in sustaining agriculture in the United States is almost completely ignored in the sustainable agriculture literature. In contrast, trees are considered a significant component of sustainable systems in less developed and resource depleted nations throughout the world. Does the apparent lack of attention in the United States indicate that trees are not considered important in sustainable agricultural systems, or is their role so obvious that there is no need to dwell on it in the literature?

Both of these views have some truth. I will try to shed some light on these ideas through a discussion of the relationship of trees and agriculture and the value of trees to agricultural systems, followed by a consideration of what I think to be some of the underlying reasons why trees have been largely ignored in discussions of sustainable agriculture in the United States.

Trees have almost always played a very prominent role in the American agricultural experience. When this country was first settled, almost every square foot of tillable land had to be wrested from the extensive forests that covered the eastern half of the nation. Although trees were a great nuisance, they also were valued because they provided abundant building materials and a ready source of energy. Therefore, as settlements moved west and farmers began cultivating the treeless prairies, they made great efforts to establish trees.

Yet even in the plains, many people consider trees an obstacle and a nuisance to agricultural production. They stay where you put them, and they will stay there a long time if properly cared for. But the very fact that they are an obstacle, and a fairly permanent one at that, is what makes them such a valuable component of resource conservation systems. Even so, trees have generally not fared well in the face of agricultural production.

Agricultural development and resource conservation

The deforestation that often accompanies agricultural expansion can have disastrous results on soils. As Kirschenmann (1988) has written in this journal: "One of the lessons of history is the fact that whenever a civilization mines its soil to enjoy short-term prosperity, that civilization suffers long-term famine and poverty." This view was expanded by Sampson (1989), who wrote: "There is no irrevocable conflict between a strong economy and a healthy environment. In fact, the two must be considered together, particularly if any significant time frame is involved. No society can get wealthy and stay wealthy by ruining the natural resource endowment upon which all wealth is based." He concludes that, "Soil conservation and water quality protection are not the optional activities of an affluent society, they are the essential fabric of a sustainable society."

Throughout much of the world, the critical importance of protecting soil and the conservation value of trees have not been taken into account until it was too late. Heavy population pressures, coupled with poor land management practices, have resulted in massive natural resource degradation in many nations. Nations such as China and Nepal face tremendous struggles to rebuild their

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natural resource base, with trees playing a pivotal role in these efforts (MOF, 1985; Brown, 1982, 1985). Where building materials and fuel are in critical supply, trees are incorporated into agricultural production not only as a means of resource conservation, but for the wood that they produce. In many areas of the world, trees are cultivated in association with food crops to maximize the production of both food and fiber from every parcel of arable land (MOF, 1985; El-Lakany, 1986; Jackson, 1987).

Trees are an essential component of a sustainable society. In developing a sustainable agriculture in the United States, the role of trees in such systems should be given due consideration. Because we are still blessed with a magnificent natural resource base, we lag behind much of the world in establishing sustainable agricultural systems. The survival of our society has not yet depended on establishing sustainable agricultural systems. This is a testament not only to the wealth of natural resources that we are blessed with, but also to the resilience of the ecosystems across much of our country. In our attempts to gain a better life through resource depletion and degradation, we have behaved no differently from most civilizations past and present. Fields have been impoverished, forests have been devastated, and water resources squandered. Our resource base remains sound primarily because these areas were given time to recover, a luxury that nations with higher population densities do not have.

The value of trees to a sustainable agriculture

It now appears that we may be approaching the end of an era and that we must now prepare for agriculture after the oil age (Sampson, 1989). Widespread public concern over the amount and quality of our water resources, the nearly ubiquitous use of farm chemicals, and a growing belief that our current system of agriculture cannot support itself without tremendous infusions of tax dollars are fueling the drive to establish sustainable agricultural systems. I will illustrate the potential value of trees in such systems by showing how they can fulfill several principles of the general concept of sustainable agriculture, as discussed by Lockeretz (1988), Erb (1989), and the American Society of Agronomy (AJAA, 1988). Particularly relevant are the following:

- Protect the soil so that erosion, contamination from sediments, and losses of water and nutrients are reduced and overall soil quality is maintained or improved;
- Cultivate a diversity of crop species to improve the biological and economical stability of agriculture;
- Improve farm profitability without sacrificing production;
- Enhance the quality of life both on the farm and for society as a whole.

Protection of soil resources

Trees have been planted in sub-humid and semi-arid regions throughout the world to reduce soil erosion and to halt or slow the process of desertification. They serve the same function in more moderate climates, but the most spectacular and massive efforts at establishing trees for this purpose have occurred where conditions have been extreme. A striking example of resource recovery occurred in the United States during and immediately following the dust bowl years in the 1930's. Two hundred twenty-three million trees established in 18,599 miles of field windbreaks from 1935 to 1942 dramatically changed the landscape of the region and helped to make the land productive again (Bagley, 1985). Present efforts in China and South Korea, where several million hectares of degraded lands have been planted to trees, are also noteworthy (MOF, 1985; Brown, 1985). It is unfortunate that such efforts are generally undertaken only after severe damage has occurred. Although trees have served to restore damaged lands, they may serve equally well in preventing such damage in the first place if they are included as an integral part of agricultural systems.

Wind erosion may be controlled by adhering to several basic principles (Lyles, 1988; Tibke, 1988):

- Maintain a vegetative or residue cover on the field at all times;
- Maintain non-erodible clods or aggregates on the soil surface;
- Reduce field widths along the direction of the prevailing winds;
- Roughen the surface of the land.

Of course, trees are not the only means of fulfilling these principals to protect soil against wind erosion. In fact, both authors stress a combination of practices, but this does not lessen the importance of trees. It is generally acknowledged that wind barriers control wind erosion completely for a leeward distance of 10 times the height. Trees provide the tallest wind barrier that is feasible to use in most areas and, therefore, allow the greatest field width between barriers.

Other vegetative barriers are used to control wind erosion. Perennial (Black and Aase, 1988) and annual (Bilbro and Fryrear, 1988) herbaceous barriers have been used successfully in the semi-arid plains of the United States. Advantages of herbaceous windbreaks rather than trees or shrubs are that they are less expensive and faster to establish and that large fields are typical in the semi-arid plains (Black and Aase, 1988). Perennial herbaceous barriers are also very effective in trapping and spreading snow across the field.

However, if we are concerned with assuring that resource conservation continue over the long term, trees have certain advantages over herbaceous barriers. Most important, they usually are very long lived when properly cared for and are not easily removed once they have matured. In addition, trees will continue to provide protection even during a drought severe enough to make herbaceous barriers fail. Tree windbreaks also take less land out of production than herbaceous barriers. Black and Aase (1988) determined that twin-row tall wheatgrass barriers removed 10 percent to 12 percent of the land from production. In comparison, two-row tree barriers 40 feet tall would remove only 7 percent to 8 percent.

Trees may not be the best solution for wind erosion control in all situations. Furthermore, some areas are not subject to significant wind erosion. However, control of wind erosion is only one way in which trees are valuable to a sustainable agriculture.

Crop diversity

Trees can increase crop diversity on the farm in at least two ways. First, the trees themselves may be grown as a crop. Second, the shelter provided by trees allows the cultivation of crops that otherwise would not be possible. This latter point is especially true in areas subject to high winds and other climatic rigors, such as the Great Plains.

Small timber holdings are typical of farms in moist regions of the country where forests occur naturally. Reestablishing woodlots on lands poorly suited for the production of crops like corn, soybeans, or wheat would provide an additional long-term crop for the farmer. The 1985 Farm Bill provided a means for landowners to establish trees on such sites through the Conservation Reserve Program. Many millions of trees have been planted on land once farmed in areas where the timber industry is active, especially the southeastern United States.

Intercropping trees with more typical agricultural crops is another way for trees to increase crop diversity. Intercropping is a common component of agriculture throughout most of the developing world, especially in countries faced with significant population pressures and natural resource depletion, such as China. The practice is not completely unknown in the United States, where nut-bearing trees or high-value hardwoods, such as black walnut, are occasionally grown with agricultural food or forage crops (Jackson, 1987). Studies in Illinois (Campbell and Lottes, 1989) and Missouri (Thurman et al., 1989) suggest that intercropping can be more profitable than traditional agriculture on marginally productive land or where erosion control is necessary. The culture of coniferous species on pasture or range land is found primarily in the southeastern and northwestern United States (Sharrow et al., 1989; Lewis et al., 1989).

The production of vegetable or fruit crops is another means to diversify a farm. These crops typically are very sensitive to wind, and at best they are difficult to cultivate in sub-humid and semi-arid regions of the country. Trees have been used extensively to protect vegetable and fruit crops from harmful weather.

In surveying the world literature, Baldwin (1988) and Norton (1988) found overwhelming evidence for the positive benefits of shelter on vegetable and fruit crops. Crop quality is often more important than quantity for fruits and vegetables. Quality is improved by protecting crops from the wind, which prevents sandblasting, blossom destruction, bruising of fruit and leaves, discoloration, and premature fruit drop (Piggot, 1980). Economically, wind protection is easily justified. Production of fruits and vegetables increased from 5 to 50 percent as a result of protection by windbreaks (Baldwin, 1988; Norton, 1988) (Table 1).

Improving profitability and production

There are several ways that trees may enhance a farm's profitability and production. These include less reliance on off-farm inputs, increased crop production and quality, increased livestock gains on less feed, and a greater variety of saleable products.

Reducing off-farm inputs. A reduction in off-farm inputs is often mentioned in discussions of sustainable agriculture (Lockeretz, 1988). Tree windbreaks and woodlots are a way of addressing this goal. Trees provide fenceposts and firewood and, if managed properly, may also provide lumber or veneer grade timber. In one example from New Zealand, a single row of 22-year-old radiata pine was valued at $20,000 per kilometer (Sturrock, 1988). Admittedly, this is an extreme example of the potential for profit from tree windbreaks. It shows that, with the right combination of species, climate, and markets, substantial monetary gains are possible. In the United States, high-value hardwoods such as black walnut, black cherry, and red or white oak have considerable market potential. However, growing sawlog-size trees is no get-rich-quick scheme even under very favorable climatic and soil conditions. It is doubtful that marketable trees of the species mentioned could be produced in less than 40 or 50 years. As an alternative, many tree species will produce rough lumber for on-farm uses in less than 40 years.

Trees are also an important source of food for both humans and animals worldwide. Depending on location, a variety of fruits and nuts can be grown on the farm rather than purchased. In addition, several species provide nutritious and often abundant animal feed (Smith, 1950; Bagley, 1981, 1988).

Aside from producing a product themselves, trees allow the reliable production of fruits and vegetables in areas where this would otherwise not be feasible. Reducing the need for off-farm

Table 1. Benefits of protection from wind for selected vegetable, fruit and specialty crops[a]

Crop	Yield increase (%)	Other effects
Sugar beet	6–25	8%–20% increase in sugar content. Improved press-juice purity. 15% quality bonus when sold.
Tobacco		Reduced nicotine content.
Strawberries	0–56	30% increase in prime quality yield.
Soya beans	8–26	
Snap beans	37–44	
Dry beans	10–21	
Tomatoes	16	60% higher yield at early harvest. 30% increase in marketable product.
Potatoes	6–19	
Asparagus		Fewer soil-filled (unmarketable) shoots.
Lettuce		Reduced tip burn.
Fruit trees		Average loss of 35% of product without protection.
Plum	32–37	10% increase in export quality fruit.
Valencia orange		25%–77% increase in export quality fruit.

[a]Based on data summarized by Baldwin (1988) and Norton (1988).

food purchases is certainly one means of improving financial stability.

Off-farm energy inputs can be reduced in many ways, such as by changing cropping and tillage practices and insulating buildings. Windbreaks are also a very effective means of reducing the costs of heating homes and outbuildings. Savings of up to 25 percent are possible in the north central United States (DeWalle and Heisler, 1988). In less windy climates, such as the northeastern United States, home heating costs may be reduced as much as 15 percent. Properly designed windbreaks will also reduce or eliminate the need for removing snow from work areas and feedlots, which can save as much as several hundred dollars per year (Wiles, 1982).

Increased crop production. Many studies throughout the world have demonstrated significant gains in the quantity and quality of crops protected by windbreaks (Table 2). Trees compete for resources with directly adjacent crop rows, but any yield reduction in these rows is more than offset by gains in the rows that are two or more tree heights from the windbreak (Bates, 1944; Read, 1964). Obviously, trees take land out of agricultural production. But again, increased crop yields more than make up for this loss. Recent studies in Nebraska indicate that windbreaks result in a $19 million increase in grain production each year (based on 1983 prices, production averages, and acreages; increase of 4,172,563 bushels of corn, 451,045 bushels of soybeans, and 973,845 bushels of winter wheat) (Wardle and Schmidt, 1985).

In summarizing the results of research in 14 countries, Kort (1988) suggested that winter wheat, barley, rye, millet, alfalfa, hay, and to a lesser extent spring wheat, oats, and corn exhibit positive responses to windbreak protection, ranging from 6 percent to 99 percent (Table 2). Based on only one or two studies each, nine additional crops showed increased production, ranging from 10 percent to 100 percent (Table 2). Only three of the 97 studies reported by Kort (1988) revealed a negative response to shelter.

Many variables are involved in crop responses to shelter, so that the value of windbreaks will vary from year to year, depending on conditions. Over the long run, windbreaks will produce higher average yields for most field and forage crops, while reducing risks associated with weather extremes in any one year.

Increased livestock production. Livestock windbreaks provide several kinds of significant benefits both in feedlots and on pasture and range lands. First, the quantity of forage is improved on pastures protected by windbreaks (Lynch and Marshall, 1969). More importantly, windbreaks increase feed conversion efficiency, weight gains, and survival of newborns, and improve animal health, all of which in turn result in greater profits (Dronen, 1988). Also, protecting livestock with windbreaks offers an additional reduction in off-farm inputs because substantially less feed is needed during the winter (Morrison et al., 1979; Aldrich, 1977; Dronen, 1988).

In Tasmania, Australia, it has been estimated that it is economically justifiable to dedicate from 1 to 5 percent of every farm to shelter plantings (Bottomly and Parker, 1974). Providing protection from climatic stress during winter and early spring can be extremely important in temperate climates (Aldrich, 1977; Holmes and Sykes, 1984). The Nebraska Forest Service (Wardle and Schmidt, 1985) estimates that windbreaks save $1.5 million annually for cow-calf operations in that state and save an additional $1.5 million for feedlots (based on 1983 prices; increase of 17,550 calves and $10 per head for 159,000 protected head of cattle for the months December-March).

Increasing the production of saleable products and wood. Beyond providing posts, poles, rough lumber, firewood, fruits, and nuts for on-farm use, and allowing more reliable on-farm production of vegetables, trees can provide additional sources of income if these products are produced in sufficient quantity. Probably the most important cause of the increasing use of trees in agricultural systems worldwide is the widespread shortage of wood. This shortage directly affects over one billion people for whom enough wood to cook meals and heat homes is becoming scarce or unavailable (Postel, 1988).

In contrast to tropical forest regions (where most developing countries are located), the forest area in temperate regions is remaining fairly stable and in some countries is actually increasing (Postel, 1988). Unfortunately, this is not true of the forest area in the United States. During the last 20 years, the forest area in the U.S. has declined by 10 percent to a post-settlement low of 233 million acres, as a result of conversion

Table 2. Yield increases for 18 crops due to windbreak Protection[a]

Crop	Number of studies	Number of field years	Yield increase (%)[b]
Alfalfa	3	3	99
Millet	6	18	44
Barley	8	30	25
Winter wheat	16	131	23
Hay (mixed grasses and legumes)	6	14	20
Rye	9	39	19
Corn	6	209	12
Spring wheat	21	190	8
Oats	12	48	6
Brome grass	1	—	100
Wheatgrass	1	5	36
Corn silage	1	—	30
Clover	2	—	25
Rice	1	—	24
Sunflower	1	6	16
Cereals	1	—	15
Mustard	1	2	13
Flax	1	2	10

[a]Based on data summarized by Kort (1988).
[b]Weighted mean = % increase or decrease multiplied by the number of field years for each study. Totals were summed across studies and divided by the total number of field years.

to crop land and encroachment by urban and industrial development. Although improved technologies and management help to offset the effects of a declining forest area, the United States consumes more wood than it produces and, in fact, has done so since about 1945 (Hall, 1983). Imported wood presently supplies about 20 percent of U.S. demand. Continued erosion of the forest land base will not help to reduce our reliance on imported wood.

The increasing world demand for wood, coupled with a decreasing forest land base (WRI, 1986; Postel, 1988), suggests the need to produce these products on sites other than natural forests or plantations. Including trees as an integral part of agricultural systems will provide the landowner with additional income and the many benefits of tree shelter and will help to alleviate the shortage of wood worldwide.

Many nations willingly convert some productive capacity from food and forage crops to tree crops and wood production. Agroforestry, the intensive use of trees in agricultural systems, promotes wood production, rehabilitation and conservation of soils, and protection of crops and livestock. Besides the value of the wood produced, the trees often provide other direct benefits. For example, leaves from the lower portions of the trees are often used for forage (Smith, 1950; Brown, 1982; Bagley, 1988), while many trees also produce fruits or nuts suitable for animal or human consumption.

Agroforestry is practiced not only in developing or resource-depleted nations, but in resource-rich nations such as New Zealand, Australia, and the United States. Quite often such systems include trees on pasture or range lands (Reid and Wilson, 1986; Sharrow et al., 1989; Lewis et al., 1989). New Zealand has done the most to develop the idea of timber production in conjunction with windbreaks (Sturrock, 1988), an example of which was presented earlier.

Enhancing the quality of life

If shown side-by-side pictures of two farms, one surrounded by trees and one surrounded by open fields, few people would select the latter as the more desirable place to live. Trees break up the monotony of crop land, soften the microclimate around farmsteads, attract wildlife, and reduce dust and noise levels that are often caused by agricultural activities. In addition, the many benefits of trees and windbreaks mentioned in previous sections also relate directly to the quality of life on the farm.

Incorporating more trees in agricultural systems in the United States and throughout the world can also improve the quality of life for those of us who do not live on a farm. Trees remove pollutants from the air and protect watersheds, and so can be considered a world cleansing machine that is constantly working to keep this planet habitable. The rivers of China and the deforested areas of the tropics provide clear evidence of the importance of trees in protecting our water resources. The role of trees and all green plants in regulating the earth's climate has received much attention in recent years, primarily because of concern over massive deforestation in the tropics and global warming. Whether the drought of 1988 in the United States and weather aberrations in other areas of the world were a result of global warming is debatable. However, most predictions indicate that we can expect such a warming, regardless of whether we are already experiencing it. Trees play a very important role in moderating this warming trend by removing carbon dioxide from the air to manufacture carbohydrates. Efforts are under way to plant more trees to combat global warming (Sampson, 1988), but very many trees would have to be planted to have a significant impact. The development of sustainable systems of agriculture that include trees would assist in this effort.

A failure to communicate

The use of trees as the basis for a sustainable agriculture has been slow to take hold in the United States. There is a sound body of research to support the incorporation of trees into agricultural systems. Why, then, is there so little mention of trees in connection with sustainable agriculture?

Perhaps the love/hate relationship that agriculture has had with trees since this country was settled is at the root of it. Trees are nice, but they get in the way. To this day, trees on agricultural lands are tolerated, when at all, as conservation measures and are not generally recognized as income producers by much of the agricultural community. Why is this?

Sturrock (1988) identified ten reasons for the slow progress made in the acceptance of trees by the agricultural community, five of which seem especially relevant to the United States:

- Older plantings required too much land relative to the amount of protection provided;
- Economic pressures which act to physically restrict the area available for trees;
- A frequent lack of quantitative data on shelter effects on crops and livestock on a *local level*;
- Most windbreaks have been poorly managed and, therefore, are in poor condition. The sight of deteriorating windbreaks does not inspire farmers or their advisors to pursue windbreak plantings;
- Most farmers have small appreciation for the intrinsic value of the trees themselves.

All of the above act as disincentives to the use of trees in agricultural settings. Especially insidious are past design problems (e.g., 10-20 row field windbreaks) and the poor condition that many windbreaks are in today. The days of 10- or 20-row field windbreaks for crop and soil protection are long past. However, their specter still haunts landowners today, having firmly implanted the idea that field windbreaks take too much land out of crop production to justify their existence. The one- to five-row field windbreaks generally promoted today (SCS, 1974) occupy very little space relative to the benefits they provide.

Several studies have indicated that the majority of windbreaks in the Great Plains are in a state of decline and in need of renovation or replacement (USDA, 1977; Schaefer et al., 1987; Fewin and Helwig, 1988, citing unpublished data of Fewin and Slosser, 1979). It is estimated that 61 percent of the windbreaks in South Dakota are in need of renovation to return them to an effective condition (Schaefer et al., 1987). Many reasons have been given for the decline of windbreaks in the plains, including poor species selection, disease and insect problems, the effects of drought, damage from herbicides, and poor management. Schaefer et al. (1987) and others (Bagley, 1988; Sturrock, 1988) have suggested that poor management lies at the root of windbreak deterioration. In South Dakota, 83 percent of the windbreaks were estimated to be infested with grass and other herbaceous vegetation. Windbreaks in good condition were generally weed free, while those in poor condition were not (Schaefer et al., 1987). Windbreaks 40 or more years old that had received good care were generally still in good shape.

As is true of most endeavors, the return derived from windbreaks largely depends on the effort put into them. The proper establishment and care of windbreaks requires a commitment of time and energy. Well-managed windbreaks work well; poorly managed windbreaks do not. Instilling landowners with the desire to aggressively manage their trees is an important key to establishing effective, long-term windbreaks. It is also the area with which windbreak advocates have had a great deal of difficulty. Most farmers don't allow weeds to overrun their crops, so why do they ignore weeds in their trees? Both Bagley (1988) and Sturrock (1988) suggested that farmers generally fail to consider that their trees have a value in and of themselves, in addition to the benefits provided to the rest of the farming operation. Because of this, there is little incentive to care for the trees. Trees and windbreaks must be accepted as an integral part of the farm-cropping system before they will generally be afforded necessary care. Apparently such acceptance is still far from manifesting itself in the agricultural community. I have already proposed many reasons for this, but there is at least one more aspect of this problem that I would like to touch on.

Consider the organizations and agencies that promote tree planting on agricultural lands: the Soil Conservation Service; local conservation districts; state forestry divisions; the U.S. Forest Service; the American Forestry Association; the American Forest Council through the American Tree Farm System; and the National Arbor Day Foundation. This list is definitely not all-inclusive, but it does serve to make a simple point. Except for the Soil Conservation Service, none of the above are closely allied with the agricultural production community. All of the above are concerned with trees or conservation of natural resources. Conservation to many people still means added costs with little promise of actually generating additional income. It is something one does because it is the "right thing to do" or because there are regulations that require it. The long-term benefits of conservation are much harder to sell than something that will generate income in the not-too-distant future. Throughout the Great Plains, tree seedlings are marketed as "conservation trees." One might question the wisdom of this. Trees are income producers as well as a good conservation measure. They should be promoted as such.

Regardless of where to place the blame, tree planting on agricultural lands has suffered through a failure to effectively communicate the value of trees to the agricultural community of researchers, federal and state agencies, private industry, and landowners. Forestry and conservation interests are outsiders, and the impact of their message is lessened by this fact. Real progress can only be made with support from the inside as well. An agronomist, beef specialist, or agricultural economist telling a farmer that production could be stabilized or increased through the establishment of tree windbreaks would be more effective than a "conservationist" with the same message. Before farmers, ranchers, and other rural landowners can be expected to more fully embrace tree planting, the help of influential individuals and organizations directly involved in agricultural production will have to be enlisted. This could be a formidable task, since even those presently involved in promoting a sustainable agriculture in this country have largely overlooked the value of trees.

Trees for a sustainable culture

"One telling measure of humanity's progress toward sustainability is the extent of efforts to plant trees" (Brown, 1985). Clearly, trees can have a larger part to play than just their traditional forestry role, or even their role in sustainable agriculture. With few exceptions, trees are a requirement for a *sustainable culture*. This role was expounded in detail by Smith (1950) in his book, *Tree Crops, A Permanent Agriculture*. Greater efforts at communicating the value of trees to agriculture will be needed if planting trees on agricultural lands on a large scale is going to be achieved. Otherwise, we can sit and wait for the next environmental disaster to do the communicating for us.

South Dakota Agricultural Experiment Station Paper No. 2470.

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EPA proposes ban of EBDCs

Most uses of the nation's most widely used fungicide chemical, ethylene bisdithiocarbamate (EBDC), will be banned within 18 months, Environmental Protection Agency Administrator William K. Reilly announced on December 4, 1989. EBDCs are a family of chemicals used to fight fungal diseases on about one-third of the fruits and vegetables grown in the United States. Research has shown that they break down from decay or heat into a potent carcinogen, posing risks higher than allowed by the national EPA dietary standards. Use of EBDCs on tomatoes, potatoes, bananas, and 42 other types of produce would be banned. The chemical could continue to be used on 10 crops: grapes, wheat, cranberries, onions, sweet corn, peanuts, almonds, asparagus, sugar beets, and figs.

ATTRA funded for 1990 with Interior Department

ATTRA, the Arkansas-based hotline information service for low-input/sustainable agriculture, has received FY1990 funding through the Fish and Wildlife Service of the Department of the Interior. Funding through the Department of Agriculture was opposed by Congressman Jamie Whitten (D-TN) after the information center was moved from Tennessee to Arkansas. Senator Dale Bumpers (D-AR) then proposed funding through the Interior budget. The hotline (1-800-346-9140) will continue its service of referrals to technical experts in sustainable agriculture. The ATTRA address is P.O. Box 3657, Fayetteville, AR 72702.