Value of Windbreaks[1]

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Abstract.--Windbreaks are an important part of in the Great Plains. They are planted for a variety of reasons and provide both economical and esthetic benefits. This is a summary of some of the benefits and the importance of using adapted, high quality nursery stock.

Early settlers in the Great Plains found trees growing only in the drainage ways and river bottoms. Due to the relentless wind, they soon recognized the need for windbreaks. They found that it wasn't an easy task to move trees from the river bottoms to the prairie, but with care it was possible. The benefits of windbreaks in the Great Plains have been recognized since these early days.

Starting with the Timber Culture Act of 1873 up to the present, millions of seedlings have been planted in windbreaks on the Great Plains. In South Dakota alone, over 150 million seedlings have been planted from 1935-85. These windbreaks are planted for a variety of reasons but mainly a$ a barrier to reduce wind velocity. Reducing the wind velocity alters factors of the microclimate, such as humidity and temperature, in the protected zone. Windbreaks conserve moisture because they reduce evaporation and transpiration in summer and trap snow in winter. Windbreaks protect farm and ranch homes, cultivated fields, gardens and orchards, livestock feedlots, and wildlife.

There have been many studies on the economic value of windbreaks. In a recent study in Saskatchewan, White (1984) found that a properly designed shelterbelt can reduce the heating of a typical farm home by $585 per year. This reconfirms an earlier study by Bates (1945) that showed about a 25 percent reduction in heating costs.

A study by Ames (1980) calculates the increased maintenance feed costs for beef cattle per degree of cold. This method shows a windbreak can reduce the maintenance feed costs for beef cattle by 10 percent on a winter day of 15°F and 15 mph winds. Savings are even greater as the temperature drops and the windspeed increases.

Dr. Brandle (1980) has published some interesting work in Nebraska on the benefits of field windbreaks. His studies show field windbreaks can increase winter wheat yields by 8 bu./ac. and soybeans by 4 bu./ac.

These studies and others show monetary benefits from planting windbreaks. How do you put a monetary value on raising a nice flower garden in the protected area of a windbreak on the windswept Plains? These nonmonetary values are also important reasons for windbreaks.

I want to switch gears a little now and talk about why we have good windbreaks and why we've been able to keep a good windbreak program going in the upper Midwest. I feel one of the most important factor is that we have a lot of high quality windbreaks and high quality windbreaks sell themselves. This quality is the result of research and information gathering that was started in the late 1800's and has continued up to the present.

During the 1890's, state agricultural experiment stations throughout the Plains established tree planting tests to determine the best adapted species. USDA field stations at Mandan, North Dakota; Cheyenne, Wyoming; Akron, Colorado; and Woodward, Oklahoma began tree planting experiments during the period 1910-20. This work is still the basis for our present windbreak planting program. The list of species (table 1) used in the 1916 shelterbelt project at Mandan isn't much different than the species that are most commonly planted today (table 2). This comparison is important because it shows us how limited we are in species selection. This is especially true for tall trees adapted to dry sites.

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Tall deciduous trees	Medium-height deciduous trees	Conifers	Shrubs
Green ash	Chokecherry	Ponderosa pine	Common buckthorn
Boxelder	Russian-olive	Scotch pine	Silver buffaloberry
Cottonwood	Tatarian maple	Eastern redcedar	Tatarian honeysuckle
American elm		Black Hills spruce	Siberian pea-tree
Siberian elm		Blue spruce	American plum
Hackberry			
Honeylocust			
Golden willow			

Table 1.--Cooperative Shelterbelt Project 1916-46
(George 1953)

Tall deciduous trees	Medium-height deciduous trees	Conifers	Shrubs
Green ash	Amur maple	White (Black Hills) spruce	American plum
Hackberry	Chokecherry	Blue (Colorado) spruce	Caragana
Honeylocust	Manchurian crabapple	Eastern redcedar	Lilac
Poplars	Russian-olive	Ponderosa pine	Peking cotoneaster
Siberian elm	Siberian crabapple	Rocky Mountain juniper	Silver buffaloberry
Willows		Scotch pine	Tatarian honeysuckle

Table 2.--Species used in the Northern Great Plains
(Dronen 1984)

How do we improve our windbreaks? The chances of finding many new species aren't very good; the real chance for improvement lies in improving the species we have and using the best known seed sources for seedling production. That's why the nurseryman is so important in the success or failure of our windbreak program.

Another area where the nurseryman is extremely important is in seedling grades. In the Dakotas' we have established minimum and maximum grades for nursery stock for all the species that are used in windbreaks. These grades were established from research and practical experience.

E. J. George (1973) found that there was significant differences in height and diameter growth of green ash with four grades of seedlings. His study was established in 1941. The four grades: 1, 2, 3, and 4 averaged 2.9, 1.8, 1.5, and 0.8 feet in height and .52, .33, .22, and .15 inches in diameter, respectively, at planting time. Grades 1 and 2 showed superior height and diameter growth over grades 3 and 4 after 29 years in the field. Regardless of the cause, genetic or bed density, seedlings having the larger stem diameter at one year continued to have that characteristic when grown for a second season in the nursery.

I like to use the comparison with the runt in a pig litter. It never catches up with the rest of the litter. In the nursery, seedlings that don't make grade should be thrown away. This is especially true for tall trees. Height is one of the most important factors for influencing the values of a windbreak because the area protected by a windbreak is 10 times the height. Therefore, every additional foot of height provides 10 feet extra width of area protected. In the George study (1973) there was about a 9-foot difference between the number one grade and the number four grade seedlings. This increased the width of the area protected by 90 feet!

For many people, planting a windbreak is a once in a lifetime experience. You, the nurseryman, can assure that adapted seed sources and high quality seedlings, properly graded, are used to ensure the best possible start and give the windbreak a good chance of being successful.

LITERATURE CITED

Ames, D., Livestock Nutrition in Cold Weather, Animal Nutrition & Health, pp. 6-7 and 38-39, October 1980.

Bates, C. G., The Value Of Shelterbelts In House-Heating. Journal Of Forestry, Vol. 43, pp. 176-196, 1945.

Brandle, J. R., the Role of Microclimate in Energy Use Efficiency, Paper No. 6150, Journal Series, Nebraska Agricultural Experiment Station, November 1980.

Brandle, J. R., B. B. Johnson, and D. D. Dearmont, Field Windbreak Economics, Paper No. 6966, Journal Series, Nebraska Agricultural Experiment Station, 1982.

Dronen, S. I., Windbreaks In The Great Plains. Northern Journal Of Applied Forestry, Vol. 1 No. 3, pp. 55-59, September 1984.

George, E. J., 31-Year Results In Growing Shelterbelts On The Northern Great Plains, USDA, Circular No. 924, August 1953.

George, E. J. and A. B. Frank, Graded Nursery Stock In Shelterbelt Type Planting Evaluated Over 29-Year Span. Tree Planters' Notes, Volume 24, No. 1, pp. 30-32, 1973.

White, Robert, Shelterbelts Help Cut Heating Costs. Farmers Light & Power, February 1984.