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Good Windbreaks Help Increase South Dakota Crop Yields

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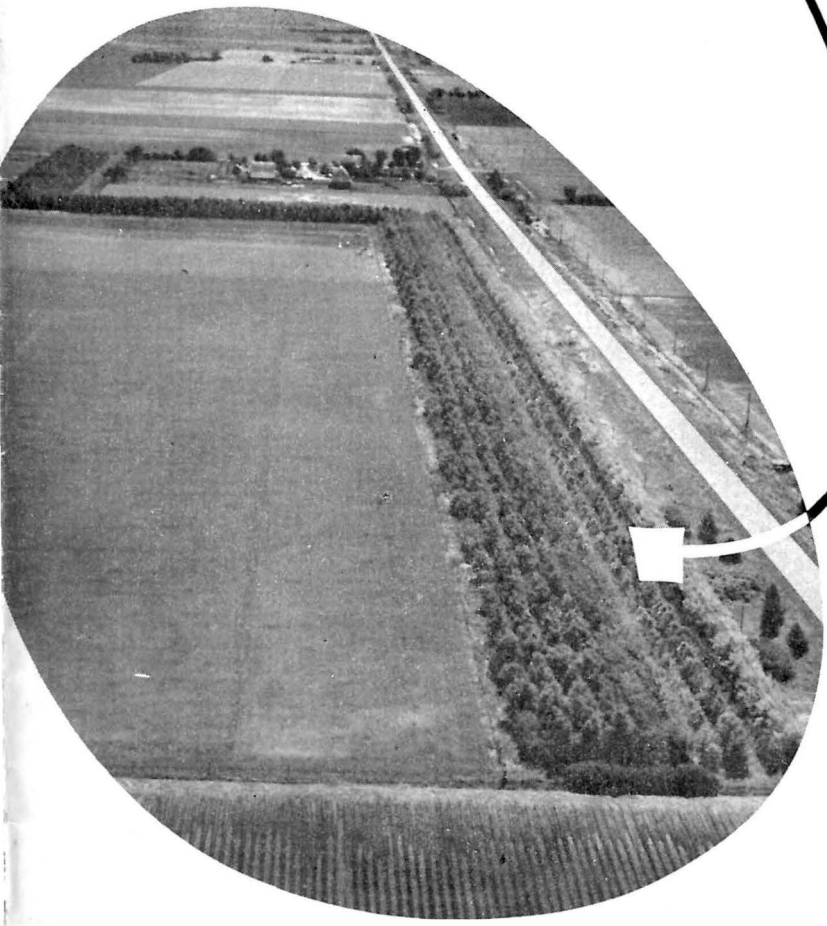

HORTICULTURE-FORESTRY DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
South Dakota State College, Brookings, in cooperation with
THE SOIL CONSERVATION SERVICE,
United States Department of Agriculture

Foreword

Planting field windbreaks, in conjunction with other conservation practices, has long been recognized as an important contribution to the agricultural economy of South Dakota. Thousands of miles of windbreaks have been planted in the state during the past 20 years, and it is the opinion of agricultural authorities that many more thousands of miles are needed.

Despite this wide-scale interest, little was actually known about the influence of windbreaks on crop yields. To obtain information on this question, the Soil Conservation Service authorized a survey during the fall of 1954 in cooperation with the South Dakota State College Agricultural Experiment Station.

A number of farmers, representative of those with good field windbreaks, were interviewed by Soil Conservation Service personnel under the leadership of A. L. Ford and A. E. Ferber, Woodland Conservationists. These farmers provided crop yield data for the major crops on fields protected by the windbreaks. South Dakota State College Agricultural Experiment Station personnel, under the leadership of Professor S. A. McCrory, assisted in the over-all conduct of the survey.

This report contains the summary and analysis of the data gathered in the study. The evidence strongly indicates that good field windbreaks are valuable assets to South Dakota farmers in their soil conservation work and in increasing crop yields.

Ross D. Davies,

State Conservationist, Soil Conservation Service

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Good Windbreaks

Help Increase South Dakota Crop Yields

A. E. Ferber, A. L. Ford, and S. A. McCrory[1]

The use of field windbreaks as a soil conservation practice in the Plains States has progressed steadily during the past 20 years. These plantings reward their owners with numerous benefits, including the reduction of wind currents, soil drifting, crop blowout, evaporation, transpiration, and control of drifting snow.

In many cases they also provide protection for livestock and wildlife and produce wood products and fruit for home use. Many farmers have also observed increased crop yields in areas protected by windbreaks.

Little research data are available on this phase. To get more information, employees of the Soil Conservation Service interviewed representative South Dakota farmers during the fall of 1954 to obtain firsthand results on the use of field windbreaks[2] for increasing crop yields.

Summary of Survey

The survey was conducted in 37 Soil Conservation Districts in the eastern one-third of the state, and 331 farmers participated in the study. Data were collected for the crop years of 1952, 1953, and 1954. Certain rigid specifications were observed in selecting windbreaks and adjacent fields as well as operators to obtain as accurate and representative results as possible.

Of the farmers interviewed, 78 percent were owners and 22 percent tenants. Fifty percent of the owners had lived on the same farm 25 years or longer.

[1]Woodland Conservationist, SCS, Denver, Colorado: Woodland Conservationist, SCS, Huron, South Dakota; Head, Department of Horticulture and Forestry, South Dakota State College Agricultural Experiment Station, Brookings, South Dakota: respectively.

[2]Field windbreaks, as used in this report, is synonymous with the term field shelterbelts.

The study included ten major and nine minor crops. Farmers were asked to estimate the increase or decrease in crop yields on the portions of the fields protected by their windbreaks as compared to yields beyond their influence. Other information was also obtained during the interviews.

Yield Estimates

Information was obtained from 991 crop-year fields[3] where crop yield increases were estimated by farmers, involving 18,182 acres of protected cropland. The summaries show that 274 of the 331 farmers interviewed, or approximately 83 percent, estimated crop yield increases for one or more of the three seasons involved. A minor percentage noted yield increases but could not furnish specific data, and a few noted no difference. Only two farmers estimated crop yield decreases due to windbreaks.

Since corn was the principal crop involved in this study, it will serve to illustrate yield increases estimated by farmers as the result of windbreak protection and influence. Yield increases were estimated on the protected portions (approximately 30 percent) of 359 crop-year fields of corn. This involved a total of 7,135 acres. The average estimated increase on this acreage was 8½ bushels per acre. Averaging in the 1,699 acres of corn where no yield increase was noted and the 56 acres where yield decreases occurred, the over-all corn yield increase was 6.7 bushels per acre. Other crops were comparably benefited.

There were no significant differences noted between crop yields and soil types as influenced by windbreaks. For yield increase purposes, windbreaks can be favorably considered in all areas capable of supporting good tree growth. There were no significant differences in yield averages during the three crop seasons involved.

Increased crop yields generally predominated in all parts of the survey area, although estimates of lower increases were more evident in the southern and eastern tier of counties.

Windbreak Considerations

Fields lying east, north, and south of windbreaks were benefited favorably to about the same degree. Crops to the west of such plantings showed the least response. It is apparent that windbreaks oriented in an east-west direction influence crop yields more favorably than those oriented north and south.

Windbreaks ranged in height from approximately 20 to 40 feet and the average width of the protected strips was about 20 rods. Five-row windbreaks increased crop yields almost as much as 10- to 15-row plantings. Windbreaks in good condition produced better results than those that were only fair.

Windbreak benefits resulted from reduced damaging wind velocities, a lowering of transpiration and evaporation, control and retention of snow, and creation of more favorable temperature relationships.

[3]Data are expressed in terms of crop-years. A field could have been counted any or all of the 3 years.

The results, based on 3 years' experience, indicate that field windbreaks, where judiciously used and adequately maintained, will, over a period of years, increase crop yields sufficiently to more than pay for the land they occupy.

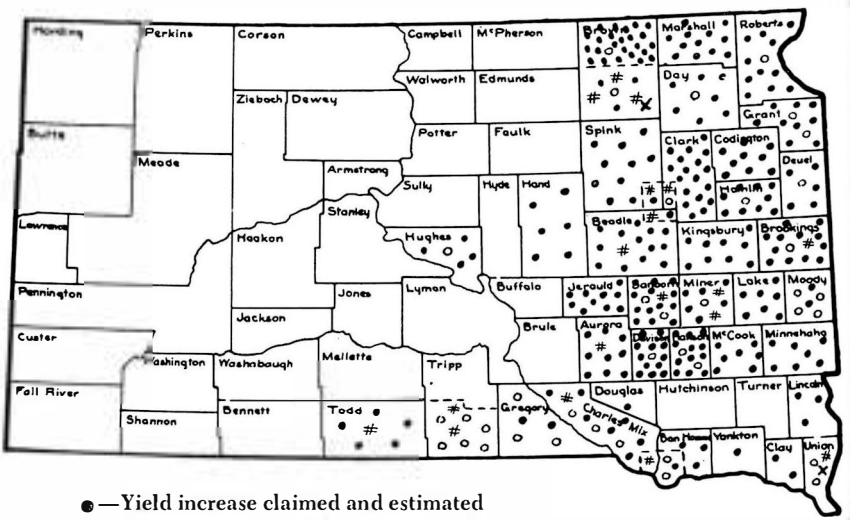
The three seasons involved were not abnormally dry or windy. During years of more adverse growing conditions, the benefits from windbreaks may be even more favorable. The results undoubtedly will vary from year to year. In addition, field windbreaks will benefit their owners in many other ways. Other conservation and land management practices are needed in conjunction with field windbreaks.

Purpose of Survey

The survey was undertaken to obtain information directly from representative farmers who are using field windbreaks in their farming operations. Since so little research data were available regarding the influence of windbreaks on the adjacent crops, it was deemed advisable to gather additional information from sources now available.

Crop yield estimates were furnished by farmers where available. These were recorded, summarized, and analyzed. This information is needed to guide and encourage farmers in the establishment of field windbreaks and to indicate

Approximate location of farms involved in the survey with farmer estimates on effects of windbreaks on crop yields.



●—Yield increase claimed and estimated

#—Yield increase claimed but not estimated

O—Claimed no difference in crop yields

X—Claimed decrease in crop yields

what might be expected from them in increasing crop yields.

Survey Methods Used

The survey was conducted in accordance with a plan and specifications developed by the Soil Conservation Service and concurred in by the South Dakota State College Agricultural Experiment Station.

Field windbreaks planted during the late 1930's and early 1940's in the eastern third of the state comprised the bulk of the plantations involved in the study. Thirty-seven soil conservation districts were selected for the project. Each was allotted interview schedules to be completed in proportion to the miles of field windbreaks existing in the district.

In locating qualifying windbreaks, which involve the adjacent fields and the operators themselves, specifications and requirements were set up as follows:

(1) The operator must have farmed the field or fields under consideration for at least the past 5 years.

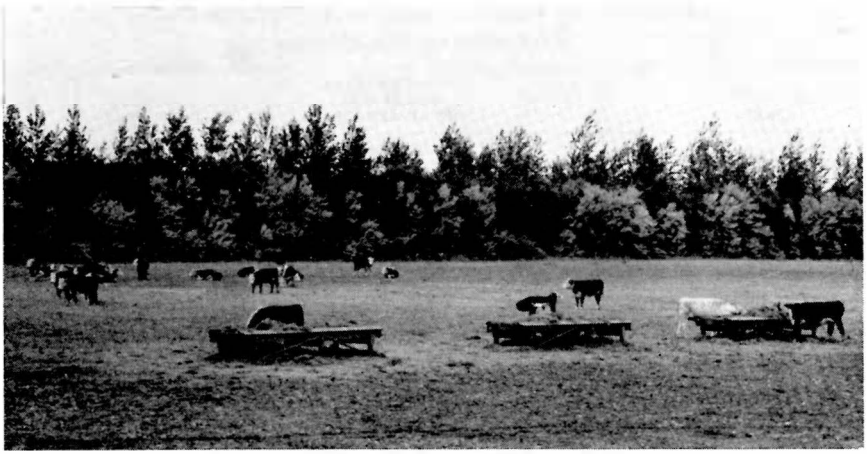
(2) The field or fields adjacent to and beyond the zone of windbreak influence were required to have reasonably identical soil characteristics, slope, and aspect as indicated by soil surveys. The rotations, cropping systems, land treatment, and other management practices should have been similar in any 1 year during the previous 5-year period in the "protected" and "unprotected" portion of the field or fields. All factors influencing crop yields were required to have been constant within practical limits except for the influence of the windbreak.

(3) The windbreaks were required to have an effective height of 20 feet or more and a minimum length of three-eights of a mile. Gaps of not in excess of 50 feet in width, nor more than two per three-eighths-mile length were permitted. A density of 50 percent or more was required. A minimum of three good rows was mandatory, one of which was required to be a tight shrub row.

Hundreds of windbreaks were screened out by local Soil Conservation Service personnel because they did not meet established specifications and requirements. In some districts, this screening eliminated all but a few. In others, as high as 50 or even more were found to qualify. Randomized sampling of the qualifying farmers was carried out to an acceptable degree.

A tentative goal of 300 interviews and completed schedules was established. A total of 339 survey schedules were actually completed and submitted. Eight were eliminated from the final summaries since they did not meet specifications. The data presented are based on 331 schedules.

Qualifying farmers were asked to estimate the difference in crop yields between the protected and unprotected portions of their fields as influenced by the windbreak.



Livestock benefit from wind protection.

The study involved the crop years of 1952, 1953, and 1954. Other information outlined in the survey was recorded. Farmers volunteered much additional useful data relative to their windbreak benefits. This was also recorded.

Crop Yield Data

The survey data are expressed in terms of crop- or field-years and not in terms of separate individual fields. One field under consideration for the 3-year period could have been in a different crop each of the 3 years.

The data in table 1 include only those fields where yield increases were noted.

The estimated yield increases apply only to those portions of the fields within the influence of the windbreak. Farmers estimated that this strip averaged around 20 rods in width for all windbreaks and fields in the survey. Approximately 30 percent of all crop acreages in the study was benefited by adjacent windbreaks. The remaining 70 percent was considered to be beyond the influence of the trees.

No crop yield data were available from many fields on one side of the windbreak or the other for one or more of the following reasons:

(1) The field did not meet specifications.
(2) The land was in pasture.
(3) There was no crop that year due to hail, rust, or inclement weather.
(4) The field was fallowed.
(5) The windbreak was located adjacent to a road or lane.
(6) One side of the windbreak was under different ownership and no data were available.
(7) The operator could not remember yields for 1 or 2 years of the 3-year period.
(8) The farmer noted yield increases but had no information as to quantity.
(9) Operators noted no increase or

Table 1. Crop Yield Increases on Portions of Fields Protected by Windbreaks

CROP	NO. CROP-YEAR FIELDS WITH INCREASED YIELDS	AV. INCREASED YIELD PER ACRE
Corn	359	8 to 9 bu.
Oats	284	8 to 9 bu.
Alfalfa	123	¾ ton
Wheat	79	3 to 4 bu.
Flax	55	3 to 4 bu.
Barley	34	8 to 9 bu.
Corn Silage	13	3 to 4 tons
Soybeans	11	5 to 6 bu.
Rye	9	About 6 bu.
Crested Wheat Grass Hay	5	¼ ton
Potatoes	4	About 80 bu.
Brome Grass	3	1 ton
Wild Hay	3	¼ ton
Melons	3	About 20% increase
Cane Silage	2	2 tons
Red Clover Seed	1	About 30 lbs.
Sweet Clover Seed	1	120 lbs.
Speltz	1	9 bu.
Millet	1	20 bu.
Total	**991**	

decrease on 246 crop-year fields in the survey.

Yield Increases Noted

The results show that 274 out of the 331 farmers interviewed, or approximately 83 percent, noted increased crop yields for 1 or more of the 3 years involved, and furnished the yield estimates. Another 18, or 5.4 percent, noted increased yields but could not estimate the amount. Only 39 farmers, or 11.8 percent, noted no significant difference in yield during all three of the crop years involved. Two farmers noted that crop yields were decreased. Detailed information on this phase is shown on the map.

The survey schedules indicate that of the 39 farmers who noted no significant yield increases, 32 stated that they felt the trees were paying for the land they occupied through other benefits. Seventeen stated they were planning or would like to plant more trees.

Data in table 2 give the over-all yield increase averages for the 10 major crops, taking into account all acreages from which information was obtained and which lay within the influence of the windbreaks. Yields from this area were compared with the normal yields beyond the influence of the windbreaks. Average yield estimates in

the right-hand column are on the conservative side since much of the acreage in column 3 showed increased yields but could not be estimated.

All estimated increases in yield were separated into the three years, 1952, 1953, and 1954, to determine the difference, if any, between the three growing seasons. It was found that the difference was so small it was not significant.

The data in table 3 indicate that the average yield increases were lowest from fields west of north-south windbreaks.

Although the difference is not great, table 4 shows that the area benefited by increased crop yields is greater north of east-west and east of north-south windbreaks than are the south or west sides of such plantings.

All windbreaks in the survey

Table 2. Crop Yield Data for all Acreages Influenced by Windbreaks, 10 Major Crops

CROP	INCREASE NOTED: AV. INCREASE	INCREASE NOTED: TOTAL ACRES	NO INCREASE NOTED, TOTAL ACRES	DECREASE NOTED: AV. DECREASE	DECREASE NOTED: TOTAL ACRES	AV. INCREASES, ALL FIELDS
Corn	8.5 bu.	7,135	1,699	22 bu.	56	6.7 bu.
Oats	8.5 bu.	5,548	1,487	11 bu.	93	6.5 bu.
Alfalfa	¾ ton	2,103	673	¼ ton	18	0.56 ton
Wheat	3.5 bu.	1,213	530	3.5 bu.	40	2.3 bu.
Flax	3.5 bu.	729	84	2.5 bu.	20	3.0 bu.
Barley	8.5 bu.	706	103	———	———	7.4 bu.
Corn Silage	3.5 tons	211	———	———	———	3.5 tons
Soybeans	5.5 bu.	175	———	———	———	5.5 bu.
Rye	6.0 bu.	274	107	———	———	4.3 bu.
Potatoes	80.0 bu.	88	———	———	———	80.0 bu.
Grand Total		18,182	4,683		227	

Table 3. Effect of Windbreak Orientation on Crop Yield Increases

CROP	NORTH OF E & W BELTS	SOUTH OF E & W BELTS	EAST OF N & S BELTS	WEST OF N & S BELTS
Alfalfa	0.97 ton	0.82 ton	0.56 ton	0.41 ton
Barley	7.5 bu.	10.1 bu.	9.7 bu.	3.0 bu.
Corn	8.4 bu.	8.6 bu.	6.4 bu.	4.8 bu.
Corn Silage	4.2 tons	2.7 tons	———	———
Flax	4.2 bu.	3.3 bu.	3.5 bu.	3.5 bu.
Rye	5.1 bu.	7.8 bu.	5.0 bu.	———
Wheat	3.3 bu.	3.7 bu.	2.7 bu.	3.5 bu.
Oats	8.3 bu.	9.2 bu.	9.4 bu.	5.4 bu.

were classified as to effective height and the amount of cropland benefited was recorded. The results of this phase are shown in table 5.

With the exception of the 21- to 24-foot height class, the width of the cropland benefited increased with increased planting height.

All windbreaks involved in the study were classified by length to determine the relation of length to width of benefited adjacent area. No noticeable difference was found. This might not be true for short windbreaks of 60 rods or less.

Estimates summarized in table 6 indicate that there is no great difference in the width of benefited area in relation to the width of the windbreak in rows. This is of great importance since there is no need to sacrifice more cropland for trees than is necessary to obtain satisfactory crop yield benefits.

Windbreaks in the lower condition class protect less adjacent cropland than those in better condition (see table 7). Most of the windbreaks in the lower condition class were grazed by livestock.

All cropland adjacent to windbreaks was classified into three categories with respect to susceptibility to blowing as follows:

(1) Most susceptible to blowing (sands and light sandy loams).
(2) Moderately susceptible to blowing (fine textured surface soils, such as clays and silty clays).

Table 4. Relation of Windbreak Orientation to the Amount of Cropland Benefited

ORIENTATION	NO. OF FIELDS	APPROX. AV. WIDTH BENEFITED
North of East-West Windbreaks	183	20 rods
South of East-West Windbreaks	136	18 rods
East of North-South Windbreaks	28	22 rods
West of North-South Windbreaks	18	18 rods

Table 5. Relation of Effective Height of Windbreaks to Cropland Benefited for Those Who Reported

PLANTING HEIGHT CLASS	NO. OF PLANTINGS IN CLASS	APPROX. AV. WIDTH BENEFITED
20 ft.	40	17 rods
21 to 24 ft.	29	23 rods
25 to 29 ft.	61	18 rods
30 to 34 ft.	85	20 rods
35 to 39 ft.	42	21 rods
40 ft. or higher	44	25 rods

Table 6. Relation of Windbreak Width to Width of Benefited Area for Those Who Reported

WINDBREAK WIDTH CLASS	NO. OF WINDBREAK IN CLASS	AV. WIDTH OF BENEFITED AREA
3 to 5 rows	25	19 rods
6 to 8 rows	44	21 rods
9 to 11 rows	142	20 rods
12 rows or more	63	22 rods

Table 7. Relation of Windbreak Condition to Benefited Area Width

WINDBREAK CONDITION CLASS	NO. OF PLANTINGS IN CLASS	APPROX. WIDTH OF BENEFITED AREA
Excellent	17	20 rods
Very good	58	20 rods
Good	180	21 rods
Fair to Good	35	16 rods

Table 8. Relation of Soil Type to Crop Yield Increases

	MOST SUSCEPTIBLE TO BLOWING	MODERATELY SUSCEPTIBLE TO BLOWING	LIGHT SUSCEPTIBLE TO BLOWING
Number of Windbreaks in Class	88 (26.6%)	82 (25.1%)	157 (48.3%)
Farmers Who Estimated Increased Yields	80 (90.9%)	70 (84.1%)	147 (91.9%)

(3) Least susceptible to blowing (medium textured soils).

Farmer estimates of increased crop yields were correlated with this soil classification. Results are shown in table 8.

Field windbreaks increase crop yields on adjacent protected land regardless of the soil's susceptibility to blowing or wind erosion. They can be used advantageously on all cropland in areas capable of supporting satisfactory tree vigor and growth.

Farmers Interviewed

The summary shows that 258 of the 331 farms in the survey, 78 percent, were owner-operated while 73, 22 percent, were farmed by tenants.

The tenants represented in this survey are of a more permanent

For maximum wind protection, both height and density are necessary.

type than the average for the area involved. Forty-one of these 73 tenants, or 56 percent, have lived on the same farm 10 years or more; and 16 of them, or 22 percent, have lived on the same farm 25 years or longer. The 258 owner-operators were well above the average in both age and tenure. For example, 128 of these owner-operators, or 50 percent, had lived on the same farm 25 years or longer.

Climatic Conditions

Precipitation, temperatures, and wind velocities directly concern and are of import in a survey of this nature. The following climatic information for the survey period (1952, 1953, 1954) is therefore included.

Precipitation

The average annual precipitation for the eastern third of South Dakota follows:

1951—26.21 inches
1952—15.89 inches
1953—25.45 inches
1954—21.08 inches

Long-time average annual precipitation for the area was 21.95 inches.

The season of 1952 was nearly 6 inches below average in precipitation, but an average crop was produced, largely due to soil moisture reserve carried over from 1951. By far the best crop year of the 3 years involved was 1953, having had 3½ inches above average precipitation. The 1954 precipitation for the area was only slightly below average, but it was noticeably unevenly distributed. In 1954 the area north of Huron and west of Watertown to the North Dakota line was generally well below average, while the entire southeastern part of the area was materially above average.

Snowfall for the period was as follows:

Winter of 1951-52—51.3 inches
Winter of 1952-53—35.4 inches
Winter of 1953-54—39.0 inches

Average for the area was 34.0 inches.

All three winters involved produced above average snowfall, the winter of 1951-52 being 17.3 inches above average.

Temperature

The mean average spring, summer, and fall temperatures for the period are shown in table 9.

This 3-year period was marked by cool, backward spring seasons during all 3 years, averaging from 1.2 to 1.6 degrees below average. All three summers were of above average temperature, the summer of 1952 being 1.5 degrees above. The fall of 1953 was one of the latest and warmest fall seasons on record, being 4.1 degrees above average.

Wind

The only wind records available for the 3-year period are for Huron, South Dakota. Since Huron is close to the center of the survey area, this wind data should be reasonably representative.

The number of hours of wind of 25 m.p.h. or above for 1952, 1953, and 1954 is shown in table 10.

The spring of 1954 was abnormally windy, while the spring of 1952 was unusually calm. The summer

and fall of 1952 were far above average in wind velocities of 25 m.p.h. and above.

Regarding high velocity winds (40 m.p.h. and above), the number of such winds that occurred by season for the 3-year period is shown in table 11.

The year 1954 generally was the windiest of the period involved, being marked by 17 winds of 40 m.p.h. or above. The spring of 1954 was one of unusually high winds, there being 11 winds of 40 m.p.h or above during March, April, May, and June of that year. Also, the summer of 1952 was far above average in high velocity winds.

On July 6, 1952, wind reached a velocity of 72 m.p.h., and on November 23, 1954, it reached 73 m.p.h.

Table 9. Mean Seasonal Temperatures, Eastern Third of South Dakota

	1952	1953	1954	AVERAGE
Spring	43.5	43.5	43.1	44.7
Summer	72.0	71.7	71.2	70.5
Fall	48.4	52.1	49.7	48.0

Source: U. S. Weather Bureau, Huron, S. D.

Table 10. Hours of Wind Velocity of 25 m.p.h. or Above at Huron, South Dakota

SEASON	1952	1953	1954
Jan., Feb., & Mar.	66	65	74
April, May, & June	50	91	122
July, Aug., & Sept.	48	15	19
Oct., Nov., & Dec.	76	64	54
Total for Year	**240**	**235**	**269**

Source: U. S. Weather Bureau, Huron, S. D.

Table 11. Number of Winds 40 m.p.h. or Above at Huron, South Dakota

SEASON	1952	1953	1954
Jan., Feb., & March	2	3	2
April, May, & June	1	5	9
July, Aug., & Sept.	6	2	2
Oct., Nov., & Dec.	4	3	4
Total for Year:	**13**	**13**	**17**

Source: U. S. Weather Bureau, Huron, S. D.

Related Information

Type of Plantings

Approximately 85 percent of all plantings represented in the survey were Prairie States Forestry Project shelterbelts planted from 1935 through 1942. The remaining 15 percent were Soil Conservation Service sponsored windbreaks and plantings made through individual farmer initiative.

Orientation of Plantings

Orientation of the plantings in the survey was:

262 plantings (79 percent) ran east and west

43 plantings (13 percent) ran north and south

26 plantings (8 percent) were two-direction belts

Length of Windbreaks

All plantings were required to be at least three-eighths of a mile (120 rods) in length. The length classification of the plantings in the survey follows:

120 rods—41 plantings (12%)

121 to 140 rods—33 plantings (10%)

141 to 160 rods—187 plantings (57%)

161 to 200 rods—16 plantings (5%)
200 rods or longer—54 plantings (16%)

Soil Type

The soil occupied by the plantings, as well as that of the adjacent cropland, was classified with reference to its susceptibility to blowing or wind erosion:

88 sites (27%) were most susceptible
83 sites (25%) were moderately susceptible
160 sites (48%) were least susceptible

Effective Height of Windbreaks

To qualify for the survey, all windbreaks were required to have an effective height of at least 20 feet.

The effective height classification for all windbreaks included in the survey is as follows:

20 feet—45 plantings (14%)
21 to 24 feet—30 plantings (9%)
25 to 29 feet—70 plantings (21%)
30 to 34 feet—92 plantings (28%)
35 to 39 feet—46 plantings (14%)
40 feet or over—47 plantings (14%)

Condition of Windbreaks

All plantings were personally inspected by the interviewers and classified as follows:

Excellent—22 plantings (7%)
Very good—66 plantings (20%)
Good—188 plantings (57%)
Fair to Good—54 plantings (16%)

Width of Windbreaks

All plantings were classified as to width in terms of number of rows of trees and shrubs as follows:

3 to 5 rows—30 plantings (9%)
6 to 8 rows—47 plantings (14%)
9 to 11 rows—180 plantings (55%)
12 rows or more—74 plantings (22%)

Farmers' Reasons for Increased Yields Due to Windbreak Influence

Farmers observed that windbreak benefits accrued from the following conditions:

(1) Crop protection from hot, drying winds during critical stages of the growing season.
(2) Reduction in evaporation rate due to lowering surface wind velocities.
(3) Reduction in crop damage by storms and high winds during the later stages of crop development.
(4) Reduction in fallen ears in corn borer infested corn as the result of lowered surface wind velocities.
(5) Added soil moisture from snow trapped on cropland.
(6) Reduction in damage to young seedlings by blowing soil in the spring.
(7) Reduction in crops being blown out in the spring, as well as in the fall in the case of fall seedings.
(8) Cropland south of east-west plantings warms up earlier in the spring, giving crops a faster start. This is reflected in the final yield.
(9) Several farmers in the northeastern part of the state noted that their field windbreaks protected flax from a late spring freeze. The unprotected part of their fields had to be re-

planted while the protected part came through the freeze undamaged.

Trees and Sale Value of Land

Two hundred and ninety-two farmers estimated that their trees increased the sale value of their land. This involved 98,595 acres of land (an average of 338 acres per farm) with a total estimated increase in sale value of $748,189. This is an average estimated increase of $7.59 per acre.

Farmers' Opinions and Comments

Farmers also volunteered information on other phases in connection with their windbreaks. A majority plan to plant more windbreaks, nearly all felt that their windbreaks more than paid for the land they occupy, and all agreed that trees improve the livability of the farm and community. Many commented favorably regarding the effects that windbreaks have in reducing soil blowing, crop damage, and in controlling drifting snow. All noted the beneficial effects that trees have on the wildlife population. Few felt that windbreak sapping and shading was a factor in crop loss. Many farmers were enthusiastic relative to benefits noted in the feeding of livestock during the winter months in the lee of windbreaks.

Listed below are typical farmer comments, which reflect the eco-

Modern tree planting with mechanical equipment. As many as 1,000 trees per hour can be planted by this method.

nomics and social aspects of tree planting on the Plains:

"Trees are a MUST on any place I farm."

"Would like to see many more trees planted in this district."

"We'll never get too many trees planted here."

"My family wouldn't be content here without the trees."

"There should be a shelterbelt every half mile over this whole area."

"This farm was a sand blowout before I planted trees."

"My net returns are larger now even though I sacrificed nine acres for trees."

"Tree planting is one of the most important soil conservation practices."

"If it weren't for my trees, I'd make the old song 'California, Here I Come' actually come true."

"Can't see why any young farmer could keep from planting trees with all the help and advice available."

"As our farming becomes more diversified, more windbreaks will have to be planted."

"I'd never be without trees again."

Acknowledgement

The authors wish to acknowledge the helpful counsel and advice received from South Dakota State College Agricultural Experiment Station personnel and others and for the assistance of the Soil Conservation Service in the conduct of this survey.