TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE Portland, Oregon SOIL CONSERVATION SERVICE

AGRONOMY No. 21 (Revised-1) January, 1973
From Revised Technical Note Agronomy No. 47 - Montana

RE: Establishment of Tall Wheatgrass Barriers for Soil Erosion Control and Water Conservation. Prepared by Wendell Thacker and Ashley Thornburg, and reviewed by Agricultural Research Service.

The following information was prepared to assist farmers in making decisions on whether grass barriers should be used by an individual or group, and to provide guidance in the mechanics of the procedure. Information is based on research data of the Agricultural Research Service, Sidney, Montana, landowner experiences gained by the Tunis-Fort Benton Erosion Control Group who seeded several thousand acres in 1971, and Soil Conservation Service observations.

Introduction

The practice of using barriers at intervals across sandy cropland to provide protection against wind erosion is not new. Woody plantings have been used for many years, as have rows of tall growing annual crops such as corn or sorghums. Perennial grass barriers have been used in the south to protect melon and peanut plantings. These plantings are on small fields and do not require the complex preparation measures and management techniques that are necessary when several hundred acres are to be planted as a dryland grain operation.

The primary use of barriers is to reduce wind erosion. We also have the opportunity in Montana to accumulate additional moisture in the form of snow to increase small grain and forage production, though the economics are not conclusive. Until research is completed this use of barriers should be only on a trial basis. Grass barriers are not a reportable item in the present reporting system.

The Barrier System

The perennial grass barrier system is made up of two rows of tall wheatgrass planted 30 to 40 inches apart with a 30 to 60 foot interval of cropland or hayland between the barriers. The grass rows should be oriented, as nearly as possible, at right angles to the prevailing winter and spring winds. Although one row will do a good job if it is solid, two rows are recommended. This assures and provides added protection in the event part of a row is rendered ineffective due to tillage operations or poor stands.

Species Selection

Plant growth characteristics of tall wheatgrass made it ideally suited to the design criteria needed for the following reasons: (1) Tall wheatgrass establishes easily and produces a good barrier in a minimum period of time. (2) It has a stiff stem which remains erect and effective all winter. (3) It is adapted to a wide range of conditions, including coarse textured soils, saline conditions and drought. (It performs well where precipitation is less than recommended for the species, because of the wide rows and the additional moisture accumulated in the barriers in the form of snow.) It should be adapted in any of the areas in the northern plains where dryland grain is grown. (4) Seed is available. (5) It produces seed stalks consistently which is essential to maintaining barrier height. (Height is about 4 feet on dryland in Montana.) (6) It is a bunchgrass and therefore easily confined to a narrow row. (7) Provides nearly uniform distribution of snow between barriers, when recommended spacings are used.

General Information and Advantages and Disadvantages

Advantages of Grass Barriers

With a barrier height of 4 feet windspeeds are reduced to provide effective soil and crop protection when spaced at not more than 50 foot intervals on sandy soils.

With grass barriers soil water storage during the first over-winter period (nine months) nearly equaled conventional fallow (21 months) at Sidney, Montana: 1966 - 100%; 1967 - 86%; 1968 - 116%; 1969 - 89%; 1970 - 100%; 1971 - 105%; 1972 - 107%. Most of this soil water gain originated from natural snowfall held in place plus a reduction in over-winter soil water losses from evaporation.

Yield data collected to date in an evaluation of five cropping systems have been encouraging. In these studies conducted by Al Black and Francis Siddoway of Sidney, Montana, total winter wheat yields obtained from fertilized continuous cropping and fertilized fallow have averaged 27 and 16 bushels per acre when computed on an annual basis. Winter wheat seeded in spring wheat stubble in a spring wheat - winter wheat rotation has yielded slightly better than continuous winter wheat. Because of specific weed problems, continuous spring wheat has not yielded as well as continuous winter wheat. A good crop rotation will be advisable since growing the same crop encourages weed problems. Deep-rooted perennial crops, such as alfalfa or legume-grass mixtures, should have good yield potential when used in conjunction with the grass barriers. They may need to be managed for hay because livestock grazing could damage the barriers. The impalatable nature of mature tall wheatgrass may permit fall grazing, although no observations have been made.

If the area between barriers is kept in a crop-fallow sequence, it is expected there will be only a small increase over non-barrier yields, but yields should be enough to at least offset the loss of land area to the barriers.

The barriers will furnish protection during crop stand establishment. In areas where it is usually necessary to wait until after the spring blow period to plant, the crop can be put in earlier.

The grass barriers, because of the narrower spacing, are more effective for wind erosion control and uniform snow distribution than taller more widely spaced barriers when winds blow at other than a right angle to the barriers. Snow distribution and soil water recharge is more uniform between grass barrier systems than tree barrier systems when both are designed on spaces of 10 times the height of the barriers. This is an important value in the use of grass barriers.

Aerial spraying for weed control is feasible, with tree shelterbelts it is a hazard.

If equipment changes become necessary and new intervals are required the barriers can be easily eliminated and readjusted.

Grass barriers, as well as trees, enchance wildlife opportunities and make the area more beautiful.

Establishment costs are low with little "out-of-pocket" investment required.

Time of establishment is relatively short compared to tree shelterbelts.

Disadvantages of Grass Barriers

Not all the land is cropable. About 10 percent of the land would be occupied by the grass rows using 50 foot intervals between barriers and a row spacing of 30 inches plus and 18-inch allowance for barrier growth on each side of the grass rows. The land out of production because of barriers can be counted as conserving base acres under the ASCS farm program. In some areas these acres have been accepted as "set aside" acres.

With more intensive cropping systems, land preparation and labor demand will be more difficult and concentrated at harvest and seeding times. Weed control will be more difficult.

Disease and insect problems may increase with cropping intensity or other factors associated with grass barriers.

The narrower strips with grass on both sides will require more time to farm. The strips should be spaced to fit both planting and harvesting equipment. Because width of harvesting equipment was not compatible with barrier intervals some operators at Fort Benton had to make an extra pass during harvest in each barrier, which added considerable time to the harvest period. When using 48 foot wide tillage or planting equipment within 50 foot barrier intervals it is almost impossible to keep the equipment between barriers without damaging them. The consensus is that when using large equipment spaced for one pass between the barriers at least 18 inches of space will be necessary on each side of the grass rows. The best solution may be to use smaller equipment on the area in barriers so as not to exceed the 60 foot limitation on intervals between barriers. The opinion of the Fort Benton group is that equipment should be used that will permit a round trip within each barrier and that a fairly generous overlap should be provided for.

Cropland limitation - Continuous cropping will not produce as much per harvested acre as crop-fallow, so any yield advantage per cropland acre which continuous cropping may have cannot be realized under acre allotments.

Selecting the Spacing of Barriers

Select an interval between barriers that will fit the planting and harvesting equipment and that will meet the needs for soil protection. The total distance between the centerlines of the barriers will be the cropland width selected plus the distance between the two rows of each barrier plus about 36 inches (3 feet) to allow for a bare area of about 18 inches on each side of the barrier. The two rows should be from 30 to 42 inches apart and the cropland area from 40 to 60 feet, though on extremely sandy areas 30 to 40 feet may be a safer spacing of barriers.

If a 50 foot interval is selected and the grass rows spaced 30 inches apart and 36 inches bare area total for both sides, the distance between the centerlines of the barriers will be 50 feet + 2½ feet + 3 feet or 55½ feet. Where wide equipment such as 48 foot is used and only one pass will be made between barriers it is recommended that the distance on each side be increase from 18 inches to two feet. Because of the basal area of tall wheatgrass plants when mature it would be better always to plan on 18 inches to two feet from the centerlines of the rows.

Seed Requirements Per Acre

for Two Row Tall Wheatgrass Barriers

Interval Between Centerline of Barriers (Two rows-30" apart)	1/ Pounds of Pure Live Seed Needed Per Acre	Pounds of Material of Average 85% PLS Quality
30 feet	0.55	0.65
40 "	0.41	0.48
50 "	0.33	0.39
60 "	0.28	0.33

1/ Based on tall wheatgrass average of 79,000 seeds per pound of pure seed, and seeding 15 live seed per foot of row.

Marking the Barrier Intervals

Measuring and staking the rows will be too time consuming for most fields. The Fort Benton group developed the following methods that save time.

1. Cable Method

   (a) A cable was placed between two pickups to space the centerlines of the vehicles at the distance between centerlines of barriers, and pickup trucks were followed by seeder.

   (b) A cable was placed between the tractor with the planting equipment and another tractor or pickup.

2. Drill Attachment Method

   A grass planter box was attached to one end of the grain drill and one row of grass was planted while drilling grain and the second row of grass was planted on the next pass. There was some difficulty maintaining uniform spacing between the two grass rows, but the method was fast and satisfactory.

Establishment

Establishment of tall wheatgrass on soils which are not highly erosive is similar to planting for pasture and hayland. It is more important to have a close, uniform stand with no gaps.

On coarse, sandy soils it is essential to plan protection for the developing stand of tall wheatgrass until the barriers have reached a stage where they can prevent wind erosion on the field. A few examples follow:

1. Establish temporary barriers with annual crops that grow at least four feet tall and remain upright. Forage sorghums or sudangrass are examples. These can be planted after the spring blow season or left standing through the next blow season.

2. If the field has been abandoned and has a protective cover of weeds or grain stubble:

   (a) Fallow a narrow strip where each barrier is to be established.

   (b) Seed about the middle of August if moisture is available, or early the following spring.

   (c) Do not begin tillage of the intervals between until barriers are fully established.

3. Fallow narrow strips on the leeward side of this year's crop or in the crop at the proper intervals. Seed in spring if clean or the middle of August if moisture is available. Leave crop stubble, or adequate residue, until the spring blow season is past.

It is important that the seedbed be free of weeds and volunteer grain and that it is firm. Follow seedbed preparation with a packer or pull a packer between the disc and planter. It is suggested that two weighted wheels ahead of the drill rows would do a good job, or one wheel if drill is equipped with a planter to seed one row on each pass. Plant in a wheel track if possible. Seeding on spring grain recrop has been much more successful than winter wheat stubble because of cheatgrass.

Use a planter that will provide uniform flow of seed, positive depth control (depth bands are best) and packing soil over the seed. Seed at the rate of 15 pure live seeds per foot of row without a companion crop. Seeds should be 3/4 to 1-inch deep on sandy soils and about 1/2-inch deep on other soils.

Hayland

Plantings for moisture accumulation on hayland should be made in about the same manner. Spacing should not exceed 50 foot intervals to do an efficient job of snow accumulation. To establish a single row with adequate density it is advisable to seed two rows about six inches apart. Clean till at least 30 inches on each side of the barrier for establishment and thereafter only as needed. This is twice the allowance planned for annual crops, but is believed to be needed because of the greater competition for moisture by perennial crops. (Tall wheatgrass barriers on hayland should provide excellent habitat for upland game birds if water is within reasonable distance.)

Management

1. Control weeds during the year of establishment and as needed thereafter by cultivating or with chemicals. Tall wheatgrass is a competitive plant and once a good stand is established cultivation may not be necessary in some localities. Generally cultivation will be necessary during the establishment year.

2. Except for soils found by soil test to be very deficient, nitrogen will be most effective if applied after stand establisment. Make an initial application of 40 pounds N per acre and thereafter as needed to maintain adequate barrier height for soil protection and snow accumulation.

3. Do not harvest seed. This will reduce barrier height.

4. Do not permit grazing of the field if animal use of the barriers in any way threatens their effectiveness.

5. Crop the intervals between barriers in any adapted crop sequence.

TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE Portland, Oregon SOIL CONSERVATION SERVICE

AGRONOMY - No. 21 February 11, 1972

The following excerpts are taken from a technical note prepared by Wendell Thacker, Agronomist in Montana. It deals with ARS work at Sidney and pertains to dryland farming. I believe, however, the principles are also applicable to irrigated land with a wind erosion problem.

John Denison
Conservation Agronomist

TALL WHEATGRASS BARRIERS FOR SOIL EROSION CONTROL AND WATER CONSERVATION

The Northern Plains Soil and Water Research Center at Sidney, Montana has been studying tall wheatgrass barriers since 1965. The following are preliminary conclusions from the research study being conducted by Siddoway, Black and Ford:

1. Average windspeed, as measured at a 12" height above ground surface, was effectively reduced by tall wheatgrass barriers spaced at 60' intervals. Windspeed from leeward of one barrier to windward of the next progressed from about 17 to 70% of open field windspeed in the 30' barrier spacings, and from 19 to 84% in 60' intervals.

2. The reduction in windspeed appears to be somewhat less from the grass barriers than from tree windbreaks when comparisons are made in terms of equivalent barrier heights. (See Fig. 1)

Other studies have shown that short barriers are more effective than tall ones for oblique winds. This is an important value in the use of grass barriers.

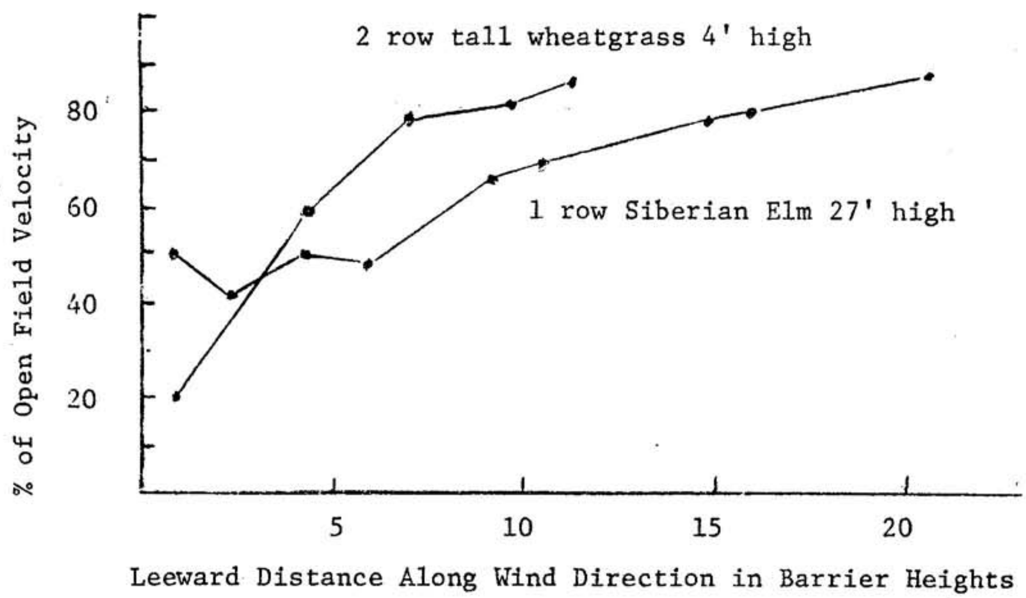

Fig. 1. Comparison of windspeeds at 1-foot elevation.

Several other grasses were tried but were not as satisfactory as tall wheatgrass, including giant and basin wildrye, prairie sandreed and big bluestem. Giant wildrye was difficult to establish. Basin wildrye required three years to reach effective height and density, and did not produce seed heads consistently. The warm season grasses were difficult to establish and did not produce seed heads consistently.

As of this date, tall wheatgrass barriers are recommended on the basis of their value for wind erosion control only. They should be used on coarse sandy soils and spaced at not more than 60' intervals. At this spacing, they should control wind erosion on sandy soils with very little help from protection afforded by crop residues. At the same time, they will furnish protection during crop stand establishment and result in production of more and better crop residues. This will provide insurance against winds which blow parallel to grass rows.

Why Use Tall Wheatgrass?

1. It is easy to establish and produces a good barrier in a minimum period of time.

2. It has a stiff stem which remains erect all winter.

3. It is adapted to a wide range of soil and climatic conditions, including moderately coarse textures and severe drought.

4. Seed is readily available.

5. It produces seed stalks consistently. This is essential for good barrier height.

6. It is a bunchgrass and presents no problem in confining it to a narrow row.