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FIELD SHELTERBELTS IN PRAIRIE REHABILITATION

D. I. CROSSLEY

Dominion Forest Nursery Station, Indian Head, Saskatchewan

INTRODUCTION:

THE FEDERAL GOVERNMENT, under the Prairie Farm Rehabilitation Act, has undertaken the rehabilitation of the prairie areas that have been subject to severe drought and soil drifting. The establishment of field shelterbelts is an important part of this program and it is with this that we are chiefly interested here. However, it might be of interest to discuss briefly the events leading up to the Act and its provisions other than tree-planting.

THE PROBLEMS:

It is difficult to conceive the vast areas of once highly productive agricultural lands in need of rehabilitation. In 1934 it was estimated that eight and one-half million acres of cropped land were affected by drought and soil drifting, and generally speaking this area has been under these influences since 1930. Locations not so long ago considered the garden spots of the west are now laid waste and, under present conditions at least, are not fit for human habitation. Farmers in such localities have not had a crop for six years. They have not even gotten their seed back in many cases nor obtained sufficient roughage for feed. Worse still during this long period of drought, soil drifting, caused by high winds blowing over large acreages of bare summerfallow, has impaired the fertility and workability of much of the land so seriously that it will be some time if ever before it can be brought back to pre-drought productivity.

It is idle to blame the existing state of affairs on nature. It is true of course that the occurrence of the drought can be laid at her door but it was certainly predictable—that is, from past experience it should have been realized that its recurrence was only a matter of time. The blame of wind erosion, however, must be placed on the system of agriculture practised. High yields and fabulous prices resulted in the working of every available acre, and slowly but surely the fibrous content of the soil was lost. The general

farming practice called for the summerfallowing of the land every three or four years in order to store up a reserve of moisture, and to eradicate weeds. With the loss of the humus content so went much of the soil's moisture retention capacity. With large acreages of bare summerfallow finely worked, little or no sod-forming humus and a low moisture retention capacity, all that was holding the land in place was the moisture it received. With the advent of the drought in 1930 the last soil binding agent was removed and severe wind erosion resulted.

The worst of the dust storms are confined to spring and fall but they can and do occur all through the summer and even through the winter if the snow disappears and the frost action pulverizes the soil clods. It is recognized that soil drifting does not occur spontaneously over a field but starts at a focal point where the soil is lighter and more exposed and spreads from there very rapidly. Continued drifting robs the land of its fertility; in most cases the loss of two inches of soil results in a marked decrease in crop yields.

A person cannot imagine what a prairie dust storm looks, feels or tastes like until he has been through one. Whole fields seem to lift themselves up and hurl themselves at you, tearing at your clothes and stinging face and hands, blinding and choking you until you are obliged to seek shelter. Housewives, in the protection of their homes, rush a meal on the table and cover it with a cloth to protect it from the grit and dust until every one is seated. Houses buried to the eaves, tractors exiled in an encircling tomb of sand, fences hidden, blinded stock, while only isolated examples of the wind's work, nevertheless serve to show the havoc that can result from careless husbandry of the land.

RECLAMATION:

Various expedients have been tried to counteract the relentless march of the soil in an attempt to undo the mischief that man has wrought. Probably strip farming was the first attempt at control. Since the bare summerfallows drifted so readily and yet were so essential in the conservation of moisture, this method of farming in strips was devised. It consists of the division of the fields into alternate strips of fallow and crop, the strips running at right angles to the prevailing wind direction and varying in width from five to thirty rods depending on the texture of the soil.

Another method of control is through the use of ploughless summerfallow, or, as it is sometimes called a "trash cover." The idea here is to keep down the weed growth without burying the stubble. The stubble or trash left on the surface protects the soil against wind erosion.

Cover cropping is another method sometimes adopted. A light seeding of grain through the summerfallow late in the summer does not use much moisture and it provides a vegetative cover that protects the land from fall wind erosion. It may be pastured late in the fall or left to freeze down.

A fourth means of combating the evils of soil drifting is through the use of belts of trees. Just as the benefits of strip farming were demonstrated by a group of progressive farmers at Monarch, Alberta, so farmers around the central Saskatchewan town of Conquest, decided to lead the way in field shelterbelt planting. Their decision was brought about through noting the obvious influence exerted by one or two belts of trees already established in the district.

Of course the adoption of strip farming, ploughless summerfallowing, cover cropping and field shelterbelts presumes that crops or trees can be established.

In the event that the land blows so severely that there is little or no chance to get a crop established, the spreading of straw is often a necessity. The object is to hold the land until the crop is sufficiently advanced to bind the soil. This spreading of straw is not always successful although it is a very certain method if done before the drifting is too severe or the area to be protected is not too large. The Russian thistle, long looked upon as a plague, has turned out to be a blessing in this reclamation work. It has the happy faculty of growing on land vacated by other forms of vegetation and does best in the drier years. In years of normal or excess moisture it practically disappears. If the land can be held for a short period the thistle soon takes over the task of soil binding and the farmer, by careful and judicious handling, can gradually get the land producing some kind of profitable vegetation. These lighter, badly blowing areas are generally being seeded down to grass after they have been held, because the farmer realized that they are the focal point for soil drifting and the safest thing is to have them under sod.

DESIDERATUM:

Early in 1935 the Federal Government came to the conclusion that conditions had reached such a stage that something had to be done and done quickly if the prairie farmer was to remain on his land. As a result the Prairie Farm Rehabilitation Act came into existence in the early part of the summer. Under the terms of this Act advisory and material assistance was provided for farmers in soil drifting control and soil moisture conservation, tree-planting, regrassing, surface water development, and other rehabilitation measures. Assistance was granted in the way of free grass seed to establish a seed plot, a cubic yard payment to assist in the digging of dams

and dugouts to catch and hold spring moisture and the damming of coulees to form stock watering places. In the matter of tree-planting, assistance was granted in the form of free trees express prepaid with a small sum allowed to cover the cost of planting to encourage the farmer to establish and maintain a windbreak around his buildings. This is an important item in the rehabilitation work since it has been noted that even through the driest years very presentable gardens can be grown if sheltered by a belt of trees to collect and hold snow and prevent extreme summer desiccation, not to mention other benefits such as the sheltering of the building site and of stock, the production of fuel and fence posts and the increased aesthetic value. In addition the Act took over the cost of planting and maintaining the belts in the Conquest Field Shelterbelt area and established three similar areas, one in Alberta, one in Manitoba and a third in Saskatchewan. The following financial assistance is granted: free trees, express prepaid, \$3.50 a thousand to cover the cost of planting and \$20.00 a mile each year until the expiration of the Act to cover cultivation costs. It might seem that the financial assistance given is rather large but it must be remembered that this work is purely experimental and the farmers are giving their labor and land in order to determine the practicability and economic soundness of something that will not prove itself for a decade.

FIELD SHELTERBELTS:

Very briefly the benefits to be expected from shelterbelts can be listed as follows: reduction in wind velocity which in turn lessens soil drifting, decreased transpiration and evaporation, increased snow collection, decreased shelling from the heads of grain and breakage and lodging of the stand. The detrimental effects would be the draining of moisture from the land adjacent to the belts and the few days delay in the spring of the year necessitated by the fact that the snow drifts would take a little longer to melt. For a more thorough discussion of this subject see "Shelterbelts for the Prairies."¹

In discussing the laying out of an area, wherever it is necessary to be specific, references will be made to the area in Manitoba around Lyleton, with which the author is most conversant. A sketch of this area showing the positions of the belts planted in 1937 is appended (pl. 2) so that a clearer idea of the scheme may be obtained.

Before going into detail it might be wise to make clear in a few words just what the establishing of field shelterbelts involves, so that the development may be more clearly followed. In its simplest form the work con-

(1) "Shelterbelts for the Prairies" D. I. Crossley, Forestry Chronicle, February, 1935.

sists of breaking a farm up into working units, each unit separated from its neighbour by a single row of trees (occasionally more than one row is used).

ORIENTATION:

Before commencing to lay out an area for shelterbelts it is necessary to decide upon the orientation of the rows of trees. In the Lyleton district it so happens that the prevailing winds quarter the sections and therefore no one orientation can be said to be better than another since the belts must run either north and south or east and west. However, in other areas this is not always the case and wherever possible the trees should run in a direction at right angles to the prevailing wind so as to give the maximum protection.

WORKING UNITS:

The biggest problem in dividing a farmer's land into strips to be protected arises from the fact that in the majority of cases he already has his farm broken up into working units that are rarely suitable for shelterbelts. In cases of this sort one must do the best he can under the existing conditions. However, let us first suppose that a free hand is allowed in planning the layout. The first thing to be done is to ascertain the texture of the soil to see whether or not it is susceptible to drifting. In most cases the evidence will be before the eyes in piled up and buried fence rows but occasionally one encounters a farmer working a light soil, who, by careful tillage operations, holds his land in place. Assuming the soil to be of medium heavy loam and thus not very susceptible to wind erosion, a quarter section (160 acres) might best be broken up into four equal units. This would require five rows of trees running the half mile with belts forty rods apart which is considered to be the maximum distance. It is not likely that strips wider than this would receive full protection. The field has now been broken up into four, forty acre units each one-half mile long. Suppose the land to be of a lighter texture—a sandy loam—and thus subject to severe wind erosion, it would then be necessary to break the quarter up into smaller units. Many farmers prefer to run a belt of trees around their land so as to get some protection against the winds that blow parallel to the main belts. This is recommended wherever possible, but it is not advised where the belt would border a road allowance. A belt in this location would pile up snow in the winter and block the road to traffic. To get around this danger the belt can be placed four rods back from the road and the snow will pile up before it reaches the margin of the land. However,

this leaves an awkward piece of ground to work and farmers are rarely in favor of it.

Fig. 1 will give an idea how the quarter section will look after it has been planted. No belt has been run along one side because it is assumed that the neighbour across the road will establish a belt here and it will serve to protect from winds in that quarter.

Let us suppose now that a creek or coulee runs through the quarter-section.

Since the collection of snow and the retention of the spring run-off is a very important task of the belts they must be arranged so as to guard against these losses into the depressions. The belts then should be run at right angles to the slope to act as barriers to the drifting snow. When this melts in the spring of the year the trees will lead much of it into the ground before it is lost to the natural water course.

When we consider the laying out of a farm that is already divided into working units, we can do no better than to follow some of the existing fence lines, endeavouring at all times to give the best protection and ease in working. If it can be arranged — where no other considerations interfere—it is best to have as many of the units as possible opening out towards the buildings in order to facilitate working.

Fig. 1

Fig. 2

Fig. 3

PREPARATION OF LAND:

After the land has been laid out so that the farmer knows the position of the belts he intends to plant, it is necessary for him to summerfallow strips eight feet wide for a year prior to planting. This is done to insure the storage of a reserve of moisture to establish the trees the following year if it so happens that little precipitation occurs. It also means the killing of many of the weeds, thereby saving a great deal of labor in keeping the trees free of this growth. A width of eight feet is recommended because it is felt to be sufficient to store adequate moisture and not too wide so as to blow.

In cases where the soil is drifting badly, it is impossible to establish belts without first getting some kind of vegetative cover on the land to tie down the soil. 1935 was a year of abnormally heavy precipitation in the Lyleton district and there resulted a heavy growth of ragweed over most of the badly blown areas. The drought returned in 1936, but the dead ragweed still remains to hold the soil. This has been most fortunate in that it allows the farmer to break out strips through the weeds for trees, leaving heavy growths standing on either side. These will be left until the trees become sufficiently well established to withstand the drifting soil. In fact the farmer will no doubt just break out narrow strips and establish them in some kind of vegetative cover before turning over more, so that the trees will never be subjected to blow sand.

After the land has been prepared it must be cultivated and kept in good tilth until the following spring when it is given a final working prior to planting.

SPECIES OF TREES USED:

Caragana and willow are set out almost exclusively in this work. Occasionally some farmer will insist on some other species such as poplar or Manitoba maple, but the amount of this stock sent out is negligible. Caragana appears to be admirably suited for the task and we are indeed fortunate in having such a species with which to work.

Caragana arborescens is a deciduous exotic imported from Siberia that has proved very hardy on the prairies. It is of the Locust family and bears the characteristic thorns. It is really only a shrub and reaches a maximum height of about twenty-five feet, although it has not been growing long enough in this country for us to be definite on that point. Belts on the Nursery Station at Indian Head planted twenty-seven years have reached a height of twenty feet and are still growing. The tree has a dense, bushy

growth and if well cut back in its early years will develop into a thick impenetrable belt fifteen or sixteen feet thick.

The seedlings are rather easily established. They are sent out from the Nursery Station as 2·0 stock and catches of 90·100 per cent. are the rule. Even in dry years when other species show a 25·50 per cent. mortality it is rare that caragana will run higher than 10 per cent.

The rather acrid-tasting bark is a very important feature. Ash and elm are so liked by various browsing animals that they are at once ruled out for this type of work but caragana is unpalatable to stock. If this were not the case all the belts would have to be fenced since the farmers usually run stock in all their fields during some part of the year. The cost of doing this would be prohibitive.

The bark is also unpalatable to rabbits and this too is most important. In many localities it is practically impossible to grow ash and elm because of these pests that chew the new growth back year after year.

Some opponents of the shelterbelt scheme have argued that the belts will drift in with blowing sand and die. Observations have shown that caragana, as long as it can keep its growing tip ahead of the piling sand, will send out new root levels from adventitious buds on the buried trunk and will grow as vigorously as ever.

A final advantage of caragana over other available species is the fact that, because of its dense, bushy growth it serves as an admirable fence after it once becomes established.

It has one or two undesirable characteristics, the chief of which is the fact that it cannot stand excess moisture. If it has to stand in water for even a few days in the spring of the year it will suffer and very likely die. To insure uniform working units the belts must be run in straight lines and in so doing they will occasionally pass through a spot where water collects for some time in the spring. It is customary to plant willow in these locations and while this species is not nearly so good for shelterbelt purposes there is usually so little of it necessary that it serves the purpose of filling in the gaps and thus prevents the belts from appearing straggly.

Blister beetle (*Lytta nuttalli*, Say) is a serious defoliator of caragana and is difficult to control, because of its migratory habit. However, the trees soon recover and put on a new set of foliage without showing any apparent damage other than a slight slowing down in growth rate.

Fig. 3

*Lyleton Field Shelterbelt Area***PLANTING:**

Planting may be done in several ways. The best and fastest method however seems to be the following: using a sulky or walking plough a single furrow is turned down the middle of the eight foot strip the full mile or half-mile as the case may be. Upon reaching the end of the strip the furrow is deepened by ploughing back again. The soil is now thrown up on both sides and the planters follow close behind, care being taken that

the plough does not get too far ahead of them so that the ground will not dry out more than is necessary. They place the seedlings a foot apart in the furrow and draw the dirt in from both sides with the feet, tramping it firmly. In one instance a very good job was done by travelling down the edge of the trees with a rubber-tired tractor, thus insuring a well packed job. In cases where the land is particularly dry it is wiser to plant with a spade, opening up a slit to receive the tree, thus retaining all the moisture possible.

SUBSEQUENT CARE OF BELTS:

The caragana must be heavily cut back during its first few years of growth. In the first year this may be done to advantage before the seedlings are planted—the tops being removed so that only an inch or two protrudes above the ground. The second spring after planting, half the growth is removed and the third spring the tips are trimmed off. After this it can be left to grow as it will and it is from this early pruning that the heavy stooling is obtained.

The belts must be kept clean of weeds and hand hoeing between the trees is necessary the first few years—the margins of the strips of course can be kept back by using a cultivator.

As the trees grow and spread their roots, the 8 foot strip must be gradually increased in width until a distance of 12 feet on either side of the belt is reached, and this should be kept cultivated indefinitely, never allowing weeds or grass to encroach on the belt. This means that after 8 or 10 years a belt of trees one-half mile in length will utilize approximately an acre and a half of land. The belt must increase returns sufficiently to warrant the taking of this out of crop production.

One of the common arguments heard against the establishing of field shelters is that they will soon pile up with Russian thistle and more labor will be expended keeping them clean than the belts will be worth. This thistle, when ripe, breaks off at the root crown and, since it is more or less round in form, rolls readily with the wind. If these are left piled in the belts they will form an unsightly mass and may cause a dangerous fire hazard. Because the bark of caragana is so very thin the aerial parts are soon killed when subjected to intense heat. This must be guarded against. However, it is felt that this danger has been somewhat over-emphasized. These thistles only reach a large size in dry years; in normal or wet years they are either very small or non-existent. Since only the large ones travel with the wind the danger is only present in dry years. It is recommended

that one of the afore-mentioned methods of combatting soil drifting such as tillage methods be adopted in conjunction with the shelterbelts until they attain sufficient height to protect the land themselves. In the event of this, the farmer will be able to work his summerfallow so that the thistle on it will be kept at a minimum.

Land has been prepared for the planting of 207 miles of field shelterbelts on the four Associations in the spring of 1938. This, together with 330 miles already planted, makes a total of 537 miles.

The Russians have been planting field shelterbelts since before the turn of the century and our program appears insignificant in comparison. It must be remembered however that we are just commencing and that the present projects are in the nature of experiments. If and when the idea proves itself we can look forward to greater progress.