

Government of the Province of Saskatchewan

DEPARTMENT OF AGRICULTURE

The Management of Saskatchewan Soils

By Prof. John Bracken

The production of paying crops is the main business of the farmer. In order that he conduct his business successfully he should know (1) the conditions that must be provided before plants can grow, (2) the factors that militate against satisfactory growth and (3) the means at man's disposal for controlling the factors that limit yields.

Seeds must have moisture, heat and air or they will not germinate. Given these things in proper amount, good seed will grow. The nourishment within the bran or outer covering supplies the young plant with the food necessary for early growth. Moisture, heat, light and plant food from both soil and air are necessary for later growth.

The factors that interfere with satisfactory growth vary in different climates and on different soils. In Saskatchewan, poor seed, rust, smut, hail, low temperatures, dry weather, weeds, drifting soil and alkali may be limiting factors in the production of crops.

Some of these factors are controllable while others cannot be controlled by man. Hail cannot be prevented, although the effect of its ravages may be lightened by insurance. The quality and purity of the seed a man sows is, however, within his own power to control absolutely. Low temperatures cannot be prevented nor even definitely forecasted over large areas, but tillage and cropping practices that tend to avoid frost or lessen its effect are now known. Neither can periods of drought be prevented, but tillage methods and crop management practices are now being followed that practically control the moisture content of the soil. Drifting soils and weeds are products of a too rapid and thoughtless development of immense areas, and affect the just with the unjust. Both can be controlled, although in some cases at great cost.

Some of the means at man's disposal for controlling these factors are: tillage, rotations, fertilisers, including manure, inoculation, irrigation, drainage, and the use of clean seed of suitable crops. The purpose of this article is to indicate briefly the relation of tillage to the control of the climatic and soil factors mentioned above.

By tillage is meant the manipulation of the soil by means of implements with a view to putting it in condition for the growth of crops. The subject deserves consideration from five points of view, tillage for native prairie, tillage for fallow, tillage for stubble land, tillage where water is a limiting factor (dry farm areas), and tillage where frost is a limiting

factor (northern areas subject to frost damage). Space will not permit even a brief reference to the management of drifting soils, alkaline soils nor weedy fields.

In breaking prairie sod, the purpose is to kill the native growth, to store moisture and to prepare a seed bed for the succeeding crop. In Saskatchewan there are two general methods of attaining these ends: the first is to break as shallow as possible, preferably in the month of June, and backset in August after the sod is partially or wholly decayed; the second is to break at a greater depth (from four to six inches) in June and surface cultivate without a second ploughing. The first method is more costly but succeeds in killing more of the native grasses than the second. It stores equally as much moisture and prepares at least as good a seed bed. It generally results in a heavier first crop which is usually later in maturing. The second crop after breaking and backsetting is usually much better than the second crop after breaking and surface cultivation, the difference being due to the relative absence of grass in one and its presence in the other. On the other hand, deep breaking and surface cultivation does not kill as much of the native growth but may store as much moisture and give equally as good a seed bed. It gives rather a lighter crop but one somewhat earlier than the first method. Neither is best for all conditions. Generally speaking, breaking and backsetting is advisable but on smooth, level prairie containing few or no creeping rooted grasses and on scrubby land the other method gives quite satisfactory results. The presence of creeping rooted perennials is a large factor in determining which of these methods should be followed on open prairie land.

The purpose of the fallow is to store moisture and to kill weeds and grass. Incidentally it develops nitrates or plant food and breaks down organic matter. Its essential function is the storage of moisture. The time and power at a man's disposal will largely influence his method of fallowing. It is desirable, however, to aim to give the field some form of surface cultivation the fall before the fallow in order to conserve moisture and germinate weed seeds. Ploughing in the rainy season, that is in the month of June, is desirable. Deep ploughing will conserve more moisture than shallow ploughing, and will result in a somewhat later crop the following year. It is desirable in dry regions and for forage crops, but is not always the best practice for cereals on heavy soils in moist regions. The ploughing should be followed as soon as possible by the harrows in order to lessen the loss of moisture from the furrow slice. Harrowing ploughed land is a most important operation in a dry climate. Throughout the balance of the summer season it is necessary to maintain a soil mulch in order to lessen the evaporation of moisture and to keep down weeds which pump moisture out of the soil. When grasses are present it is sometimes advisable to plough the fallow a second time, otherwise a second ploughing is unnecessary. For cereals the fallow should be firm. To attain this end a packer may be used, but is not essential.

The purpose of tilling stubble land is to conserve moisture, to control weeds and grass, and to prepare a seed bed. The conditions of the soil on such a field vary widely. Usually it is firm and dry and carrying a considerable amount of stubble. The methods of handling such a situation are many. On heavy soils rich in organic matter the stubble is usually

left long and burned. Where this is possible there is no doubt but that the land may be put in shape for a succeeding crop not only cheaply but quite satisfactorily. Stubble is not only useless but injurious to the soil until it decays. It is well to remember, however, that the burning of stubble and straw means a complete loss of the organic matter and nitrogen it contains, and that these are the most valuable constituents of the soil.

Where burning is undesirable, any one of three practices may be followed. The field may be left uncultivated, it may be surface cultivated with the disc and harrows, or it may be ploughed. Seeding in untilled stubble land sometimes gives fair returns on clean fields that were thoroughly fallowed the second year previous. It is a practice that often results in crop failure and is one that should be discouraged. It should not be followed except under especially favourable conditions such as new land which is free from grass and weeds, and having a long stubble that it is not desired to burn. Surface cultivation on stubble land is advisable when the stubble is not too long and when grasses are not present in the field. If grass is present, ploughing is necessary. If the stubble is too long, discing does little good and makes it difficult for the drill to put the seed deep enough in the soil. Ploughing is always desirable for a third crop and often even for a second. The relative returns from fall and spring ploughing depend upon the condition of the soil at the time of the operation. If the soil is moist in the fall, fall ploughing generally gives largest returns. On the other hand, if it is out of condition at that time it may give very unsatisfactory returns. Harrowing after ploughing is essential and it is also very important that ploughed land be thoroughly worked down, otherwise the furrow slice will dry out and the crop "fire" when a period of dry weather comes.

The probability of damage from frost may be lessened in several ways. Early maturing classes of crops may be chosen. Within each class early varieties may be used. Early seeding generally results in earlier maturity, and thorough preparation of the seed bed results in earlier germination and consequently earlier ripening. Thick seeding induces early maturity. Packing results in earlier maturity. Late ploughing of breaking or fallow gives an earlier though lighter crop. Pasturing the fallow with rape or one of the cereals results in an earlier but lighter crop the next year. Deep breaking surface cultivated gives an earlier but lighter crop than shallow breaking backset. Shallow ploughing of the fallow gives an earlier but lighter crop than deep ploughing. If these practices do not mature cereals sufficiently early to avoid frost some other crop should be chosen.

In those regions that suffer most from drought and but little from frost, the principles of dry farming must be observed. These, in many cases, are opposed to the principles of northern farming. In most parts of Saskatchewan and particularly on light soils one year's moisture must be stored in the soil by means of the fallow for the use of the succeeding crop or crops. Deep ploughing early in the rainy season is essential for success in the dryer parts of the province. It creates a larger reservoir for the storage of rain water. Once the moisture is in the soil it is important that it be kept there. This is achieved by harrowing immediately after every ploughing so as to maintain a mulch on the land, and by keeping down weeds by surface cultivation. The moisture that is stored in the soil and retained there must be kept available to the crop. Where

fall or spring ploughing is practised, sufficient surface cultivation must be given to place the furrow slice firmly in contact with the subsoil. Otherwise the moisture in the latter will not rise to meet the needs of the crop. Thin seeding produces a larger crop but a later one in dry regions. The fertility of the soils in dry regions must be maintained, else with its depletion more moisture will be necessary to produce the same growth.