

To avoid harm to spring sowings Take care of the cover crop

Growing a cover crop in the interval between main crops modifies soil behaviour and defers the normal soil tillage preparations for spring sowings. Depending on the soil type and the crop to be sown, certain precautions are necessary, notably concerning the date of destruction of the cover crop.

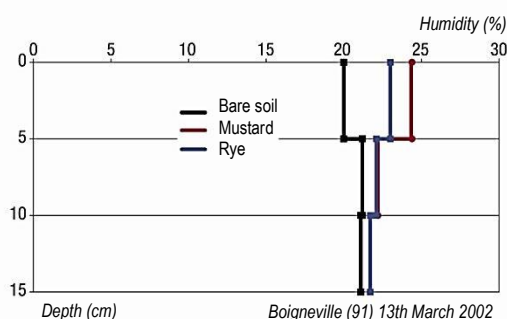


Maize sown without tillage following oats destroyed in spring. Note the rather poorly-closed drill slit and evidence of slug damage.

If no soil tillage has been done, a living or destroyed cover crop left in place changes the behaviour of the soil compared with one left bare. In autumn, the soil structure has been protected from the action of rain drops by the soil cover and the root system. A fragile silty soil may therefore be less compacted in spring after a winter cover crop. On the other hand, a covered soil suffers less from variations in temperature and moisture at the surface than a bare soil. These less pronounced freezing-thawing and wetting-drying alternations tend to reduce the quantity of fine soil in clay or calcareous clay soils in spring. Numerous observations show that in spring, on a non-tilled soil, cover crops tend to improve soil moisture content somewhat compared with bare soil. This is particularly true for the top five centimetres (figure 1). Two explanations can be put forward. The first is that the residues left by the cover crop (stems, leaves etc.) tend to reduce the evaporation of water like any mulch.

Like any mulch, the residues left by the cover crop tend to reduce water evaporation.

Effect of cover crops on soil moisture content in spring (Figure 1)



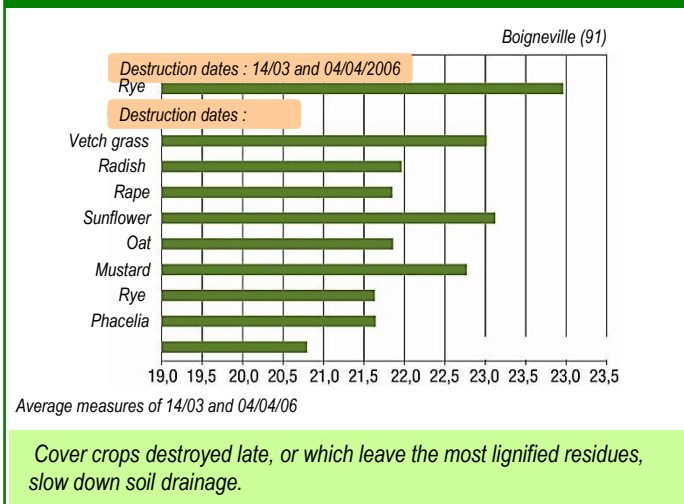
Cover crops tend to produce a slightly higher soil moisture content, particularly in the top five centimetres.

Continuous monitoring of the soil moisture content also shows that the moisture content at field capacity is higher under a cover than on bare soil, because of the effect on soil structure. The moisture content at field capacity corresponds to the soil water content when the excess water has been rapidly removed by leaching or drainage.

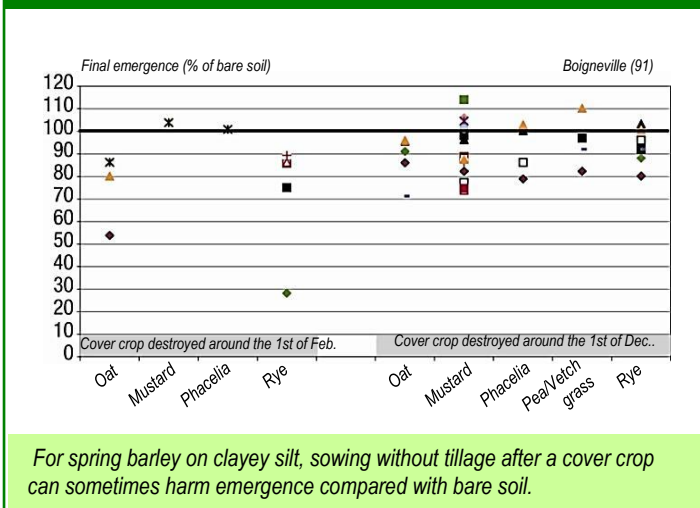
The phenomena described above need to be qualified. In fact, the later the cover is destroyed, the higher the soil moisture content tends to be in the surface layer, even though the cover absorbs water (figure 2). Similarly, cover crops which leave the most lignified residues, even after early destruction, also slow down the speed of drainage of the soil. Mustard is one of the commonest cover crops to show this problem. One must also qualify the soil moisture content at sowing according to the situation. The earlier one wishes to sow (barley, peas etc.), the more slowly the soil tends to drain (especially on wet clays) and the more noticeable is the effect of the cover crop.

Early sowing without tillage after a cover crop may impair emergence.

Effect of the choice of cover crop and its date of destruction on soil moisture content in spring (Figure 2)



Effect of the date of destruction of the cover crop on the emergence of spring barley sown without tillage (Figure 3)



Presence of rodents at the end of winter 2008 in a mustard crop.

In these situations, it is important, when sowing without tillage in winter or in spring, to be vigilant about the date of destruction and the choice of species of the cover crop. On the other hand, later sowing of maize on a light soil allows much more latitude in this respect. With relatively early spring sowings (e.g. barley) on clayey silt, no-plough sowing after a cover crop can sometimes result in poor emergence compared with a sowing done on bare soil (figure 3). In these trials, sowing took place on the same day after the cover crop and on the bare soil. This could distort the results, as the conditions were not optimal in each case.

For sowing in early spring, it is better to destroy the cover crop early.

To delay the sowing by several days after the cover crop could also prove to be disadvantageous. To try to understand this dilemma better and establish the linkage between analytical experiments and normal farming practice (the cropping system approach), modelling was used and has confirmed that a mustard cover crop destroyed at the end of November on clayey silt without tillage would delay sowing by 10 days on average, which could have an effect on the yield.

In our network of trials, the tillering capacity of the barley made up for the delayed emergence after the cover crops destroyed early (figure 4). There was even an increase in yield after legumes. These rather reassuring conclusions for barley may not always apply, however, notably for crops which do not have the same capacity for compensation, like peas.

Later sowing allows one to wait for the soil to drain better, giving better sowing conditions.

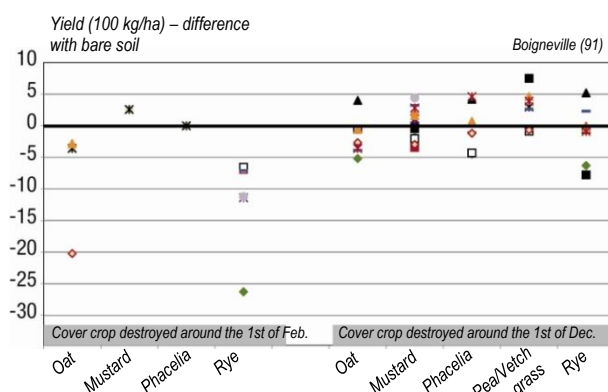
On early spring sowings without tillage, various advice can be followed to sow in the best conditions : destroy the cover from the end of November ; do not hesitate to reduce the quantity of residues left on the soil (little-lignified cover species, crushing or rolling the cover, scuffling the soil in winter when frosted, etc.), sowing the crop early into frozen soil, and of course sowing into a soil sufficiently drained if it is not frozen. For crops sown later and often with single-seed drills as for maize, the conditions seem more easily mastered : good soil drainage is easier to achieve at this time, single-seed sowing allowing more precise positioning of the seed under « limiting » conditions.

In the absence of soil tillage in spring, good soil moisture conditions at sowing can be more difficult to achieve after late destruction of a cover crop.



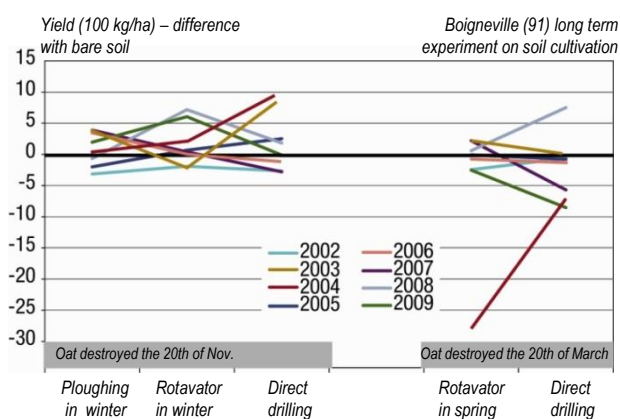
Maize sown directly into bare soil (left-hand side) and after a cover crop destroyed in mid-November (right-hand side). The cover crop was a mixture of winter oats, white mustard and forage lentil.

Effect of the date of destruction of the cover crop and of the species on the yield of spring barley sown without tillage (Figure 4)



Gramineaceous cover crops destroyed late are really harmful. Emergence losses do not explain everything. There may be « previous crop » effects, allelopathy etc.

Effect of the date of destruction of the cover and the method of sowing maize on its yield (Figure 5)



In this trial, emergence losses of maize and yield losses were quite well correlated.

On the other hand, crops like maize do not forgive significant losses at emergence, so one needs to pay a great deal of attention when sowing this crop.

Late destruction of the cover crop can be injurious (figure 5). Good soil moisture conditions at sowing can be more difficult to achieve in this situation, sometimes with perhaps coarser soil preparation, more aerated by the presence of plant trash in the seed-bed.

Pest problems also help to explain these results, with slugs or rodents which are difficult to control in a no-till situation in spring with a cover destroyed late, with untilled soil covered in residues, also cold, etc. In certain cases (e.g. hard soil in spring, pests and diseases etc.) a little light surface tillage, if done in good conditions, can help to place the seed in the fine soil and limit emergence losses. On the other hand the drawbacks can be the risk of erosion in certain regions and that of drying out the seed-bed.



Clay soil of the Dijon plain. On the left, traditional summer preparation by ploughing which has already well weathered by the beginning of winter. On the right, ploughing done in sticky conditions in November and which will not develop well if the winter is harsh.

What impact do cover crops have in the case of ploughing ?

Ploughing « evens out » many soil parameters. Ploughing-in a cover crop is a fairly simple solution to facilitate the sowing of the following crop in the majority of cases. However some cases may pose problems.

First there is the deep ploughing-in of organic matter at the bottom of the furrow which could pose a problem with residues decomposing in conditions which may be anaerobic, with possible harm to crop rooting. The results obtained in most cases after a cover crop on ploughed soil (yield) are however very reassuring for maize, barley, peas etc. This remains to be verified for the very fine rooting of fibre flax.

Another question is about the correct incorporation of the cover crop. It applies particularly to very tall crops such as well-grown mustard. To avoid having to shred it before

ploughing, some farmers have made adaptations to flatten out the crop before turning it in. This can be done with a roller mounted in front of the tractor which is ploughing (see photo) or by stretching a chain across instead of fitting skim coulters.

It is in clayey soils that the introduction of cover crops into cropping systems poses the most problems, especially in the case of ploughing. In fact, although ploughing is traditionally done in summer or early autumn on this type of soil, the presence of a cover crop can slow down this operation. Ploughing risks being done in sticky conditions and there will be less time to benefit from the alternating weather conditions which favour the creation of a fine seed-bed. In general, regulations allow the sowing of cover crops to be omitted on clay soils.

Work is needed to find possible alternatives, such as ploughing in summer before the cover crop, ploughing before the month of November, no ploughing, other ways of trapping nitrates etc...



A farmer's dodge to flatten out and bury a cover crop in a single pass (worthwhile if the cover is well developed).

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