Seed covering techniques

Ploughing + rotary harrow drill

Chopping, no soil cultivation then sowing using DPS12 + Cambridge rollers

Chopping, 2 stubble cultivations then sowing using DPS12 + Cambridge rollers

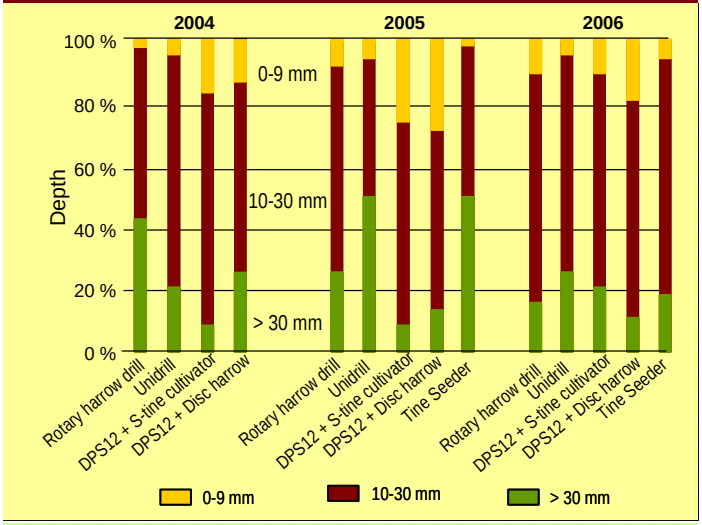
Chopping, 1 stubble cultivation then sowing using DPS12 + Cambridge rollers

Oilseed rape sown on 04/09/06 at Boigneville (near Paris). Comparison of four methods.

Knowledge of seed covering techniques and conditions in which they are implemented is crucial for approaching broadcast sowing with confidence. Here is a summary of the various solutions available.

Depending on the species and conditions, broadcast sowing requires more or less thorough seed covering. The first solution may be not to cover the seed at all: if the soil has been well-prepared, certain species, Brassicaceae in particular, only require the seed to be spread, and rain does the rest. In some situations, crop residue can be used as a "minimalist" covering, especially when sowing under the combine harvester cutter bar. Emergence will then depend on residual moisture or future rainfall. This technique is designed for sowing Brassicaceae, as they require minimal amounts of water to emerge.

2004-2005-2006 spring barley trial at Boigneville (near Paris): depth comparison for each sowing technique *(fig. 1)*

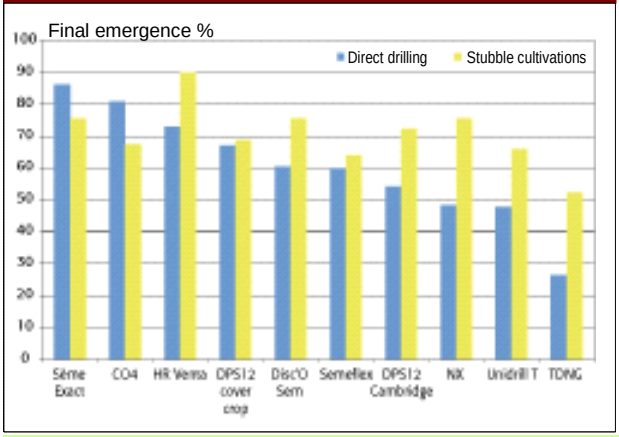


DPS 12 is a fertiliser pneumatic spreader

In each case, broadcast sowing, represented by the DPS12 + S-tine cultivator and DPS12 + disc harrow, positions at least 60% of the plants in the 10-30 mm depth band, with a slightly more marked tendency to place seeds on the surface than other techniques. On the whole the other techniques are equivalent, be it the rotary harrow drill combination, the disc drill or the tine seeder.

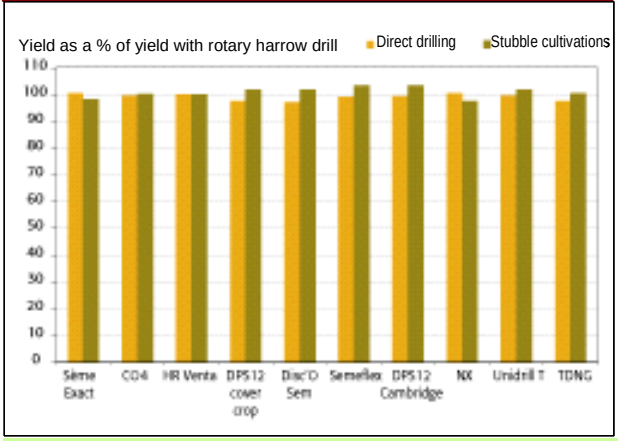
Plants are less developed when broadcast sowing is used on uncultivated soil because emergence occurs later. Conversely, plant density is identical after ploughing + rotary harrow drill and stubble cultivation broadcast sowing+ Cambridge rollers.

Final emergence rate, depending on intercropping management and sowing technique used - ARVALIS - Institut du végétal – Cetiom oilseed rape establishment trial at Boigneville (near Paris), 2006 *(fig 2)*



The DPS12 + Disc harrow and DPS12 + Cambridge rollers broadcast sowing techniques give results similar to those obtained using traditional techniques. Note the remarkable score of the DPS12 Cambridge roller technique combined with direct drilling, with 55% final emergence. The stubble cultivator drill combination with Discosem till-seeding achieves good results in prepared soil, with 75% final emergence. Semexact, CO4 (rigid tine drill) and the rotary harrow drill combination stand out favourably with between 70 and 90% emergence depending on soil preparation. Generally, soil cultivation, even if it is minimal, significantly improves the rate of emergence.

Yields obtained, depending on intercroppinmanagement and sowing technique used, expressed as a percentage of the rotary harrow-drill technique. ARVALIS – Institut du vegetal – CETIOM oilseed rape establishment trial at Boigneville (near Paris), 2006 *(fig. 3)*



In this trial, yields are very similar, regardless of final emergence rates, sowing technique and intercropping management. This proves that oilseed rape has a significant capacity to compensate, even when emergence is difficult (fig. 5). The “type of year” factor may have helped in cases of late emergence, with a particularly mild month in October. In order to complete our reference data, this trial is being repeated for the 2007-2008 season, on the same basis, but with a few variations, including drill equipment and preparation.

Cambridge rollers, suitable for Brassicaceae

Cambridge rollers were tested in 2006 on an oilseed rape trial in three different situations: on prepared soil (chopping + 1 stubble cultivation and chopping + 2 stubble cultivations), as well as on unprepared soil (chopping). With favourable conditions in autumn 2006, this technique was entirely successful.

- On prepared soil, emergence was identical to the levels noted with traditional sowing techniques.
- On unprepared soil, the start of emergence only occurred after rainfall. Final emergence rate was however on a par with other crop establishment techniques *(fig. 2)*. The delay in emergence can be explained by poorer seed to soil contact than when soil has been prepared. Mild weather conditions in autumn 2006 having encouraged emergence, we cannot conclude that this solution is consistently successful, but its success is much more certain if the soil is prepared, to improve seed to soil contact.

To sow Brassicaceae, the seed can be simply spread, providing conditions are favourable.

Seed covering using rollers is not suitable for spring sowing as at that time of year rain does not necessarily follow sowing, making emergence much more unpredictable. This is also true for species other than Brassicaceae that need to be at least lightly covered to emerge.

S-tine cultivator: good germination conditions for seed

An S-tine cultivator is the tool most commonly found on farms. A machine in good condition, with depth control, can easily achieve 4 ha/hr. However, excessive speed results in uneven sowing. Used to prepare the seedbed, the S-tine cultivator sorts out fine earth and clods, which - except in the absence of seedbed consolidation - places the seed in optimum germination conditions. It is not particularly suitable if large quantities of trash remain on the soil, and requires good management of their size and spread. The fact that the tines mix the soil down the entire cultivation depth helps to incorporate the seed with the earth. This technique is suitable for all species sown traditionally using a drill seeder, and requires particular care for shallow sowing and spring sowing. In both cases, seedbed consolidation is recommended after sowing, to ensure proper seed to soil contact.

A technique involving the use of a S-tine cultivator has the advantage of this tool being the most commonly found piece of equipment on farms.

Heavy harrow: suited to shallow cultivation

Heavy harrows are suited to shallow cultivation but tolerate absolutely no crop residue. The different compartments, combined with forced working depth, result in regular cultivation depth over the whole width of the tool as each of them follows soil contours independently. To achieve even cultivation, it should be used in conjunction with roller or comb type equipment. The way in which the tines work helps to sort clods and to crumble the seedbed to encourage emergence.

A heavy harrow is a fairly simple tool which, through its compartmented design, is able to adjust to the topography of the land.

This prototype, presented by Duro at Innovagri in 2006, takes up the principle of the spade roller, incorporating a sowing solution. Here the seed is dropped just in front of the second row of spades.

Stubble cultivation harrow: suitable for clayey-calcareous soils

Suited to very shallow stubble cultivation, this tool is ideal to cover seed in clayey-calcareous soils with a moderate amount of straw. Sowing depth depends directly on the preparation depth, which is achieved progressively with several passes. Requiring little traction, and able to quickly cover widths of over 8 m at a speed of 10 to 15 km/hr, this tool is often combined with a spreader placed in front of the tractor. Designed for sowing depths of up to 2-3 cm, it is capable - with very flexible tines - to adjust to quite uneven surfaces. Devoid of any seedbed consolidation device, it produces better results after summer sowing or in dry weather conditions when it is supplemented with a pass of a heavy roller.

Disc harrow: good quality covering

Disc harrow is a versatile stubble cultivation tool which produces even shallow cultivation, thus ensuring good quality seed covering, including when plant debris is present. The way the discs lift and turn over the earth contributes to the quality of the cultivation work and greatly improves the evenness of depth. From that point of view, it even performs slightly better than tined tools. The use of a consolidation roller is definitely beneficial and carrier rollers also produce extremely even work. Using small pitched (200 mm) sets of discs improves precision at shallow depths. Only drawback: the weight of this equipment, which is an advantage for the first stubble cultivation in dry conditions, can be a disadvantage for covering seed, as it requires a lot of power which is not normally necessary for this operation. In addition, in wet conditions it can encourage the formation of clods, especially in clayey soils.

Used with disc harrows, rollers produce very even cultivation work.

The design of modern disc harrows with a roller ensures perfect depth control.

Short disc harrow: even depth

The way in which they operate makes discs particularly well suited to shallow cultivation, ensuring even cultivation depth. The 250 mm gap between discs is compensated for by the fact that they are on two overlapping rows, which means that a disc cultivates the soil every 125 mm. The cutting angle, and even more importantly the angle of penetration, do the rest. Equipped with a roller, this type of machine is ideal to cover seed. This tool is able to operate at speeds of over 10 km/hr, and - like most of those presented in this article - it helps meet work throughput levels required by seed spreaders.

Spade rollers: seed is spread throughout the full cultivation depth band

Suited to shallow cultivation, the spade roller is a tool requiring little pulling power and able to operate at high speeds. It must be used on a firm cultivated bed to encourage spade rotation and ensure good cultivation depth control. The spades operate similarly to stubble cultivation harrows, with very good penetration capabilities. Like for tined tools, the seed is spread throughout the full cultivation depth band. In the long run, the weakness of this type of tool may lie in the reliability of the bearings.

Seed covering

If an ideal tool existed, it should meet the following criteria:

- able to produce even cultivation at shallow depths,
- able to sort clods, leaving rough parts on the surface,
- turning over action of working parts,
- able to consolidate seedbed,
- able to adjust to soil evenness,
- flexibility: soil preparation and seed covering,
- high work throughput and low traction requirement.

Some criteria seem to be contradictory (clod sorting and turning over action for example): this exercise helps to highlight the fact that there is no such thing as a machine "capable of doing everything". Choosing a machine consists in clearly defining one's needs and constraints, and finding, among all the possible solutions, the one which appears to be the best compromise.

Horsch Semexact: excellent emergence rate in dry conditions

Horsch's Semexact is an interesting case, even though it is now seldom used. On even, consolidated soil, it helps ensure incomparable evenness of depth. The soil stripped by the rotor is refined and covers the seed previously deposited on the seedbed, while the rougher parts are placed on the surface. Emergence rates are always excellent in dry conditions, since the seed lies on an uncultivated base which remains cool. Major disadvantage: the work throughput no longer meets current expectations, especially when the power requirement of this tool is taken into consideration.

Used after adequate preparation work, the Semexact remains the leading tool in terms of quality of deep positioning and quality of emergence.

Till-seeding is making a comeback

Till-seeding, which had its heyday with the Semavator, is making a comeback with non-pto driven machines such as short disc harrow. The earth flow is generated by the rotating discs and the seed is dropped either upstream of the discs, i.e. between the two rows, or downstream, between the second row and the roller.

The till-seeding technique must imperatively involve the use of a consolidating roller in order to maximise the chance of successful emergence, especially for spring and summer sowing.

The Semavator gives the option of dropping the seed either before or after the rotor. Since the late 60s, its use has mainly developed for establishing wheat after grain maize.

Large amounts of straw unevenly spread can be very problematic in a min till system, and even more so with broadcast sowing.

Shallow soil preparation

As with any other sowing technique, the success of broadcast sowing depends on suitable soil preparation. It is no accident that it is implemented as part of a min till system. This technique requires shallow preparation and even ground to achieve, in the absence of sowing components, optimum management of the establishment depth. As far as possible, preparation work undertaken before broadcast sowing must aim to coincide with the sowing depth of the crop. Ideally, this preparation should be carried out using a tool which will cover the seed. This tip helps to limit sowing depth to the cultivation depth established during the preparation work, without modifying the settings between the two operations. This only applies, of course, if the soil structure and the species that is going to be established do not require deep soil cultivation.

Preparing the soil with the tool used to cover the seed helps to limit the sowing depth to the maximum cultivation depth.

Generally, till-seeding is suited to autumn crops such as oilseed rape, wheat and winter barley. Winter cereals do not present any particular problem since, established in autumn, their sowing is very often followed by rain. As for oilseed rape, it does not need to be sown very deep. Spring barley may cause greater problems, and additional measures must be taken, both in terms of preparation and sowing conditions, as spring sowing may be followed by long dry spells. But even with 10 to 20% plant losses in the emergence phase, cereals are able to compensate for water deficiency. Conversely, spring peas are much more problematic. Very sensitive to seedbed quality and establishment depth, yields can drop very quickly, and rigorous management is crucial to provide this species with all the conditions it needs to grow properly. Sowing techniques that include the use of sowing components (shoe, disc, tine…) seem to be best, in order to try and guarantee success.

Finally, it is important to remember that crop debris management, in accordance with the specific situation of the farm, is a major factor in achieving successful sowing without ploughing. Broadcast sowing does not escape this rule. The example of oilseed rape established after wheat in two radically different situations illustrates this point perfectly:

- on the clayey-calcareous soil of the Barrois region (northeastern France): previous crop harvested on 20th July with 6 tonnes of straw baled in the field, oilseed rape established on 20th August.
- on silty soil in Picardie (northern France): previous crop harvested on 10th August with 9 tonnes of straw baled in the field, oilseed rape established on 20th August.

The Picardie farm presents more problems, including some linked to the very short intercropping season and the amount of straw: shallow soil preparation can be envisaged; deep soil preparation makes seed depth more difficult to control. Each situation is different, and in the above case, success will depend on taking additional precautionary measures regarding the till-seeding technique used, as well as the settings. The problems that arise are not insurmountable and a clear analysis of the situation as well as a learning phase when the technique is restricted to a few hectares can help acquire the necessary know-how. In any case, if a farmer has the option of testing broadcast sowing on his/her farm, it is definitely worth a try.

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