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Effects of direct drilling on spring cereals, turnip rape and pea

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In 2007, 30%, 10% and 17 % of the winter cereal, spring cereal and oilseed rape area of Finland was direct drilled. Direct drilling has been studied by MTT Agrifood Research Finland since the 1980s, but conclusions here are mainly based on field trials on clay soils in 2000s. Differences in amount and quality of yield from ploughed and no-till soil vary between years, fields and species. Timing and implementation of drilling in no-till soil is especially challenging. When it occurs after drilling, early summer drought may interfere with crop establishment. On the other hand, if plant stands establish well, prospects are good for successful growth. Typically yields were higher in rainy early summers when soils were ploughed, while under dry conditions in early or midsummer direct drilled crops yielded equally or more than those sown in ploughed soil. In rainy summers the yield decrease could be quite marked when the crop was direct drilled, and especially so with sensitive spring barley. Direct drilled plant stands were also more sensitive to dry and warm periods during the grain-filling phase through maturing earlier and having smaller grains. Oat did grow and yield more reliably than other spring cereals when direct drilled. However, in wet spring 2004 in monoculture trial, high amount of preceding year's oat wastes delayed sowing, and further rains caused failure in oat growth. Spring wheat often yielded less when direct drilled, but in dry summers it outyielded crops from tilled fields. Establishment of spring turnip rape was halved in direct-drilling, mainly because the fertiliser close to the seed reduced germination. Also establishment of pea was poor in direct drilling, and only in 2007 with help of rain and 20 % extra seed, the same plant number than in ploughed soil was reached. However, for both turnip rape and pea, lower plant number did not necessarily mean lower seed yield.

The protein content of spring cereal grains was low in direct drilling. This was obviously a consequence of low mineralisation of N in no-till soil (Kristensen et al. 2000). Effects on the quality were otherwise small, although the share of small grains of malting barley increased with direct drilling. Alakukku (2006) found no decrease in grain nitrogen concentration from crops grown on clay soil, but on clay loam both nitrogen and phosphorus contents decreased more than grain yield on no-till. This indicates the need for evaluation of more long-term effects of zero tillage. Special attention has to be paid to crop rotation in no-till fields. Until now, the results from preceding crops are somewhat surprising; the seed yield of spring wheat in both years (2006 and 2007) was lower after oil crops than spring cereals in tilled soil and no-till alike. Interesting finding was that the after-effect of pea was proportionally weaker in direct drilling. Transferring legume N to succeeding crop is challenging without tilling, and should be studied more.

Fields are often highly heterogeneous with respect to plant growth conditions (Rajala et al. 2007). Heterogeneous fields increase the risk of uneven growth and ripening under no-till conditions. Furthermore, sowing normally occurs later in untilled than tilled soil. This causes differences in time of rain and heat with relation to growth stage, which makes comparison between the two methods difficult. In the future, more attention should be paid on studying and developing direct drilling itself, instead of comparing it with conventional methods.

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