COMPANION PLANTING IN OILSEED RAPE

Companion planting is the practice of growing a secondary crop that dies off over winter alongside the main crop. The prime companion crops are legumes because of their many beneficial effects. The German Society for Conservation Tillage (Gesellschaft für konservierende Bodenbearbeitung (GKB) e. V.) has studied the effect of companion plants on winter rape in a three-year innovation project entitled "Cultivation of oilseed rape with companion plants in precision drilling and wide row planting regimes".

The aims of this project was to document the benefits of different companion plants in oilseed rape, to optimise the method and to develop recommendations for novice growers. One aim of growing companion crops is to reduce the use of chemicals and pest damage. In addition, legumes can provide the oilseed rape with additional nitrogen while their organic mass that is killed off in winter should promote soil life.

The trials took place on farms in the federal state of Lower Saxony in the Hildesheim and Helmstedt districts. Due to the poor weather conditions at the time of seeding in 2017, the second year of the trial, it was not possible to drill at the Hildesheim site in that year. The drill was a Gherardi G300 direct drill. This machine drills the rapeseed and at the same time sows the companion crops between the crop rows in a single pass. The rape variety AVATAR was drilled with a row spacing of 45 cm at a rate of 25 viable seeds/m². All trial plots received the customary and consistent fertiliser and chemical treatments. The application rates of herbicides that are applied in autumn to control weeds and the herbicides themselves have to be chosen according to the companion crops. The companion crops consisted mainly of legumes – lentils, common vetch and peas – along with field beans, sown either as a single crop or in mixes with non-legumes. Mix A contained summer vetch, American vetch and Egyptian clover. Mix B contained buckwheat, lentils, chickling peas, common vetch, Egyptian clover and niger.

TABLE 1: COMPANION CROPS WITH SOWING RATES

Companion crop/mix	Latin name	Sowing rate kg/ha
Lentils	Lens culinaris	40
Common vetch	Vicia sativa	50
Peas	Pisum sativum	80
Field beans	Vicia faba	100
Mix A (common vetch, American vetch, Egyptian clover)	Vicia sativa, Vicia americana, Trifolium alexandrinum	40
Mix B (buckwheat, lentils, chickling pea, common vetch, Egyptian clover, niger)	Fagopyrum esculentum, Lens culinaris, Lathyrus sativus, Vicia sativa, Trifolium alexandrinum, Guizotia abyssinica	30

The crop densities and the amount of fresh mass of the trial crops were recorded along with the yields. Soil samples were also collected and the soil was tested for organisms. Significant differences were found in the crop densities of the oil seed rape plants and the companion plants during the two trial years. The dry, warmer-than-average weather in 2016 helped the lentils, vetch, peas and field beans become well-established, while the small-grained legumes in the mixes

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Using companion crops in oilseed rape to boost organic matter and ensure deep root penetration is something that Matthias Joest, in charge of arable farming at the agricultural cooperative Agrargesellschaft Herbsleben AG in Thüringen, is keen to explore. Innovation spoke to him about companion planting as a new approach in oilseed rape crop management.

Mr Joest, what convinced you to try growing oilseed rape with companion crops?

Joest: Legumes produce a large amount of root mass which loosens the soil and provides additional organic matter. We've been growing peas on the farm for years so we have seen this for ourselves. Last year we tried sowing small-grain legumes at the same time as oilseed rape for the first time to see if the rape crop could benefit from this effect. It's something I'd envisaged for a long time, but we didn't have the right drilling equipment. Last year we hired a suitable machine so we were finally able to begin companion planting. We drilled 35 to 50 seeds, depending on the weather and condition of the seed bed, at standard row spacings.

> **THE OILSEED RAPE MAY BE SMALLER IN AUTUMN BUT MORE HOMOGENEOUS.«**
>
> Matthias Joest

Which plants make suitable companion crops in your view?

Joest: We started with a mix of clover and vetch, which worked very well. The vetch germinated quickly in the autumn and rapidly developed deep roots. In fact, it formed a really huge root structure. Peas would also make a good companion crop and that's certainly something we plan to try. I'm not so sure about non-legumes though, because it's important that the companion crops don't compete with the oilseed rape. Plants grown in companion with others tend to behave differently than when grown as a single crop. Competition changes the plant communities.

Does oilseed rape develop differently when grown together with a companion crops?

Joest: In autumn the oilseed rape plants are certainly smaller when grown with companion crops, but the stand is more homogenous. Oilseed rape doesn't grow as rapidly when other plants are present and so there is less risk of overgrowing. It's particularly important for us that the plants do not compete for light, but we haven't encountered this problem with the current mix. The oilseed rape crop benefits from the extra nitrogen which the legumes provide.

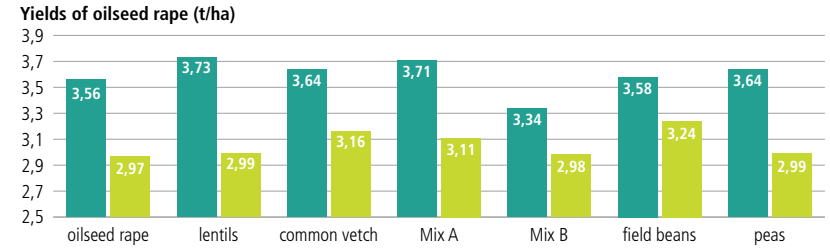
How do you see the future development of companion planting in oilseed rape on your farm?

Joest: So far we have companion planted only some of our OSR fieldbut we plan to expand this in the coming years. Next autumn we will grow companion crops on 100 hectares of our 250 hectares under oilseed rape cultivation, so half the total area. Then we want to try growing other legumes with the oilseed rape to see what works best.

Thank you for the interview.

The common vetch are clearly visible in the crop.

FIG. 1: YIELDS OF OILSEED RAPE IN THE YEARS OF TRIAL



Yields of oilseed rape 2017; Yields of oilseed rape 2018
Source: Dr. Jana Epperlein

found it more difficult to emerge in these dry conditions. The lentils and peas germinated well in the damp autumn of 2017, as did the common vetch and American vetch in Mix A. But here too, the clover struggled due to the extreme weather. Overall, the large-seeded components in the mix were found to establish more rapidly and successfully than the small-seeded components. The buckwheat, for example, put on very little growth and flowered quickly. The cooler temperatures in October killed off the niger first. Other non-hardy species such as lentils succumbed to the frosts in November. Any remaining companion plants were then killed off by the more prolonged periods of cold weather in December. Analysis of crop densities showed that the companion crops had neither a very positive nor a negative effect on the number of germinated rape plants as the main crop. At the end of the period of vegetative growth, the above-ground fresh mass of both the oilseed rape and the companion crops was measured. These measurements showed considerable differences in analogy to the crop density, with differences referring not only to the two trial years but also to the individual plots.

To assess the ecotoxicological effects of companion crops in oilseed rape, the Solvita test was carried out in the individual test plots in spring to determine the soil's biological reactivity. The Solvita soil life test measures soil fertility and the natural resistance of the soil to harmful microbes. Soil respiration is indicative of the level of soil activity and the release of nitrogen. In both sites the biological activity was found to be greater in the companion-planted plots than in the single-crop plots.

Yields of oilseed rape in the monocrop plots and in the companion-planted plots were roughly the same. In the 2017/18 trial year yields were below the long-term average due to difficult weather conditions – wet at the time of drilling followed by severe drought in summer. The variants seeded with companion crop mixes were not found to have a significant impact on yields, which can be attributed to the non-legume components in mix. Lentils, peas and common vetch proved to be the best overall companion plants in terms of yields. The long-term effects of increased levels of organic carbon left in the soil by the companion crop were not studied. In 2016/17 the trial plots yielded an average 3.50 t/ha compared with the national average in Germany of 3.29 t/ha. The 2018 yield was exactly on a par with the national average at 3.0 t/ha.

The field beans can develop well between the oil seed rape plants.

Summary

Growing oilseed rape together with companion crops should bring numerous agronomic and commercial benefits. Companion crops that include legumes provide the oilseed rape with additional nitrogen during the crop year and boost supplies of organic carbon, which encourages soil activity. This was found to have a positive effect in the spring, so even in the short term. Although the long-term effects on soil organisms, the increase in the value of the preceding crop and the enrichment of the soil with organic matter were not quantified, these aspects could constitute another significant benefit. Companion cropping improves the soil structure in the space between the rows. Improved gas exchange helps the soil warm up more quickly which in turn encourages conversion processes and root growth. As the legumes fixed additional nitrogen it was possible to reduce fertiliser inputs. This also to some extent explained the higher yields obtained from the plots companion-planted with legumes. The other companion crops had neither a positive nor a negative effect on the number of emerged oilseed rape plants.

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