

UNDERSOWING OILSEED RAPE WITH GRASS

An alternative means of nitrogen fixation

Nadine Wellmann · Lippstadt

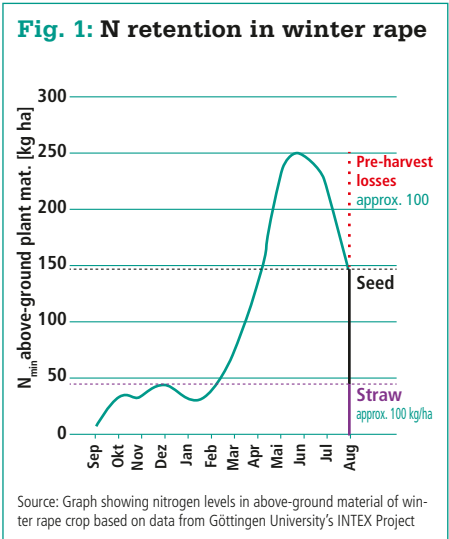


The new German Fertiliser Ordinance has made nitrogen fixation an even more important issue than it was before. One method of reducing the potential for nitrate leaching is cultivating cover crops to follow on from rape. But as it is difficult to establish catch crops after oilseed rape undersown grass in rape may present an interesting option. Yet, this is not to be confused with intercropping oilseed rape and legumes.

The new German Fertiliser Ordinance and Water Framework Directive set the terms for a fertiliser strategy of the future. In our view, it is the issue of nutrient balance which lies at the heart of these regulations, compelling farmers to recover every kilogram of nitrogen. It may be possible to solve the problems associated with the nitrogen surplus purely mathematically by adjusting the application rate of nitrogen (nitrogen balance).

But due to its phenological traits, oilseed rape still produces a nitrogen surplus (source-limited plant) and this persists even when reducing nitrogen application rates. According to Lickfett/Intex 2001, from the flowering period onwards oilseed rape sheds some flowers and leaves which still contain high levels of nitrogen residues and pro-

tein (Fig. 1). As a result, 80–100 kg of nitrogen enter the soil prematurely via this route as the leaves slowly break down. Any form of tillage following a crop of oilseed rape accelerates the mobilisation and transfer of nitrogen to the subsoil. A follow-on wheat crop generally absorbs 20–40 kg N before winter. The plants are no longer able



Tab. 1: N_{min} following oilseed rape with undersown grass, samples in wheat taken in Sept. immediately after ploughing in the grass and drilling the wheat

Sample no.:	Designation	Soil type	Depth in cm from-to	N_{min} kg/ha	NO_3-N kg/ha	NH_4-N kg/ha	S_{min}
14-267418	Zero N plot		0–30	45	45	< 1	
14-267419	Zero N plot		30–60	25	25	< 1	
Summe				70	70	< 1	
14-267416	Red fescue		0–30	15	15	< 1	
14-267417	Red fescue		30–60	15	15	< 1	
Summe				30	30	< 1	
14-267422	Perennial ryegrass		0–30	11	11	< 1	
14-267423	Perennial ryegrass		30–60	6	6	< 1	
Summe				17	17	< 1	
14-267420	Italian ryegrass		0–30	11	11	< 1	
14-267421	Italian ryegrass		30–60	5	5	< 1	
Total				16	16	< 1	



to reach and absorb the remaining nitrogen (40–60 kg according to calculations).

Solution

The primary goal must be to fix nitrogen in the topsoil. To improve the pre-crop effect of oilseed rape and thus have a positive effect on the nitrogen balance in the following wheat crop, it would make sense to cultivate nitrogen-fixing cover crops. This would require tillage, the drawback of which is that even very shallow cultivation would lead to a significant and very rapid release of nitrogen and the plants would not be able to fully absorb it. In addition to that the timeframe required for the cultivation of fast-growing cover crops and the control of volunteer oilseed rape seed is insufficient. Undersowing with grasses would gain four weeks in the growing season. Volunteer oilseed rape can also be successfully controlled in the undersown grass using flail mowers or other mechanical means. This also fits in with the most recent findings on the prevention of oilseed rape dormancy and persistence.

In recent years trials have been conducted with different undersown crops in oilseed rape to fix nitrogen in a similar way to the established procedure of undersowing maize. Red fescue was sown in autumn using an air spreader and followed by ryegrass variants in the spring. Red fescue has the advantage of being very slow-growing and tolerant of FOB herbicides, thereby permitting the control of weeds.

Preliminary results

With measurements meeting expectations, initial trials confirm the validity of the approach of using undersown grass in oilseed rape. At the

Immediately before harvesting the undersown grass shows little signs of growth (left), whilst one week after threshing the oilseed rape, it has grown significantly (right).



Undersowing oilseed rape –how it's done

With oilseed rape the time of sowing the undersown crop also depends on the chosen species of grass. The slower-growing red fescue can be sown in autumn, whereas ryegrasses are established in early spring. The undersown crop can be wet-sown, where the seed is sown in combination with spreading slurry, or sown with an air spreader.

Wet-sown grass seed can be applied from early February by a vacuum slurry tanker. This is done by fitting a 50 mm bypass to the intake hose of the slurry tanker to suck up the grass seed. If the slurry has a high DM content, it will be a good idea to soak the seed in water for 30 minutes. When the tank is filled to capacity, the next batch of seed can be steeped in water. This gives the seed time to soften before refilling the tank. The liquid is applied by drag hoses, which ensures that the grass seed is sown at ground level. Subsequent rainfall increases the chances of success.

Sowing should also take place as early in the season as possible if an air spreader is used for sowing. Subsequent rainfall is desirable to improve the success of sowing and prevent seed sticking to the leaves. Slugs present the greatest risk. In areas that are particularly prone to slug damage, it is advisable to apply slug pellets at the same time. This costs are approximately 35–50 EUR/ha.

About a week after harvesting the oilseed rape, the field can be rolled, flailed or cut. Fertiliser should only be applied if another crop is to be sown. The land is usually ploughed in preparation for sowing wheat. This gives the grass eight weeks to fix nitrogen and water. It is still easy enough to kill off the grass and subsequently process the organic matter with a cultivator or disc harrow since in eight weeks the grass sward is unable to build up the quantities of dry matter that may require ploughing. Volunteer oilseed rape can be controlled with a straw harrow or flail mower. This method has proved particularly popular when the oilseed rape is to be followed by spring crops.

time of harvesting, the undersown plants were hard to spot yet just one week later, they had put on substantial growth and the first volunteer rape seedlings to emerge were removed with the flail mower. Then the tiny grass plants began to grow rapidly and after three weeks the field was covered in a green sward. N-Min samples were taken on the trial plots in October after incorporating the oilseed rape and drilling the wheat. Whilst 70 kg N was recorded at a depth of 0–60 cm in the plot that had not been undersown, in the ryegrass blocks only 16/17 kg N/ha was found. The N-Min was sampled again on 20 December 2014. The aim was to discover whether nitrogen fixation is sustained. In the control plot 102 kg of nitrogen was found in the 0–90 cm depth range. In contrast, only 35/45 kg of nitrogen was found on the undersown plots.

Conclusion

Oilseed rape is ideally suited as an undersown crop. If done correctly, the undersown crop does not affect the growth of the main crop. The semi-shade at ground level afforded by the oilseed rape until maturity, combined with relatively high air humidity, provide the perfect conditions for grasses to germinate and develop. Competition from the undersown crop has not been observed in the tests to date. However, these are preliminary test runs designed to investigate the technical feasibility. Performance trials will be conducted in future years. As anticipated, no tillage and the use of undersowing as a means of storing nitrogen is easily measurable. In the trials red fescue was sown in conjunction with the oilseed rape

Tab. 2: N_{min} following oilseed rape with undersown grass, samples in wheat taken in Dec. 2014

Sample no.:	Designation	Soil type	Depth in cm from-to	N _{min} kg/ha	NO ₃ -N kg/ha	NH ₄ -N kg/ha	S _{min}
14-307094	Control		0–30	35	35	< 1	
14-307095	Control		30–60	40	40	< 1	
14-307096	Control		60–90	27	27	< 1	
Summe				102	102	< 1	
14-307088	Undersowing 1 ryegrass		0–30	22	22	< 1	
14-307089	Undersowing 1 ryegrass		30–60	13	13	< 1	
14-307090	Undersowing 1 ryegrass		60–90	9	9	< 1	
Summe				44	44	< 1	
14-307091	Undersowing 2 red fescue		0–30	17	17	< 1	
14-307092	Undersowing 2 red fescue		30–60	10	10	< 1	
14-307093	Undersowing 2 red fescue		60–90	8	8	< 1	
Total				35	35	< 1	

and perennial and Italian ryegrass were sown in early spring.

Sowing has been very straightforward from a technical point of view during the last few years. The crop was herbicide tolerant (Clearfield was not tested) and growth was not affected during all this time up to the point of harvesting. Flailing proved to be an extremely successful means of controlling volunteer oilseed rape in the trials. The grasses were able to fix up to 70 kg N/ha and reliably store it until the end of the year. Incorporation of the spring sowings after killing them off was easily done with the cultivator. The autumn-sown red fescue left behind a much denser root

system, making it more difficult to cultivate. Slugs proved to be the greatest issue, causing some trials to be abandoned altogether. Even if these options are not included in calculations of nitrogen and greenhouse gas balances, the development of these alternative forms of cultivation are both necessary and feasible.



Nadine Wellmann
Fon +49 2941 296 469