

UNDERSOWING CREEPING RED FESCUE (*FESTUCA RUBRA* VAR *RUBRA*) FOR SEED PRODUCTION IN WINTER AND SPRING WHEAT COVER CROPS

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ABSTRACT

Sowing red fescue (*Festuca rubra* L.) seed crops in autumn without cover crop or in winter wheat sown at two sowing rates (100 vs. 200 kg ha⁻¹) and two row spacings (13 vs. 26 cm) was compared to spring establishment without cover crop or in spring wheat at the same sowing rates and row spacings. Yields of winter and spring wheat averaged 5190 and 4106 kg ha⁻¹, respectively. First years' seed yields of red fescue were, on average, 7% higher after spring- than after autumn sowing; with cover crop this can be explained by the taller plants of winter wheat. However, because of less variation in wheat harvest time, fluctuations in red fescue seed yields were smaller after winter than after spring wheat. Yields of wheat and red fescue seed were affected more by cover crop sowing rate than by cover crop row spacing. Establishment in winter wheat sown at 100 kg ha⁻¹ gave the highest economic return.

KEYWORDS

Cover crops, *Festuca rubra*, grain yield, red fescue, row spacing, seed yield, sowing rate, wheat

INTRODUCTION

Since the start of red fescue seed production in Norway in the late 1970s, most growers have practiced spring sowing without cover crop. Early experiments (reviewed by Jonassen and Hillestad, 1990) showed an 84% reduction in first years' seed yields after undersowing in spring barley as compared to spring sowing without cover crop. In those trials, no attention was paid to the sowing rate or row spacing of the cover crop; factors which are known to be critical when undersowing grass seed crops in cereals (Jonassen, 1993; Meijer, 1987; Nordestgaard, 1984).

In Denmark and The Netherlands, red fescue seed crops are commonly undersown in winter wheat. This provides the red fescue with a long period for seedling growth, and the possibility of eradicating voluntary wheat with herbicides favours the winter wheat / red fescue combination.

During the past five years, the proportion of winter- to spring wheat has increased in Norway, and, in 1995, each of the two forms contributed about 50% of the country's wheat acreage. The objectives of the present research were (1) to compare winter and spring wheat as cover crops for red fescue seed crops under Norwegian climatic conditions; and (2) to investigate the effect of cover crop row spacing and sowing rate on wheat yields and subsequent seed yields of red fescue.

MATERIALS AND METHODS

Field trials were laid out at The Norwegian Crop Research Institute (Planteforsk), division Landvik (58°N), in the autumns of 1990, 1992 and 1993. The experimental design was a three or four replicate split plot with sowing time (Septemer vs. April/May) on main plots and wheat sowing rates (100 vs. 200 kg ha⁻¹) and row spacings (13 vs. 26 cm) in factorial combination on subplots. Both in autumn and spring, subplots without cover crop were included for control. Main plots were harrowed shortly before drilling the wheat, and after rolling, red fescue 'Leik' was sown at a rate of 5 kg ha⁻¹ perpendicularly to wheat rows. Cultivars of winter and spring wheat were 'Folke' and 'Tjalve', respectively. Nitrogen applications to the wheat crops were 80 kg ha⁻¹ in spring + 30 kg ha⁻¹ at heading, and

the red fescue seed crops received 50 kg N ha⁻¹ both in autumn (after wheat straw removal) and in spring.

RESULTS

On average for sowing rates and row spacings, grain yields of winter and spring wheat were 5190 kg ha⁻¹ and 4106 kg ha⁻¹, respectively. In both forms of wheat, and at both row spacings, a reduction in the sowing rate from 200 to 100 kg ha⁻¹ tended to reduce wheat yields by 15-20%. An increase in row spacing from 13 to 26 cm had negligible impact on grain yield of spring wheat, but tended to reduce grain yield of winter wheat by approximately 10%.

The highest seed yield of red fescue (1211 kg ha⁻¹) in the first harvest year was obtained on plots sown in spring without cover crop. Establishment in spring was advantageous also on plots sown with cover crop, especially when the wheat was sown at 13 cm row spacing and a sowing rate of 200 kg ha⁻¹

With both forms of wheat, first years' seed yields of red fescue were influenced more by cover crop sowing rate than by cover crop row spacing. With winter wheat, there was a tendency that sowing at 26 cm was more advantageous to the undersown seed crop at high than at low sowing rate.

Without cover crop, panicle number as well as weight per panicle tended to be higher after sowing in spring than after sowing in autumn. Use of cover crop depressed panicle numbers most severely on spring sown plots, but this was partly compensated by a higher panicle weights.

Sowing time or cover crop had no effect on second years' seed yields of red fescue, which are therefore not reported.

DISCUSSION

On plots sown without cover crop first years' seed yields of red fescue tended to be higher after spring than after autumn sowing. This result was unexpected, but, it can partly be explained by overcrowding of tillers during the 21 months' period from sowing to the first seed harvest on autumn-sown plots. It should be emphasized that these experiments were conducted in the best climatic areas of Norway (growing period from early April to November), and on fairly light soils (sandy and silt loams) with good red fescue seedling emergence.

According to Meijer (1987) and Chastain and Grabe (1988), competition for light is more critical than competition for water or nutrients when undersowing grasses in cereals. Since the winter wheat cv. Folke used in these trials developed taller canopies than the spring wheat cv. Tjalve (plant heights around 100 cm and 60 cm, respectively), the latter allowed for more light penetration to undersown grass plants. For this reason, seed yields of red fescue were higher after spring than after winter wheat in two out of three trials, and the difference was most accentuated at the higher sowing rate and closer row spacing. However, the suitability of a cover crop also depends on its harvest time, which is normally earlier in winter than in spring wheat. Thus, in the third trial, 'Folke' was harvested one month earlier than 'Tjalve' (14 August vs. 14 September 1993), and in this particular field average seed yields of red fescue were 74% higher after winter than after spring wheat. It thus appears that

although establishment in spring wheat may produce higher seed yields on average for several years, fluctuations in first years' yields will probably be smaller after winter wheat.

With winter and even more with spring wheat, yields of wheat of red fescue seed were more affected by cover crop sowing rate than by cover crop row spacing. This is in good agreement with earlier Danish and Dutch experiments (Nordestgaard, 1984; Meijer, 1987) indicating that light penetration to the undersown grasses depends more on the density of cereal plants than on their spatial distribution.

With the results presented in table 1 and current Norwegian prices, the highest net income (gross revenues minus costs to wheat seed and fertilizer) for the year of establishment and the first seed harvest year was obtained when undersowing the seed crop in winter wheat at a sowing rate of 100 kg ha⁻¹ (Fig. 2). This is now being recommended in red fescue seed production in SE Norway.

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Table 1

Grain yield of wheat in the year of establishment and seed yield, panicle number and weight per (unthreshed) panicle in the first harvest year of the red fescue seed crop. Mean for three trials.

Sowing time / companion crop	Row spacing cm	Sowing rate kg ha ⁻¹	Grain yield of wheat, kg ha ⁻¹	Cleaned seed yield kg ha ⁻¹	Panicles per panicle m ²	Weight mg
Autumn/no comp. crop	-	-	-	1113	1946	99
Autumn / winter wheat	13	100	5031	865	1514	108
Autumn / winter wheat	13	200	5929	581	1092	112
Autumn / winter wheat	26	100	4567	911	1548	109
Autumn / winter wheat	26	200	5232	769	1283	127
Spring/no comp. crop	-	-	-	1211	2078	109
Spring / spring wheat	13	100	3758	881	1261	118
Spring / spring wheat	13	200	4468	728	1137	131
Spring / spring wheat	26	100	3682	936	1500	137
Spring / spring wheat	26	200	4515	788	1138	132
LSD 5%			ns	340	626	24

Figure 1

Net income (1 Nkr \blacktriangle 0.22 Canadian dollars) in the year of establishment + first seed harvest after sowing red fescue seed crops in autumn or in spring without cover crop (controls) or in wheat (winter wheat for autumn sown plots: spring wheat for spring sown plots) at various sowing rates and row spacings.

