Covercrops in Blackcurrant (*Ribes nigrum*)

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Abstract

With the objective to identify the effect of soil cultivation and nitrogen supply in organic production of blackcurrant a field trial was planted autumn 1996 under unsprayed conditions. The bush rows were cleaned mechanically for weed, and cover crops were established in the alleyways.

During establishment all four cover crops gave a sufficient nitrogen supply. The level of nitrogen in soil and the growth were smallest in the annual sown cover crop. Minirhitzotrons were used to follow blackcurrant root growth in total mechanical cleaned plots and plots with sown alleyways. The maximum root dept of blackcurrants of 125 cm were obtained direct under the bush in autumn 1998, whereas the roots only were present down to 40 cm 1.5 meters from the centre of the row. The variety 'Titania' had a deeper root pattern than 'Ben Lomond'. There were no significant yield differences among the soil treatments. There was a tendency to a higher yield for 'Titania' in 2000 in the annual sown cover crop, probably due to the deeper root pattern of 'Titania' and thereby less susceptibility to mechanical root damage. 'Titania' had the highest yield in the two cropping years 1999 and 2000, whereas 'Ben Lomond' had a very low yield due to severe infections of American gooseberry mildew *(Sphaerotheca mors-uvae)*, which caused very little shoot growth. 'Farleigh' was susceptible to white pine blister rust (*Cronartium ribicola*) and infections of leaf spot (*Gloeosporidiella ribis*) occurred every year. 'Titania' and 'Intercontinental' had the best field resistance to diseases.

INTRODUCTION

Soil cultivation and nitrogen supply are of most importance in organic production where only organic fertilisers are allowed. In practice, organic manure is nearly impossible to obtain from another organic farm. Therefore, covercrops as an alternative nitrogen source may be an alternative organic fertiliser for farms specialised in organic blackcurrant production.

MATERIALS AND METHODS

To investigate the effects of different cover crops on growth and production of blackcurrants, a field trial was planted in the autumn of 1996 under unsprayed conditions. The bush rows were mechanically weeded, and cover crops were established in a two-meter wide strip in the alleyways. Planting distance was 3.5 x 0.6 m.

Varieties in the trial: 'Ben Alder' 'Ben Lomond', 'Farleigh', 'Intercontinental' and 'Titania'.

Treatments carried out:

1: Annual cover crop sown every year in July. Vetch (*Vicia sativa*) and rye (*Secale cereale*) mulched down in April. Mechanical weed cleaning from April to July.
2: Perennial white clover (*Trifolium repens*) and rye grass (*Lolium perenne*) mulched.
3: Perennial white clover (*Trifolium repens*) and rye grass (*Lolium perenne*), 50-kg total nitrogen added in spring using slurry.
4: Perennial white clover (*Trifolium repens*) and rye grass (*Lolium perenne*).

No further supply of fertiliser was given.

The soil treatments were established as randomised blocks with four replicates.

The plot size was 3.5 x 15 m and each plot contained 25 bushes.

Leaf samples were taken every year in July to assess nutrient content. 50 leaves per plot without petioles were selected randomly. The leaves were dried at 80°C and analysed for total nitrogen, potassium and magnesium.

Soil samples to investigate nitrate content in the soil water were taken in April, May and November 1997-1999. 10 subsamples per plot were taken and divided in the following depths: 0-50 cm, 50-100 cm and 100-150 cm.

During establishment annual shoot growth was measured in winter of 1997 and 1998. Minirhizotrons, glass tubes of 1.5 m length, were established in each plot direct in the bush row and 0.5 m, 1.0 m and 1.5 m from the centre of the bush row, respectively. Root growth was assessed using mini video camera in spring, early summer, late summer and late autumn 1997-1999. Root growth is determined as deepest root at the actual dates of assessment.

Soil moisture percent in the 50 cm topsoil was measured in the bush row and in the centre of the alleyway weekly in the summer and autumn 1999, repeated twice in each plot. Equipment used was a 'Trase' system that measured soil moisture by time domain reflectometry (TDR). Yield and berry size from each plot were recorded after mechanical harvest in 1999 and 2000.

Attacks of diseases and pests were assessed on a scale of 1= no attack and 9 = severe attack on five bushes in each plot in June, just before harvest and in September each year.

RESULTS AND DISCUSSION

Nitrogen

During establishment all four cover crops gave a sufficient nitrogen supply, with the supply from the annual sown cover crop being lowest. In 2000 the general level was below the optimum value for all treatments (Fig. 1). The leaf samples showed no significant differences between the soil treatments for the supply of phosphorus, potassium and magnesium (Data not shown). Lindhard (1997) found that alleyway cover crops did not compete for nutrients in established black currants.

The level of nitrogen in the soil was lowest in the annual sown cover crop. The annual shoot growth in 1998 was most reduced in plants grown in the annual sown cover crop except for the variety 'Titania' (Data not shown).

Roots

Minirhizotrons were used to follow blackcurrant root growth in total mechanical cleaned plots and plots with cover crops. It was not possible to distinguish between blackcurrant roots and roots of cover crops. The maximum measurable blackcurrant root depth of 125 cm was obtained directly under the bushes in autumn 1998, whereas roots only were present down to 40 cm 1.5 meters from the centre of the row (Fig. 2). The variety 'Titania' had a deeper root system than 'Ben Lomond'. More roots were found half a meter from the centre of the bush in 75 to 125 cm depths (Fig. 2).

Black currants grown in bare soil have a smaller root system than bushes grown in mulched soil, which does not necessarily mean a better survival of the plant (Larsson 1997).

Soil Water

The water content, in the upper 50 cm of the soil in the bush row was highest in the soil with the annual sown cover crop (treatment 1) and the mulched white clover/rye grass (Treatment 2) alleyways in the summer of 1999 (Fig. 3). Larson (1997) also found that covering the soil with different materials enlarged the soil moisture in blackcurrants and Lindhard Pedersen (1997) also showed a tendency towards a higher soil water content in the bush row with a vegetation free alleyway.

Yield and Diseases

There were no significant yield differences among the soil treatments (Table 2). 'Titania' had, however, a tendency to a higher yield in 2000 in the annual sown cover crop, probably due to the deeper root pattern of 'Titania' and thereby less susceptibility to root damage from mechanical weeding. 'Titania' had the highest yield in the two cropping years 1999 and 2000 (Table 1), whereas 'Ben Lomond' had very low yields due to severe infections of American gooseberry mildew *(Sphaerotheca mors-uvae)* (Table 3) causing very little shoot growth. 'Farleigh' was susceptible to white pine blister rust (*Cronartium ribicola*) and infections of leaf spot (*Gloeosporidiella ribis*) that occurred every year and caused severe leaf drop in September. 'Titania' and 'Intercontinental' had the best overall field resistance to diseases (Table 3). This was also found by Lindhard Pedersen (1998a, 1998 b).

The soil treatments did not affect the level of diseases in the bushes; this agrees with the finding of Lindhard Pedersen (1997).

CONCLUSION

The four cover crops gave a sufficient nitrogen supply during establishment. The blackcurrant variety 'Titania' had a deeper root pattern than 'Ben Lomond'. There were no significant yield differences among the soil treatments, but large differences were found between the varieties. 'Titania' had the highest yield. 'Titania' and 'Intercontinental' had the best field resistance to diseases.

Literature Cited

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Tables

Table 1. Yield (Tons/ha) and berry size (g/100g) for 5 blackcurrant varieties average of 4 soil treatments in 1999 and 2000.

Variety	Yield 1999	Yield 2000	Berry size 1999	Berry size 2000
Ben alder	2.06 b	1.77 d	56 d	64 c
	1.81 b	3.55 b	72 c	67 c
Intercontinental	3.57 a	2.36 c	143 a	117 a
Titania	3.80 a	4.27 a	91 b	90 b

Values followed by the same letter for the same variety in column do not differ significantly at $p<0.05$.

Table 2. Yield (Tons/ha) and berry size (g/100g) for 5 blackcurrant treatments average of 5 varieties in 1999 and 2000.

Variety	Yield 1999	Yield 2000	Berry size 1999	Berry size 2000
Annual	2.14 a	2.93 a	79 a	79 a
Clover grass mulched	2.11 a	2.53 a	80 a	79 a
Clover grass + slurry				
Clover grass				

Values followed by the same letter for the same variety in column do not differ significantly at $p<0.05$.

Table 3. Susceptibility (rated on a scale 1-9, 1=no damage) of American gooseberry mildew, leaf spot and White-pine blister rust for 5 varieties and 3 years.

	Mildew in July			Leaf spot in September			Blister rust in September		
Variety	1998	1999	2000	1998	1999	2000	1998	1999	2000
Ben Alder	3.0 b	2.0 b	1.5 a	9.8 a	8.6 a	8.8 a	1.5 b	3.7 b	1.2 c
Ben Lomond	5.2 a	4.4 b	3.5 b	8.6 b	6.3 b	8.6 a	1.3 bc	3.0 c	2.0 b
Farleigh	2.2 c	2.0 b	1.0 a	8.4 d	2.4 d	8.1 b	4.0 a	8.8 a	5.9 a
Intercontinental	2.2 c	2.5 c	1.0 a	7.6 d	7.1 b	8.5 a	1.0 c	2.2 d	1.0 c
Titania	1.9 d	1.1 d	1.0 a	8.1 c	6.4 b	5.9 c	1.0 c	1.2 e	1.0 c

Values followed by the same letter in column do not differ significantly at $p<0.05$.

Figures

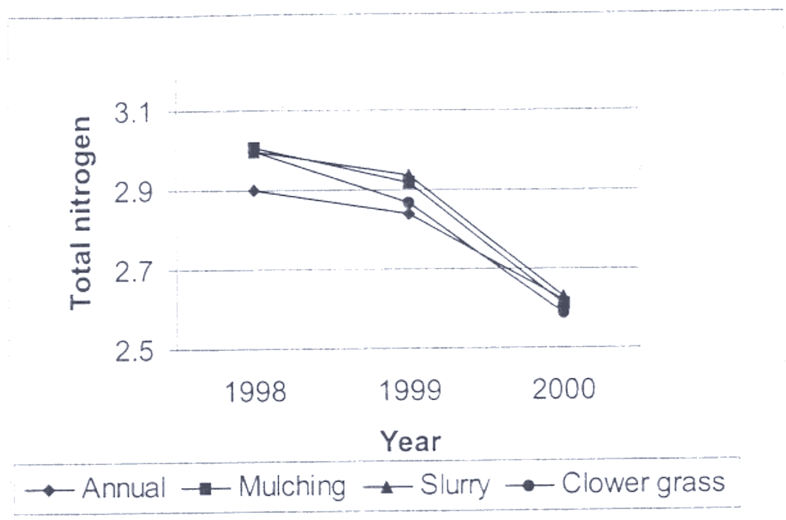
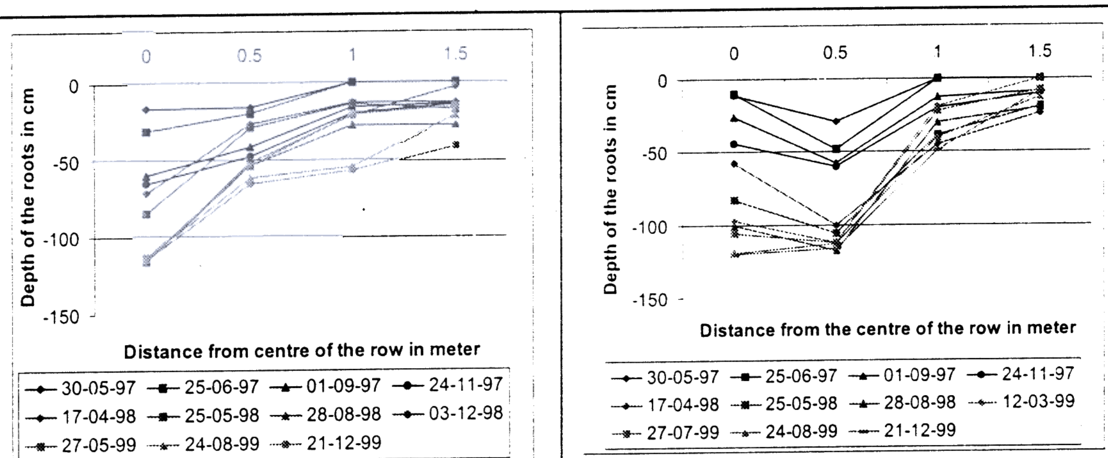


Fig. 1. Nitrogen content in the leaves in percent of dry matter. Optimum level is 2.7-3.2 pct.



Variety: Ben Lomond

Variety: Titania

Fig 2. Root growth was assessed for two varieties as deepest root at the actual dates 1997-1999 at 4 distances from the centre of the row. Total mechanical weeded soil surface.

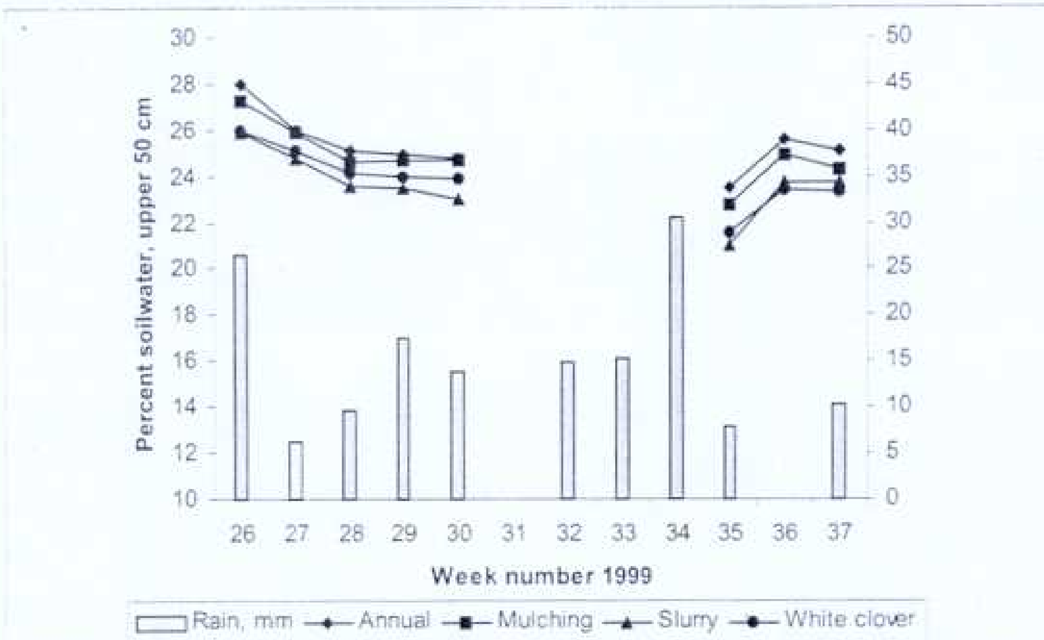


Fig. 3. Percent soil water in the upper 50 cm of the soil in 1999 and mm precipitation.