Organic Forage Seed Production in Denmark

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Introduction

Organic plant production must be based on organically produced seed, however, if not available, a dispensation allows the farmer in EU to use conventionally grown seed. This dispensation is valid until 31st December 2003 and unless the dispensation is prolonged, only organically produced seed can be used in organic farming systems within the EU as from January 2004. Forage production for ruminants is based on grass and clover mixtures, but currently the supply of organic forage seed in Europe is scarce. A mixture of grass and clover species is only considered organic when each constituent is organically produced.

In Denmark 3.5 per cent of the arable land is converted to organic production and 2.7 per cent is under conversion. The majority of the organic farms are specialised in milk-production and at those farms an adequate supply of animal manure is normally available. Milk-production is predominant in Western Denmark, whereas the majority of farms in Eastern Denmark, at the richer soils, rely on arable production. Recently, an increasing proportion of those is converting to organic farming. The majority of the organic, arable farms have no access to animal manure, and therefore one of the main obstacles for organic grass seed production here, is nitrogen supply.

Since 1998 experiments in optimising management techniques in organic grass and clover seed production have been performed at the Danish Institute of Agricultural Sciences. The main objectives are

Establishment
enhancement of seed crop competitiveness against weeds enabling mechanical weed control with minor crop damage

Mixed cropping
intercropping with green manure crops

Pests
cultivation techniques reducing *Apion* damage in clover
alternative management techniques increasing seed yield

Utilisation of by-products
control of excessive clover and grass growth by sheep grazing

Materials and methods

An organic crop rotation was established in 1996/97 at The Danish Institute of Agricultural Sciences, Research Centre Flakkebjerg. Organic seed production trials were established in this rotation in 1998 and additionally registrations and plant samples are collected in organic seed grower fields.

Preliminary results

Establishment

To obtain high seed yields, grass and clover seed crops must be established at relative low plant densities. At the other hand: Optimal competitiveness against weeds is achieved when the crop develops fast, to reach as high a ground cover as possible.

In field trials we have tested establishment of perennial ryegrass (*Lolium perenne* L.) in and between rows of spring barley, cover crop. Our experiments have shown, that the undersown perennial ryegrass has a better establishment (higher biomass production, more tillers) when sown between barley rows compared to sowing in the same row, however, in the consecutive seed production year, no difference in seed yield was recorded between the two establishment techniques. When sown between the cover crop rows ground cover by crops were higher and therefore competition against weeds are enhanced. Management guidelines are summarised in table 1. Grass species with a low seed weight such as red fescue (*Festuca rubra* L.) and smooth stalked meadow grass (*Poa pratensis* L.) may not establish successfully when sown in the cover crop row.

Mixed cropping

One of the most essential problems in organic grass seed production on arable farms in Eastern Denmark is inadequate nutrient supply - especially nitrogen. Besides the nitrogen amount, seed crops are also very sensitive to the timing of nitrogen application. Correct timing will stimulate reproductive development whereas excessive and poorly timed nitrogen application will be in favour of vegetative growth. If a nitrogen-fixating precrop provides nutrients, the grass seed crop will take up nitrogen as soon as it is mineralised which will most likely lead to excessive vegetative growth. Mixed cropping of a grass seed and a green manure crop provides an option on timing the nitrogen release.
Perennial ryegrass seed crops are established at wide row spacing, 24 cm to allow for a companion crop of green manure. A number of green manure crops are tested (table 2).

Table 1. Management guidelines for establishment of organic grass seed crops.

Field situation	Optimal establishment technique
low weed number **and** weed species with seeds, that can easily be separated from the grass- or clover seed	the grass seed crop should be established between cover crop rows to obtain maximal ground cover by the two crops / no mechanical weed control
high weed number **or** weed species with seeds, that can are difficult to separate from the grass or clover seed	the grass seed crop should be established in the row of the cover crop to allow for mechanical weed control between rows

Table 2. Green manure crops established in perennial ryegrass for seed.

White clover	*Trifolium repens* L.
Alsike clover	*Trifolium hybridum* L.
Red clover	*Trifolium pratense* L.
Persian clover	*Trifolium resupinatum* L.
Bird's foot trefoil	*Lotus corniculatus* L.
Black medick	*Medicago lupulina* L.
Berseem clover	*Trifolium alexandrinum* L.

In the establishment year some indication was seen that persian, alsike and red clover developed strongly, which might hinder a successful harvest of the cover crop in wet years. The green manure crops were cut (approximately 1 cm below ground level) to eliminate competition against the seed crop and to stimulate nitrogen release at the onset of spring growth in the seed production year. However, the cutting was not sufficient to prevent white clover, alsike and red clover developing to vigorously. The persian and berseem clover had not survived the Danish winter and bird's foot trefoil and black medick was cut back satisfactory.

Seed yields of perennial ryegrass showed no difference between **treatment a**: 25 kg N ha^{-1} + mixed cropping with persian clover, bird's foot trefoil or black medick and **treatment b**: 100 kg N ha^{-1} to perennial ryegrass grown in pure stand.

Pests

Seed yields in organic clover has been very disappointing (averaging 100 – 200 kg ha^{-1}). Registered yields in 1998 show a 75 per cent decrease when white clover was grown organically compared to conventional production (Lund-Kristensen *et al.*, 2000). It is believed that *Apion* damage is one of the main explanations for these low yields. Investigations in a number of organic clover seed fields in 1999 have shown that *Apion* damage may account for approximately 30 per cent of yield loss varying from 5 – 65 per cent (Rohde *et al.*, 2000). However, the investigations also showed that other management techniques failed in order to obtain optimum yields especially during harvest. Now our trials are focussing on minimising *Apion* damage and optimising establishment techniques especially in organic white clover seed production.

Utilisation of by-products

Establishment of seven grass species each sown together with red clover in a spring barley cover crop (Deleuran & Boelt, 2000) has shown that high forage yields can be obtained in two cuts, despite nitrogen application rates are low. In this cropping system seed yields are obtained in the second year after establishment. However, grazing animals might be used to control additional growth of the seed crop either in autumn prior to seed harvest or in spring in the seed production year. In the project we focus on grazing time in autumn and the first results will be obtained in 2001.

Conclusion and future work

In Denmark organic forage seed production has been established since 1992 and in 2000 organic grass and clover seed were produced on nearly 1000 hectares. Production of one of the main constituents of forage mixtures, perennial ryegrass now fulfils the requirement for organic seed in Denmark in this species and seed is available for export. Of other grass species used in forage mixtures only smooth stalked meadow grass is not organically produced, however the request is rather small. Among the clovers there is now a production of organic seed of red clover that matches the demand, however another main constituent of forage mixtures, white clover is still in request. A new national project has recently been approved. A substantial part of this project is the implementation of the experimental results, which will be achieved by a number of demonstration trials. Focus for these trials will be a rapid dissemination of results, which will support the incorporation of seed crops in organic crop rotations.

References

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