



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

SF 012 (GSK229a)

Effects of perennial weeds on
weed control and fruit quality in
blackcurrant

Final 2012

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Project Number: SF 012 (GSK229a)

Project Title: Effects of perennial weeds on weed control and fruit quality in blackcurrant

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Report: Final report, 2012

Publication Date: 30/06/2012

Previous report/(s): None

Start Date: 1 February 2012

End Date: 31 December 2012

Further information

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GROWER SUMMARY

Headline

- Broadleaf dock has a more deleterious effect on fruit quality, juice Brix and pH, anthocyanin content, sugar and vitamin C content than other weed species in blackcurrant.

Background and expected deliverables

The number of herbicides approved for use in blackcurrants has diminished in recent years due to the EU review and harmonization of crop protection products. The recent loss of dichlobenil (Casoron) has had a significant effect on weed control in UK blackcurrant plantations and there has been a resulting increase in broad-leaved and perennial weeds. Docks (*Rumex* spp.), creeping thistle (*Cirsium arvense*), couch grass (*Elymus repens*) and mallows (*Malva sylvestris* & *M. neglecta*) are becoming particularly prominent.

Their presence in blackcurrant plantations can not only compete with the crop for light, water and nutrients, they can impede machine harvesting and contaminate the harvested crop. There is also concern that the yield and quality of fruit can be affected both by high levels of weed infestation and conversely, the use of traditional herbicide treatments. Since fruit quality is crucial to the juice processing industry, it is important to understand the impact of perennial weeds and herbicides on fruit quality.

This project aimed to provide clear information and a better understanding of how perennial weeds affect blackcurrant fruit yields and quality.

The objectives of the work were to:

1. Assess the impact of weed-infested plots on harvesting quality and fruit yield.
2. Correlate fruit quality factors, such as Vitamin C, sugars and organic acids with various treatments and an untreated crop.

Summary of the project and main conclusions

Four species of perennial weeds at two different infestation densities were tested for their effect on berry yield and on resulting fruit quality in well-established blackcurrant during 2012. The trial was conducted at East Adamston Farm, Muirhead, Angus, Scotland courtesy of Andrew Husband.

Six-year-old blackcurrant ('Ben Hope') was used for the trial. Existing monotypic weed populations within three adjacent blackcurrant rows were identified for this trial on 23 May. The species were:

- Broadleaf dock (*Rumex obtusifolius*);
- Couch grass (*Elymus repens*);
- Creeping thistle (*Cirsium arvense*);
- Willow-herb (*Chamerion angustifolium*).

Infestations were rated as being "low" or "high" in density by species; plots were 1 m long, centered on a single row of blackcurrant bushes. Weeds were allowed to grow in the plots until most were in late bud stage, immediately before flowering of the first stems of creeping thistle and willow-herb, at which time weeds were clipped at the soil and above-ground fresh biomass was collected and weighed (26 July). Weed-free plots were kept free of all perennial weeds until harvest. All other weed species (both perennial and annual species) were removed by hand through berry harvest.

A range of quality parameters were measured at intervals following harvest including organic acid and sugar identification and quantification, vitamin C quantification, total fruit polyphenols and total anthocyanin.

The experimental design was a randomised complete block with four replicates. Only replicates 1 to 3 were picked for yield, while all four replicates were sampled for fruit quality analysis.

Full details of fruit quality sampling are included in the Science Section of this report.

Weed species alone did not affect berry yield or size. Juice yield was better when produced with broadleaf dock than with other weed species, although these berries were also more acidic and had lower °Brix. Total polyphenol content was greater when berries were produced with creeping thistle than with either couch grass or willow-herb. Anthocyanin and sugar content was greater when berries were produced with couch grass than with broadleaf

dock or willow-herb. Vitamin C content was better in fruit grown with couch grass or willow-herb rather than broadleaf dock.

Surprisingly, weed density did not play a major role in these results. Data were therefore combined across 'low' and 'high' density for these analyses. Several measured parameters were not closely related to weed density, but most parameters tended to be negatively affected by weed competition. Although not statistically significant ($P < 0.05$), berry yield and fruit size was numerically reduced by presence of weeds, while polyphenol, anthocyanin, sugar, organic acid, and vitamin C content were also reduced. Conversely, berry number and juice yield were non-significantly increased by weed competition.

When analysed, taking into account weed species and contrasting with blackcurrants grown in the absence of these perennial weeds, several patterns emerged in the data. Again, berry yield was not affected by the combination effect of weed species and density.

Weed biomass was slightly biased toward willowherb (2.02 kg/m^2) and away from couch grass (1.03 kg/m^2), showing that willowherb was more productive in competition with blackcurrant than couch grass.

Broadleaf dock reduced °Brix and pH of blackcurrant fruit, the only weed species to do so in this analysis. Vitamin C content of fruit competing with broadleaf dock was reduced in comparison to fruit from non-weedy blackcurrant, although creeping thistle and, to a lesser extent, couch grass also reduced fruit content of vitamin C. Total polyphenol content was reduced by competition with willow-herb.

Full details of all the data collected from the quality sampling are included in the Science Section of this report.

Main conclusions

- Weed density was not a major factor in either yield or fruit quality, although the trend in the data was for negative consequences resulting from weed competition.
- Of the four perennial weed species tested, broadleaf dock caused the most negative effects in fruit quality, lowering juice °Brix and pH, and lowering anthocyanin, sugar, and vitamin C content compared to other weed species.

- Willowherb reduced polyphenol, anthocyanin, and sugar content, while couchgrass also reduced polyphenol and sugar content.
- Based on these single-year data, it appears that broadleaf dock should be the primary target for weed control efforts.

Financial benefits

Given the results of this one-year project, it is difficult to calculate the exact financial benefits of weed control in blackcurrant plantations. However, given that plantation establishment costs amount to £4,000 per hectare and plantations can take up to three years to reach full production, any delay in reaching full production, which might be caused by weed competition, will result in lost revenue in the early life of a plantation and increase the time taken to pay off the establishment costs. This work has also demonstrated that certain weed species can have a deleterious effect on fruit quality, which could have an influence on the suitability of the harvested product for its intended market, such as juice.

Actions points for growers

- Growers should aim to gain control of weeds during the establishment of blackcurrant plantations to achieve maximum yields as early in the crop life as possible.
- Particular attention should be paid to perennial weed control and especially broad-leaved dock, which can have a deleterious effect on a range of fruit quality parameters.