Final report to:	Mr J Wickham GlaxoSmithKline Wallis House Brentford Middlesex TW8 9BD (Tel. 0208 560 5151)
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Project leader:	Roger Umpelby, ADAS Rosemaund
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AUTHENTICATION

I declare that this work was undertaken either, directly by me, or under my personal supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

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1. PRACTICAL SECTION FOR GROWERS

i. Background and objectives

Black currant gall mite (big bud mite) in combination with the reversion virus is the major limiting factor in the life of most black currant plantations and, on traditional cultivars, it needs treatment every season before and after blossom. The acaricides approved for gall mite control are broad-spectrum and are very harmful to predators and other beneficial organisms. Treatments applied for gall mite control mean that black currants are one of the few fruit crops where adoption of integrated pest management has not been possible. The development and recent release of black currant cultivars resistant to either gall mite (Ben Hope) or to reversion (Ben Gairn) by SCRI gives the opportunity to reduce or eliminate chemical treatment for gall mite control thereby allowing the development of an IPM programme. The study described is part of an evaluation of the effect of reduced treatments for gall mite control on the new varieties on the incidence of pests and diseases in commercial plantations.

Two established commercial plantations of Ben Gairn and Ben Hope were monitored throughout the season for levels of pest and disease, and for the presence of beneficial organisms. At one site each variety was grown with two different alleyway types in different blocks, one block had a herbicide treated alley and the other alleyway was grassed.

The objectives of the study were:

1. to monitor the susceptibility of commercial plantations of Ben Gairn and of Ben Hope to pests and diseases
2. to evaluate the effect of alley maintenance method on pest and disease levels

ii. Results and conclusions

Ben Gairn

No active (sporulating) diseases were seen on the foliage. Some leaf distortion was seen at one site but, unlike in 2000, this could not be attributed to disease. A low level of fruit *Botrytis* was recorded

No big bud (black currant gall mite) or reversion was seen in the early season at either site. At one site black currant gall mite was recorded in the dormant season (2001-2002), but less than 1% of bushes were affected. No gall mite was seen at the other site.

Leaf midge was absent at one site, but at the other, where no Meothrin had ever been used, 100% of bushes were infested.

Significant levels of currant-sowthistle aphid were seen early in the season with treatment being justified to prevent shoot damage. Low numbers of the permanent currant aphid were recorded in July at one site.

Two-spotted spider mite developed at one site, but did not reach a damaging level.

Adult vine weevils were recorded at one site, but only caused minor damage.

Capsid damage was high at both sites, Ben Gairn seems to be particularly prone to capsid attack.

Caterpillar damage was significant at both sites. Sawfly caterpillars were commonest at one site, while tortrix moth caterpillars were dominant at the other.

Ben Hope

At one site some early season leaf spotting was recorded which initially was thought to be early disease symptoms. Further checks indicated that the spotting was a physiological problem. Leaf spot was however recorded at both sites late in the season, but damage was not extensive being limited to small lesions and little leaf fall was attributed directly to it.

No active mildew was seen at either site.

No reversion was seen.

At one site no big bud was seen at any time, but at the other site big buds were found and these were confirmed as being caused by an Eriophiid mite, probably the black currant gall mite.

Leaf midge was absent at one site, but at the other, where no Meothrin had ever been used, 100% of bushes were infested.

Damage caused by currant-sowthistle aphid was noticeable in the late Spring at both sites, but infestation was less severe than on Ben Gairn. At one site shoots were infested with the permanent currant aphid in late June and July.

Capsid was present at both sites but damage was considerably less than on Ben Gairn.

Caterpillar damage was similar to that seen on Ben Gairn at both sites with sawfly being most common at one site, and tortrix moth at the other.

The method of alley maintenance had no consistent effect on levels of pests or diseases.

The numbers and range of beneficial organisms tended to reflect the presence of different pests in the crop rather than any effect of crop structure or alleyway maintenance.

iii. Recommendations

The results over two years have shown some real differences in the susceptibility of the two varieties to pest pressure. The results from disease monitoring were less conclusive.

Now that many more crops are approaching maturity, it would be more useful to collect less detailed information from a wider range of sites.

Of particular interest will be the incidence of gall mite on Ben Hope, and of disease susceptibility and these aspects should be studied.

Caterpillars and capsids appear to be likely to increase with the reduction in use of broad-spectrum pesticides and studies on their control in an IPM programme should be undertaken as soon as practical.

2. SCIENCE SECTION

SUMMARY

Two established commercial plantations of Ben Gairn and Ben Hope were monitored throughout the season for levels of pest and disease, and for the presence of beneficial organisms.

Ben Gairn

Leaf spot was not seen at either site.
No mildew was seen and the hyper-sensitive reaction symptoms reported in 2000 were not repeated.
Botrytis was very low at both sites.
Big bud (black currant gall mite) was seen at a very low level (0.5% of bushes infested) at one site, but was not seen at the other site.
Leaf midge was absent at one site, but 100% of bushes were infested by July at the other site where no Meothrin had ever been used.
No symptoms of reversion were seen either on the flowers or foliage.
Significant levels of currant-sowthistle aphid were seen at both sites early in the summer.
Capsid damage was high at both sites and Ben Gairn appears to be particularly susceptible to damage by this pest.
Caterpillar damage was significant at both sites, but did not require treatment.

Ben Hope

Leaf spot was recorded at both sites late in the season, but caused no significant damage nor early leaf fall.
No symptoms of mildew or *Botrytis* were seen at either site.
At one site big buds infested with black currant gall mite were recorded on up to 4% of bushes.
No big buds were seen at the other site.
Leaf midge was absent at one site, but 100% of bushes were infested by July at the other site where no Meothrin had ever been used.
No reversion was seen at either site.
Currant-sowthistle aphid was present at both sites, but less damage occurred than on Ben Gairn. The permanent currant aphid was the other main species found.
Capsid damage was high at one site and moderate on the other, but was lower than on Ben Gairn.
Caterpillar damage due to tortrix moths was extensive at one site, at the other site sawfly caterpillars were most common.

In plantations where a comparison was made between alley maintenance methods, no consistent differences in pest or disease levels were detected.

INTRODUCTION

In 2000 four sites in different areas of the country where Ben Gairn and Ben Hope had been planted in 1996 or 1997, were monitored to determine levels of disease and numbers and incidence of pests and a range of beneficial invertebrates. The aim of the observations was to provide growers with younger plantations information on likely problem pests and diseases. The work reported here gives the results from the second years observations on two of the four sites.

Each site was monitored throughout the growing season, with a dormant season check for black currant gall mite.

MATERIALS AND METHODS

Sites

1. Pixley, Ledbury, Herefordshire
2. Bradford on Tone, Taunton, Somerset

Variety

Ben Gairn and Ben Hope at each site planted in the winter of 1996/7 or 1997/8. Bushes cut down in winter of 1998/9 to provide cutting material for new plantations.

Plots

Site 1
Approx 3.2 ha of Ben Gairn
Approx 3.4 ha of Ben Hope
The two plantations were immediately adjacent to each other in one field.

Site 2
Approx 0.8 ha of Ben Gairn
Approx 1.5 ha of Ben Hope
The two plantations were immediately adjacent to each other in one field and were flanked by mature Baldwin plantations.

Layout

At each site there was no replication and assessments were done in single large blocks.

At Site 1 there were 4 comparisons. For each variety, approximately half of the plantation had the conventional herbicide treatments in the alleyways, while the remainder had a well-established grass strip. The two separate parts of the plantation of each variety were assessed separately.

At Site 2 the blocks were not subdivided so the only comparison was between the varieties.

Assessments:

At each site a pre-season check was made for black currant gall mite (big buds).

At each site five detailed assessments of pests, other invertebrates and diseases were done (May to September). During these visits 25 or 50 bushes were selected at random and were assessed for disease presence and pest damage. On each selected bush a branch was beaten onto a collecting tray for insect monitoring. Additionally 50 leaves were selected at random from each block and were checked for phytophagous and beneficial insects and mites. The visit during May included a check for flower symptoms of reversion. Visual assessment of leaf quality was done at each visit, which included checks for symptoms of reversion.

In January 2002 each site was checked for big buds caused by black currant gall mite.

The pitfall trapping for predatory ground-living beetles and the tile trapping for slugs both done in 2000 was not repeated in the 2001 study.

Crop Husbandry:

Routine applications of herbicides were made overall at site 2. At site 1 herbicide application to the alley was not applied to the grassed rows. At both sites the only control measure for black currant gall mite was pre-blossom sulphur applications. Treatments were needed for aphids at both sites and at one site a single treatment on Ben Gairn was needed for capsid control.

RESULTS AND DISCUSSION

A wide range of pest, neutral and beneficial invertebrates were identified at the 2 sites during the study. The raw data from the monitoring have been summarised below on the basis of individual pest and disease. Information on beneficial and neutral invertebrates is included.

Aphids

Aphids were present at both sites. The currant-sowthistle aphid was the dominant species at both sites being present in substantial numbers causing leaf rolling and shoot damage. At both sites the percentage of bushes attacked by the currant-sowthistle aphid was highest on Ben Gairn, as an example at one site 6% of bushes of Ben Hope were infested in June compared to 26% of Ben Gairn. The level of damage in 2001 was lower than in 2000, but in both years most damage occurred on Ben Gairn. The permanent currant aphid was recorded at both sites in July and was more extensive on Ben Hope. Low numbers of the currant-lettuce aphid were seen at both sites.

Although currant-sowthistle aphid numbers over the two years may appear to indicate that Ben Hope and Ben Gairn are particularly susceptible to this species, it should be noted that in both seasons this aphid species was common, widespread and damaging on many plantations of other cultivars.

Capsids

As in 2000, capsids were recorded at both sites with Ben Gairn suffering more damage than Ben Hope, although the differences were less than in 2000. At one site the overall capsid damage was less than in 2000, but at the other 100% of bushes of Ben Gairn were damaged in

May. The main species found during bush beating was the common green capsid but, as in 2000, some European tarnished plant bug were found. The results in 2001 confirm that, in the absence of broad-spectrum insecticides, capsids can be expected to become a major pest of black currants and are likely to require specific treatment for control. Work needs to be undertaken to identify control measures which are compatible with an IPM strategy.

Caterpillars

Caterpillars were recorded at both sites involving several different species. At one site the main problem was caused by tortrix moth caterpillars, although currant pug moth caterpillar numbers increased later in the season. At the other site sawfly caterpillars were the dominant type with damage occurring throughout the season and right into August, but tortrix and currant pug moth caterpillars were also recorded. Experience on hops has shown that once broad-spectrum foliar sprays are omitted, populations of the currant pug moth increase steadily and, after several seasons, can reach economically damaging levels. In 2000 Ben Gairn and Ben Hope were equally affected by caterpillar, but in 2001 more damage was seen on Ben Hope early in the season, but there was little difference in damage levels later in the season. Like capsids, caterpillar problems are likely to increase under an IPM regime, but naturally-occurring parasites and predators of caterpillars are more likely to build-up and a natural balance should ultimately develop reducing the need for insecticide usage. Despite this IPM compatible insecticides for caterpillar control need to be identified.

Gall mite

At one site no black currant gall mite infested buds were seen on either cultivar.

At the other site no gall mite was seen on Ben Gairn at the start on the season, but a very low level (0.5% of bushes infested) was recorded in January 2002. At this same site gall mite had been recorded on Ben Hope in the dormant season of 2000/2001 and an assessment in January 2002 showed more galled buds. The level of infestation was very low on each infested bush, only one or two galled buds per bush, but the infestation was widespread but scattered throughout the plantation with approximately 4% of inspected bushes being infested. During the check for gall mite in winter 2000/2001, a number of infested bushes were marked and these were re-checked in January 2002. None of the bushes marked in winter 2000/2001 had galled buds present in January 2002, nor had any of the immediately adjacent bushes. This indicates that the mites were not thriving on the cultivar, although it was obvious that the mites at this site could survive on Ben Hope despite its genetic resistance to the pest. The Ben Hope was adjacent to a plantation of Baldwin which was heavily infested with gall mite and, given the distribution of the infestation seen in 2002 and the lack of carry-over on previously infested bushes, the 2002 infestation had probably come from the Baldwin, rather than spreading within the Ben Hope.

Leaf midge

At one site, where no Meothrin had been applied to the Ben Gairn and Ben Hope since planting in 1997, no leaf midge damage was on the inspected bushes.

At the other site, where Meothrin had never been used on the farm, leaf midge damage was present from early May right through into July. The number of bushes damaged was initially highest on Ben Hope, with 28% of bushes damaged in mid May, compared to only 6% of Ben Gairn. By late June 100% of Ben Hope bushes were damaged, but only 86% of Ben Gairn. By mid July 100% of bushes in both cultivars were damaged and overall the early season variations were likely to be of no economic consequence.

Scale insect
There were no records of scale insect in 2001.

Two-spotted spider mite
No spider mites were found at one site.

At the other site low levels of spider mite were recorded in parts the plantations of both cultivars from early July. Initially the infestation was only present in Ben Gairn, but later was recorded in Ben Hope although the pest was more widespread in Ben Gairn, but this could be pure chance as the pest is notoriously patchy in its distribution. The number of mites per leaf was low, initially less than 10, and although numbers increased after picking no significant leaf damage occurred, none of the typical bronzed patches of bushes appeared and no leaf fall was seen. Damage was restricted mainly to lower leaves and the very wet summer certainly helped slow the population increase. As no specific Phytoseid mite predators were seen in the plantation, the population may increase substantially in 2002, although one less common predatory mite was found (see below under 'beneficial insects and mites').

Vine weevil
At one site no vine weevil adults were seen, but a very low level of leaf notching was noted in August which was probably caused by vine weevil. Both varieties were equally affected.

At the other site vine weevil numbers were sufficiently high that adult weevils were being caught in the beating trays. Vine weevil adults are normally nocturnal, retreating to ground level in the day and it is only when numbers start to rise that they are usually recorded during beating. In the parts of the plantation where adults were caught some feeding damage could be seen on the young leaves, but overall at a low level. As with spider mite, vine weevil distribution is often very patchy and there were no consistent differences in the numbers found or the damage seen between the two cultivars.

Vine weevil numbers were higher at both sites than in 2000.

Other pests
A number of other phytophagous invertebrates were recorded including leafhoppers, froghoppers, shield bugs and crickets. Although these are plant feeders most are unlikely to ever be regarded as sufficiently damaging to consider treatment. The one possible exception is leafhopper which is now regarded as a minor pest on some other fruit crops and treatments are occasionally needed for its control. Leafhopper populations tend to build up steadily under IPM as pesticide use is reduced.

Beneficial insects and mites
As in the 2000 study a wide range of beneficials was recorded at each site. Spiders were the most common predators, but parasitic wasps (aphid and caterpillar parasites), anthocorids (aphid predators) and ladybirds were found regularly.

Predator and parasite numbers were much higher where pest numbers, particularly aphids, were highest. Hoverfly and lacewing larvae were much less common than in 2000, mainly being found in association with currant-sowthistle aphid infestations. Where the permanent currant aphid was found, the colonies were all attended by ants, which protect the aphids from predators and parasites. In these colonies some parasitised aphids were seen, but few predators. Some general predators such as soldier beetles and predatory capsids were found, with soldier beetle numbers being very high in July. Low numbers of rove beetles

(Staphylinidae) were found on the foliage during beating, these beetle are normally ground dwellers but will seek prey on the aerial parts of plants. Inspection of the leaves showed heavy aphid parasitism at all sites.

At one site the predatory mite *Anystis agilis* was seen on most bushes. This mite is a predator of two-spotted spider mite, but being more polyphagous is not normally regarded as being such an effective spider mite predator as *Typhlodromus pyri* or some of the *Amblyseius* spp.

Earwigs were present at both sites, and although a contaminant of the harvested crop, they are effective predators and feed on a wide range of pest species.

Neutral invertebrates

A range of neutral invertebrates was recorded, with Psocids (bark or book lice) being most common. A number of other scavenger species were found but at very low numbers. Neutral invertebrates can be quite useful in providing an alternative food source for predators.

Mildew

No active mildew was seen at either site in 2001. In 2000 extensive symptoms typical of a plant's hyper-sensitive reaction to disease, leaf discolouration and distortion, was seen on Ben Gairn at one site following a period of warm dry weather (ideal for mildew development). These symptoms were not seen again in 2001 although some leaf distortion, but without the discolouration, was seen in July in the same crop.

Leaf Spot

Early in the season some speckling of Ben Hope leaves was seen at both sites and it was thought this could develop into leaf spot. However these symptoms were transient and no sporulation occurred which indicates that the symptoms were probably physiological. In late August some leaf spotting developed on Ben Hope at one site and this progressed steadily affecting all leaves. The symptoms were similar to those seen in 2000 being a peppering effect of small and discrete spots. These symptoms were caused by leaf spot, but very little leaf fall could be attributed to the disease until late autumn. At the other site similar symptoms of leaf spot appeared later on Ben Hope. Although at this site leaf fall was more extensive, the foliage was already extremely yellow and natural senescence was probably the major factor in the leaf fall.

No leaf spot was seen on Ben Gairn.

Botrytis

Botrytis was seen on Ben Gairn at both sites at very low levels. The disease was not present until just before picking, when some fruit was becoming slightly over-ripe in very damp weather.

Reversion

Reversion was not seen at either site on either variety despite the Ben Hope being immediately adjacent to a plantation containing high levels of gall mite and reversion.

Effect of alley maintenance on pest and disease levels

At the one site where two different alley maintenance methods were used it was not possible to identify any consistent differences in pest or disease levels between the two systems.

CONCLUSIONS

Over the two years observation both Ben Gairn and Ben Hope demonstrated low susceptibility to foliage diseases. Leaf spot incidence on Ben Gairn was very low but Ben Hope appeared to be much more susceptible. Leaf spot was far less damaging on Ben Hope than on other established cultivars such as Ben Lomond and Ben Tirran.

Ben Hope is not completely resistant to black currant gall mite, although the pest did not appear to thrive on the cultivar. There may well be different genetic races of the mite in different areas of the country.

Both varieties were susceptible to other recognised common pests of black currants, but Ben Gairn appears to be particularly susceptible to capsid and currant-sowthistle aphid damage.

RECOMMENDATIONS

It is recommended that the study should not be repeated in 2002, but that more field monitoring of more recently planted crops should be done on a wider scale.

Research efforts should be targeted at identifying IPM-compatible control measures for capsid and caterpillar.

Studies should be started to check the genetic variability of field populations of black currant gall mite.

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