Project title:	Blackcurrants: Assessment and ranking of new varieties with respect to their winter chill requirement
Project number:	SF 012 (GSK225)
Project leader:	John Atwood, ADAS UK Ltd
Report:	Annual report, August 2011
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Key staff:	John Atwood, Project leader Carl Wardell, Scientific officer
Location of project:	The Moat, Newent, Glos. and ADAS Rosemaund
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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Signature  Date 9 September 2011

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GROWER SUMMARY

Headline

The majority of new blackcurrant cultivars tested had relatively modest winter chill requirements; however cultivars 9443-3 and 8962-1 required more chilling than Ben Tirran, so may not be suitable for UK conditions in the long term.

Background

As with many temperate zone plants, blackcurrants have defined winter chill requirements which vary with cultivar. If these requirements are not met, bud break is misaligned leading to non-uniform growth, poor yields and uneven ripening. With climatic conditions becoming more variable it is important to critically assess the chilling response of potential new blackcurrant cultivars in order to determine their suitability for locations where lower levels of winter chill might be experienced.

Summary

Un-forked branches with at least 13 buds on one year old extension growth from each cultivar were cut twice weekly from January to March 2011 and kept at 20^{o}C for 21 days. Branches were assessed using 75% bud break as the criteria for the chill requirement having been met. The chill requirement was defined as the total number of hours below 7^{o}C recorded from 7 October 2010 to the cutting date by which sufficient chilling had been received. Results are summarised in Table 1.

Table 1. Chill unit requirements (total number of hours <7°C for 75% bud break) for blackcurrant cultivars from the Newent trial site

Cultivar	Date sufficient chill received for 75% bud break	Chill units (total number of hours <7°C from 1/10/10)
92105-13	05-Jan	1447
9265-6	05-Jan	1447
95141-3	07-Jan	1495
91153-1	07-Jan	1495
9559-6	11-Jan	1581
9521-2	11-Jan	1581
Ben Gairn	11-Jan	1581
9154-4	14-Jan	1581
Ben Starav	14-Jan	1581
9260-20	17-Jan	1595
92127-1	17-Jan	1595
Ben Hope	20-Jan	1662
9453-1	20-Jan	1662
Ben Vane	24-Jan	1755
9253-1	04-Feb	1968
Ben Tirran	04-Feb	1968
9443-3	14-Feb	2024
8962-1	10-Mar	2445

The results are encouraging in that the majority of cultivars tested had relatively modest chill requirements which were similar to commercial cultivars Ben Gairn, Ben Starav and Ben Hope which normally receive sufficient cold during the winter period in the UK to render the crop competent to produce maximum yields during the subsequent growing season. Cultivars 9443-3 and 8962-1 however had high chill requirements, greater than Ben Tirran, so might not be suitable for UK conditions if milder winters were to be more common. These cultivars have not performed well in agronomic trials so should not be taken forward for release. Cultivar 9253-1 however has performed well in agronomic trials but appears to have a higher chill requirement than average. This should be taken into account when considering this cultivar's suitability for general release.

Five standard cultivars Ben Gairn, Ben Hope, Ben Starav, Ben Vane and Ben Tirran included in the current study were common to a previous chill requirement project (Atwood 2004). Whilst the ranking of cultivars was exactly the same in both studies the estimated chill requirements varied within 150 units for the lower requirement cultivars Ben Gairn, Ben

Hope and Ben Starav. Chill requirements in 2011 were however less by 364 and 360 hours for Ben Vane and Ben Tirran respectively. This could be because the chill units in 2010-11 were at much lower temperature than in 2003 or 2004. It is thought that the higher requirement cultivars respond proportionately greater to temperatures lower than 7^{o}C (Jones & Brennan 2009). The simple 7^{o}C model used in this study may not fit these cultivars' response exactly but provides a guide. The chill requirement of Ben Vane is thought to be complex and may be similar to cultivars such as 'Andega' where excessive chilling can be inhibitory to budbreak (Jones & Brennan 2009). In practice Ben Vane performs better in the field under low chill conditions than would appear from the model prediction.

Financial Benefits

It is important that the cultivars selected for release are adapted for UK climatic conditions, now and in the future. The effect of planting a cultivar with insufficient adaption is that yields can be reduced by around 2/3rd and quality is affected by uneven ripening. Taking a typical full yield of 4 t/ha, the cost yield reduction could be around £1700 / ha.

Action Points

- Cultivars 92105-13 and 9265-6, followed by 95141-3 and 91153-1 had the lowest chill requirements. These cultivars would be the most suitable for sites characterized as experiencing mild winters.
- Cultivars 9443-3 and 8962-1 had high chill requirements and may not be suitable for UK conditions if milder winters become more prevalent
- Cultivar 9253-1 had a moderately high chill requirement; this variety has good agronomic characteristics but may not be suitable for milder parts of the UK.

SCIENCE SECTION

Introduction

The need for plants to experience a period of cold is well established (Jones & Brennan 2009). Although the 2010/11 and 2009/10 winters were cold, prior to 2009 a number of winters were experienced where the amount of cold experienced by blackcurrant cultivars was inadequate, leading to delayed and uneven bud break, with consequent adverse effects on yield and quality.

With climatic conditions becoming more variable it is important to critically assess the chilling response of potential new cultivars in order to determine their suitability for locations where lower levels of winter chill might be experienced.

Materials and methods

Method

The procedure adopted was similar to that employed by Lantin (1973, 1977). From early January, twice weekly, two randomly selected branches were cut at the base from bushes of each plant in the Newent cultivar trial. Care was taken to ensure that mature branches were selected with both two year old and one year old extension growth. The extension growth was selected to have at least 13 buds. Branches arising from previous years side pruning or laterals from the base of a branch were not used where possible. In a few cases where the rows were short or the growth poor, only one branch was selected to ensure there was sufficient wood available.

Following cutting, branches were labeled with date and code and placed in a warm (20˚C) insulated room at ADAS Rosemaund in plastic flower buckets with sufficient water to cover the base of the shoot.

Assessments

After 21 days branches were examined and the top three and following 10 buds were recorded as broken or not. The definition of bud break being growth stage B1 (a distinctive

appearance of green that can clearly be identified as a potential leaf). The total number of buds broken was recorded.

Experiment design

The cultivar trial consists of single non-replicated rows of individual cultivars. Because of the limited replication possible in this trial data presented are the mean of paired excised shoots (where possible, see material and methods) at every observation for each cultivar.

Results

Budbreak

The full records of bud break after 21 days are shown in Appendix 1. Using this data a ranking has been drawn up for all cultivars in the trial to show the first cutting date for which sufficient chilling had been received to give an average of >75% of buds breaking for two consecutive cutting dates (Table 2).

Observations of the branches over the period showed that in most cases the 75% target bud break date was clear-cut, with subsequent cutting dates giving similar or more bud break.

Table 2. Chill unit requirements for the blackcurrants cultivars from the Newent trial site

Cultivar	Date sufficient chill received for 75% bud break	Chill units (total number of hours <7^{o}C from 7/10/10)
92105-13	05-Jan	1447
9265-6	05-Jan	1447
95141-3	07-Jan	1495
91153-1	07-Jan	1495
9559-6	11-Jan	1581
9521-2	11-Jan	1581
Ben Gairn	11-Jan	1581
9154-4	14-Jan	1581
Ben Starav	14-Jan	1581
9260-20	17-Jan	1595
92127-1	17-Jan	1595
Ben Hope	20-Jan	1662
9453-1	20-Jan	1662
Ben Vane	24-Jan	1755
9253-1	04-Feb	1968
Ben Tirran	04-Feb	1968
9443-3	14-Feb	2024
8962-1	10-Mar	2445

Discussion

The last Lantin study was completed in 2003 and 2004 (Atwood 2004). The 2010-11 winter was much colder than that experienced in 2002-3 and 2003-4 with around 250 more chill units accumulated at the middle of January. At the onset of the trial 1,447 chill units had been accumulated already so it is possible that the cultivars with the lowest requirement (92105-13 and 9265-6) had a lower requirement than 1,447 units.

Cultivars with a similar or lower requirement to Ben Hope should normally be satisfied given current climatic conditions in the UK. Fortunately the majority of the cultivars tested had a lower or similar requirement to Ben Hope. The cultivars Ben Vane, 9253-1, Ben Tirran, 9443-3 and 8962-1 all had higher requirements. Previous studies (Atwood 2004) showed that Ben Vane possibly has a complex chill requirement with a low initial requirement that can be delayed if further chilling is experienced. This phenomenon was also reported for the cultivar 'Andega' where excessive chilling can be inhibitory to budbreak (Jones & Brennan 2009). Ben Tirran is known to have a relatively high requirement and 9443-3 and 8962-1 had higher chill requirements than Ben Tirran. These cultivars may not be suitable for general release.

The 2003 and 2004 studies contained a few standard cultivars common to the 2011 study. These were Ben Garn, Ben Hope, Ben Starav, Ben Vane and Ben Tirran. Whilst the ranking of cultivars was exactly the same in both studies the estimated chill requirements varied within 150 units for the lower requirement cultivars Ben Garn, Ben Hope and Ben Starav. Chill requirements in 2011 were however less by 364 and 360 hours for Ben Vane and Ben Tirran respectively. This could be because the chill units in 2010-11 were at much lower temperatures than in 2003 or 2004. It is thought that the higher requirement cultivars respond proportionately greater to temperatures lower than 7^{o}C (Jones & Brennan 2009).

Conclusions

The majority of new cultivars tested had relatively low chilling requirements, making them suitable for the normal range of climatic conditions in the UK.

Two new cultivars 9443-3 and 8962-1 however had higher chill requirements than Ben Tirran, making them unsuitable for general release in the UK. Both have also performed poorly in other agronomic aspects (Atwood 2011). 9253-1 has good agronomic qualities but has a relatively high chill requirement. This should be taken into account when considering this cultivar for commercial release as it may be unsuitable for use in areas where winters are milder.

Knowledge and Technology Transfer

No knowledge or technology transfer activities were carried out during this project.

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Lantin, B. (1973). The chilling requirements of the buds of blackcurrant (*Ribes nigrum*) and of some redcurrants (*Ribes* sp.). Ann. Amél. Plantes 23: 27-44.

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Appendix 1. Bud break data (number of buds at bud burst – buds 1-3 and 4-13 from tip – 1-2 samples per date)

		Date cut																																											
Row	Variety	05-Jan		07-Jan		11-Jan		14-Jan		17-Jan		20-Jan		24-Jan		27-Jan		31-Jan		04-Feb		07-Feb		10-Feb		14-Feb		17-Feb		21-Feb		24-Feb		28-Feb		04-Mar		07-Mar		10-Mar		15-Mar		18-Mar		20-Mar	
1	Ben Gairn	3	3	2	2	3	3	3	2	3	3	3	2	3	3																																
		9	9	8	7	7	8	9	7	9	10	9	10	10	10																																
2	Ben Hope	3	0	2	1	0	1	3	3	3	3	3	3	2	2	2	3	2	3	3	3	2	2	3	3																						
		8	1	7	7	7	8	7	9	6	4	9	10	9	10	8	8	9	7	10	9	9	8	9	10																						
3	9154-4	1	2	2	3	1		2		3		2		3		2																															
		7	9	6	10	7		8		8		9		10		10																															
4	9253-1	3	2	2	2	3	3	2	2	3	2	2	3	2	3	2	3	3	1	3	3	2	2	2	2	3	3	3	3	3	2	3	3														
		1	2	2	3	4	4	2	7	3	5	1	4	6	8	3	7	8	7	9	7	8	9	7	8	9	7	8	10	10	8	8	9														
5	8962-1	2	1	1	0	3	2	3	3	1	2	1	2	1	2	2	3	1	1	2	3	3	3	1	1	3	2	2	3	2	3	3	3	3	2	0	0	3	3	3	3	3	3	3	3	3	3
		3	3	4	1	2	4	9	2	1	4	0	0	1	0	3	7	4	7	8	3	7	8	2	4	3	1	2	7	2	4	4	10	8	6	0	0	7	8	9	10	10	10	3	8	9	9
6	92105-13	3	3	3	3	2	2	3	3	3	3	2	2	3	3																																
		6	9	9	6	6	7	9	10	7	9	8	10	10	10																																
7	9260-20	3	2	1	3	2	3	1	3	3	1	3	3	3	3	2	2	3	3	3	3	3	3																								
		4	5	5	7	9	5	0	6	9	9	9	9	10	9	10	3	7	10	9	10	10	9																								
8	9265-6	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3																														
		7	9	10	10	10	10	9	10	10	10	10	10	10	10	10	10																														
9	92127-1	1	1	3	3	2	3	3	3	3	3	3	3	3	3	0	0	3	3	3	3	3	3	3	3																						
		3	1	9	4	3	8	7	3	7	8	8	10	9	10	0	2	10	9	9	8	10	10	10	10																						
10	Ben Tirran	1	0	1	3	3	3	2	3	3	3	2	2	1	2	0	0	0	0	3	2	2	3	1	2	3	1	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3				
		2	3	8	8	6	6	7	8	4	7	7	4	7	5	0	0	0	0	7	7	6	7	7	7	7	8	7	9	7	10	9	9	8	10	9	9	8	10	8	9	8	10				
11	Ben Starav	1	3	3	2	2		3		3		3		2		0		3		3																											
		5	5	8	7	7		9		10		9		9		0		10		9																											
12	Ben Vane	3	2	3	2	3	2	3	2	3	2	3	1	3	2	1	3																														
		7	5	6	10	4	4	8	4	4	6	8	3	9	8	9	10																														
13	9559-6	1	1	1	2	3	1	2	3	3	2	3	0	3	2	1	1	3	3																												
		7	7	6	10	9	8	8	9	10	9	9	0	10	10	9	10	10	10																												
14	9521-2	1	2	1	1	3	3	2	3	3	3	3	3	2	3	3	3	3	3																												
		9	4	8	6	10	10	9	10	10	8	10	10	8	10	10	9	10	10																												
15	9453-1	2	2	2	2	2	2	2	3	3	3	3	3	3	3																																
		9	8	5	8	10	10	5	7	7	6	8	8	10	8																																
16	95141-3	2	3	2	3	2	2	3	3	2	3	3	3	2	3	3	3																														
		2	6	9	8	8	9	10	6	7	10	5	9	8	9	10	8																														
17	91153-1	2	1	3	3	3	2	0	3	3	3	3	3	3	2	2	3																														
		7	7	10	7	8	8	4	8	7	8	10	8	6	3	7	6																														
18	9443-3	1	2	2	1	2	2	2	3	1	3	1	1	1	2	2	2	2	1	0	0	3	2	2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3								
		2	2	4	1	5	3	3	4	4	5	2	4	1	2	0	5	5	5	0	0	7	7	8	5	8	9	7	7	7	8	7	7	7	8	10	10	10	7								

