Grower Summary

SF 012 (GSK214)

Blackcurrants: Evaluation of dormancy breaking treatments & Field evaluation of Erger G for dormancy breaking (Combined report with GSK213)

Final 2007

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GROWER SUMMARY

Headline

- Two adjuvants, Activator 90 and Silwett-L77, showed potential as alternatives to Erger G when applied with calcium nitrate as dormancy breaking treatments on Ben Tirran blackcurrant with a winter chill deficit of just under 1000 hours <7°C.

Background and expected deliverables

A number of commercial blackcurrant cultivars are known to have a significant winter chill requirement to enable even bud break and uniform ripening. With the prospect of warmer winters, this chill requirement may be increasingly difficult to achieve. Commercial trials have shown that Erger G + calcium nitrate, a proprietary nutrient/adjuvant combination, can promote earlier and more even bud break on cultivars that have not received sufficient winter chilling. As the 2006/07 winter was unusually mild, cultivars such as Ben Tirran and Ben Alder did not receive sufficient winter chilling for normal dormancy breaking. The 2007 season therefore provided an opportunity to make detailed observations on farm applied dormancy breaking treatments of Erger G + calcium nitrate.

However, Erger G is expensive, has not always proved effective in improving crop evenness and has limited availability. It is known that combinations of nutrients with other adjuvant sprays applied before bud burst can have a similar effect at potentially lower cost. In the work reported here a wide range of nutrient/adjuvant combinations were tested on cut shoots forced under controlled conditions using the techniques developed by Lantin (1973) for determining chill requirements for blackcurrant cultivars.

Summary of the project and main conclusions

A range of treatments (Table 1) were tested on cut bud sticks of dormant Ben Tirran that had not received sufficient winter chilling for normal bud development. The experiments were done under controlled conditions with the bud sticks forced for 21 days at 20°C before recording bud break.

Table 1: Experimental treatments applied to cut shoots

Treatment number	Trade name	Active ingredient	Application rate	Approval status
1	Untreated	-	-	-
2	Water dip	-	-	-
3	Calcium nitrate		125 mg/L	Nutrient
4	Calcium nitrate + Erger G	- Not disclosed	125 mg/L 50 mL/L	NutrienT Nutrient
5	Calcium nitrate + Silwett L-77	- 80% w/w polyalkylene oxide modified heptamethyltrisiloxane + < 20% w/w allyloxypolyethylene glycol methyl ether	125 mg/L 1.5 mL/L	Nutrient Adjuvant A0193
6**	Calcium nitrate + Silwett L-77	- 80% w/w polyalkylene oxide modified heptamethyltrisiloxane + < 20% w/w allyloxypolyethylene glycol methyl ether	125 mg/L 3 mL/L	Nutrient Adjuvant A0193
7	Calcium nitrate + Silwett L-77	- 80% w/w polyalkylene oxide modified heptamethyltrisiloxane + < 20% w/w allyloxypolyethylene glycol methyl ether	125 mg/L 15 mL/L	Nutrient Adjuvant A0193
8	Calcium nitrate + Newman's T-80	- 78% w/w polyoxyethylene tallow amine	125 mg/L 5 mL/L	Nutrient Adjuvant A0192
9	Calcium nitrate + Newman's T-80	- 78% w/w polyoxyethylene tallow amine	125 mg/L 50 mL/L	Nutrient Adjuvant A0192
10	Calcium nitrate + Torpedo-II	- 210 g/kg alkoxylated tallow amine, 380 g/kg alcohol ethoxylates, 75 g/L natural fatty acids + 210 g/kg polyalkylene glycol	125 mg/L 1 mL/L	Nutrient Adjuvant A0541
11	Calcium nitrate + Torpedo-II	- 210 g/kg alkoxylated tallow amine, 380 g/kg alcohol ethoxylates, 75 g/L natural fatty acids + 210 g/kg polyalkylene glycol	125 mg/L 10 mL/L	Nutrient Adjuvant A0541
12	Calcium nitrate + Activator 90	- *750 g/L alkylphenyl hydroxypolyoxyethylene + 150 g/L natural fatty acids ***750 g/L alcohol ethoxylates + 150 g/L natural fatty acids	125 mg/L 1 mL/L	Nutrient Adjuvant A0337 A0547
13	Calcium nitrate + Activator 90	- *750 g/L alkylphenyl hydroxypolyoxyethylene + 150 g/L natural fatty acids ***750 g/L alcohol ethoxylates + 150 g/L natural fatty acids	125 mg/L 10 mL/L or 10 mL/L	Nutrient Adjuvant A0337 A0547
14	Calcium nitrate + Maxicrop original	- Seaweed extracts	125 mg/L 10 mL/L	Nutrient Nutrient
15	Calcium nitrate + Route	- Zinc + nitrogen complexes + alkylpolyglycoside	125 mg/L 10 mL/L	Nutrient Nutrient

* used for 26/2/07 cutting date, ** used for 19/3/07 and 22/3/07 cutting dates, ***used for 22/3/07 cutting date

Two observational studies focusing on Erger G were also done on field-grown blackcurrant crops at Newent, Gloucestershire, (Ben Tirran) and Bradenham, Norfolk, (Ben Alder). Treatments are shown in Table 2.

Table 2: Experimental treatments applied to field crops

Treatment number	Product	Active ingredient	Conc.	Application volume (L/ha)	Timing	Approval status
F1	Untreated	-	-	-	-	-
F2	Calcium nitrate Erger G	- Not disclosed	125 mg/L 50 mL/L	250[1] or 300[2]	12/3/07	Nutrient Nutrient
F3	Calcium nitrate Erger G	- Not disclosed	125 mg/L 50 mL/L	500	12/3/07	Nutrient Nutrient
F4	Calcium nitrate Erger G	- Not disclosed	125 mg/L 50 mL/L	250[1] or 300[2]	29/3/07	Nutrient Nutrient
F5	Calcium nitrate Erger G	- Not disclosed	125 mg/L 50 mL/L	500	29/3/07	Nutrient Nutrient
F6[1]	Calcium nitrate Slither	- 80.0 % w/w polyalkylene oxide modified heptamethyl trisiloxane	50 mg/L 0.8 mL/L	500	29/3/07	Nutrient Approved Adjuvant A0458

[1] Newent site

[2] Bradenham site

All applications were made using a cross-flow-fan blackcurrant sprayer.

Results

The results of the experiments done on cut shoots are shown in Table 3. Calcium nitrate + Erger G, Silwett L-77 at all rates and Activator 90 original were all effective at the later cutting date when 1,535 h <7°C winter chill had been received. The 0.15% rate of Silwett L-77 treatment resulted in slightly less even bud break.

At the earlier cutting date, only 1,334 h <7°C winter chill had been received and only the high rates of Silwett L-77 and Activator 90 original were effective alongside Erger G at this stage.

A further experiment was done to investigate the newly-available formulation of Activator 90 (Table 4).

Table 3: Percentage bud break 21 days after 26/02/07 & 19/03/07 cutting dates

No.	Treatment	Application rate	Average % of buds at bud break (B1) after 21 days at 20°C	
			26/02/07 cut (1334 h <7°C)	19/03/07 cut (1535 h <7°C)
1	Untreated		2.3	3.8
2	Water dip		1.5	8.5
3	Calcium nitrate	125 mg/L	6.9	26.9
4	Calcium nitrate + Erger G	125 mg/L 50 mL/L	97.7	95.4
5	Calcium nitrate + Silwett L-77	125 mg/L 1.5 mL/L	46.2	87.7
6	Calcium nitrate + Silwett L-77	125 mg/L 3 mL/L	Treatment not included	98.5
7	Calcium nitrate + Silwett L-77	125 mg/L 15 mL/L	90.8	100.0
8	Calcium nitrate + Newman's T-80	125 mg/L 5 mL/L	13.1	34.6
9	Calcium nitrate + Newman's T-80	125 mg/L 50 mL/L	12.3	36.9
10	Calcium nitrate + Torpedo-II	125 mg/L 1 mL/L	9.2	35.4
11	Calcium nitrate + Torpedo-II	125 mg/L 10 mL/L	50.8	77.7
12	Calcium nitrate + Activator 90 original	125 mg/L 1 mL/L	9.2	43.1
13	Calcium nitrate + Activator 90 original	125 mg/L 10 mL/L	90.0	98.5
14	Calcium nitrate + Maxicrop original	125 mg/L 10 mL/L	3.1	24.6
15	Calcium nitrate + Route	125 mg/L 10 mL/L	0.8	23.1
		P (ANOVA*)	<0.001	<0.001
		df	126	135
		SED	6.04	6.77

* ANOVA = Analysis of Variance

Table 4: Percentage bud break 21 days after 22 March 2007 cutting date

No.	Treatment	Application rate	Average % of buds at bud break (B1) after 21 days at 20°C
			22.03.07 cut (1607 h <7°C)
1	Untreated		7.7
6	Calcium nitrate + Silwett L-77	125 mg/L 3 mL/L	88.5
12	Calcium nitrate + Activator 90 new	125 mg/L 1 mL/L	34.6
13	Calcium nitrate + Activator 90 new	125 mg/L 10 mL/L	87.5
		P (ANOVA)	<0.001
		df	36
		SED	5.83

The new formulation of Activator 90 proved to be effective at the higher rate only, as per the old formulation. Although it is not possible to compare the two sets of results directly, the results suggest that it may be slightly less effective than the older formulation. It is not possible to be sure whether it would be adequately effective at lower levels of winter chill.

It is clearly preferable to wait until the maximum amount of natural chilling has been received before applying dormancy breaking treatments. Better results can then be achieved with a broader range of chemicals and lower application rates.

For late treatments, where around 1,535 h <7°C had been accumulated, the effective treatments were calcium nitrate plus Erger G, Silwett L-77, Activator 90 (original and new formulations - but only at the high rate of 10 mL/L). Of these, the most cost effective treatments were Activator 90 or Silwett L-77 at an application rate of 1.5 mL/L. Increasing the rate of Silwett L-77 from 1.5 mL/L to 3 mL/L improved the evenness of bud break and increased the percentage of bud break from 87.7% to 98.5%. It is possible that the 3 mL/L rate will prove more robust under field conditions, although it is interesting that a useful result was achieved at Newent with Slither at the much lower rate of 0.8 mL/L.

Where much less winter chill has been accumulated the most effective alternative treatment was Activator 90 original. However whilst the original formulation was available during 2007 it will be replaced during 2008 with the new formulation which has not been tested at the same level of chill deficit.

It is recommended that the treatments to consider as alternatives to Erger G are Silwett L-77 (3 mL/L) or Activator 90 new formulation (10 mL/L).

Note that both of these application rates are higher than the current maximum label recommended rates for Silwett L-77 and Activator 90, at 1.5 mL/L and 1 mL/L respectively. These rates are within the concentration limit for reduced volume pesticide use, which is 10 times the maximum label recommended rate. However Activator 90 is rated as having a risk of serious damage to eyes. This would preclude use of Activator 90 at higher than label concentrations if it were applied with a pesticide. In this case no pesticides are being applied so higher concentration use is *legal* but clearly there is an enhanced risk in this situation and Silwett L-77 would be preferred for this reason.

The results of the field observations on effects of Erger G + calcium nitrate were less conclusive. At Newent there was a very substantial winter chill deficit for Ben Tirran (only 1,463 h accumulated at bud burst, but 2,328 h required) and the effect of the Erger G treatment was minimal, both in forcing bud break and crop evenness. At Bradenham there was a smaller winter chill deficit for Ben Alder (1806 h accumulated at bud burst, but 2157 h required) and the Erger G + calcium nitrate (higher rate, applied at the later date) forced earlier bud development, but again this was not carried through to a benefit in crop evenness. However, the farm treatment at Newent, a silicon based adjuvant (similar to Silwett L-77), Slither 0.8 mL/L + calcium nitrate proved more effective giving a 1.2 t/ha improvement in yield and a more even crop (Table 5). However the yield was still very low at 5.2 t/ha.

Table 5: Percentage fruit colour recorded 7 days pre-harvest (Newent site field observation – harvested 25/7/07).

	Fruit colour		
Treatment	**Black**	**Red**	**Green**
F1. Control	65	18	17
F6. 29/3 applied Slither 0.8 mL/L + Calcium Nitrate 50 mg/L (Farm treatment)	76	15	9

Main conclusions.

This work has identified potential alternative treatments for dormancy breaking in blackcurrant and has quantified the effects in a year when natural winter chill levels were lower than normal. However, the field observations on Erger G showed that it cannot be assumed that:

(a) treatments showing potential from bud stick tests will perform as well in the field (b) that the initial forcing of bud break will necessarily result in a more even crop.

Financial benefits

Table 6: Cost of treatments assuming application at 400 L/ha

No.	Treatment	Application rate	Cost £/ha
1	Untreated		0
2	Water dip		0
3	Calcium nitrate (£10/kg)	125 mg/L	20
4	Calcium nitrate + Erger G (£5.5/L)	125 mg/L 50 mL/L	135
5	**Calcium nitrate + Silwett L-77 (£36/L)**	**125 mg/L 1.5 mL/L**	**42**
6	**Calcium nitrate + Silwett L-77**	**125 mg/L 3 mL/L**	**63**
7	**Calcium nitrate + Silwett L-77**	**125 mg/L 15 mL/L**	**226**
8	Calcium nitrate + Newman's T-80 (£3/L)	125 mg/L 5 mL/L	26
9	Calcium nitrate + Newman's T-80	125 mg/L 50 mL/L	80
10	Calcium nitrate + Torpedo-II (£25/L)	125 mg/L 1 mL/L	30
11	Calcium nitrate + Torpedo-II	125 mg/L 10 mL/L	120
12	Calcium nitrate + Activator 90 (£4/L)	125 mg/L 1 mL/L	22
13	**Calcium nitrate + Activator 90**	**125 mg/L 10 mL/L**	**36**
14	Calcium nitrate + Maxicrop original (£25/L)	125 mg/L 10 mL/L	45
15	Calcium nitrate + Route (£10/L)	125 mg/L 10 mL/L	60

The most effective alternative treatments to Erger G are listed in bold. Of these, the cheapest treatment is calcium nitrate + Activator 90 @ 10 mL/L, at £36/ha. The cost of the high rates of Silwett L-77 and Torpedo-II rule them out of consideration.

If no treatment is applied when there is a chill deficit it can be assumed that 33% of a typical 9 t/ha crop of Ben Tirran might be lost due to bare wood, and/or uneven ripening causing berry drop prior to harvest.

The financial loss would be £650 x 3 t/ha = £1,950/ha which could be partially offset by treatments costing from £36/ha. Even if the yield response was only 1.2 t/ha as reported at Newent, there would still be a substantial cost benefit.

Action points for growers

- Where there is a significant chill deficit for a cultivar, a dormancy breaking treatment should be considered.
- The treatment should be made as late as possible prior to bud burst to maximize natural winter chill units.
- At 1,535 h <7°C for Ben Tirran, calcium nitrate applied with either Erger G, Silwett L-77 or Activator 90 (both formulations, 1% rate) was effective in forcing an even bud break in cut shoot tests.
- Where there was less winter chill received, at 1,334 h <7°°C, calcium nitrate applied with either Erger G, Silwett L-77 (15 mL/L rate) or Activator 90 (original, 10 mL/L rate) was effective in cut shoot tests.
- The most cost effective treatment was calcium nitrate + Activator 90 at a 10 mL/L rate, however extreme caution is required for the use of Activator 90 at this rate because of the hazard rating “risk of serious damage to eyes”.
- The new formulation of Activator 90 was effective at 1,607 h <7°°C for Ben Tirran but has not been tested where less winter chill units had been received.
- For very low winter chill situations it would be worth experimenting with either Silwett L-77 (1.5-3 mL/L) or Slither (0.8-1.5 mL/L).
- Although Erger G performed well in cut shoot tests, field performance was disappointing with limited bud forcing and little effect on crop evenness.

- Although cut shoot tests indicate treatments with potential it cannot be assumed that they will perform as well under field conditions, or that the effect on crop yield and evenness will be significant.

- The use of dormancy breaking treatments is likely to advance bud break and potentially advance harvest slightly. This could be used to advantage where a greater spread of harvest dates is required from one cultivar.