# Grower Summary

## TF 186

Apples: Increasing the efficacy of potassium hydrogen carbonate (potassium bicarbonate) for powdery mildew control by a range of adjuvants and sulphur.

Final 2011

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Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

## Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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| **Project Number:** | TF 186 |
| **Project Title:** | Apples: Increasing the efficacy of potassium hydrogen carbonate (potassium bicarbonate) for powdery mildew control by a range of adjuvants and sulphur. |
| **Project Leader:** | James Carew |
| **Contractor:** | Farm Advisory Services Team Ltd |
| **Industry Representative:** | Nigel Kitney |
| **Report:** | Final |
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| **Previous report/(s):** | Annual 2009 |
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| **Project Cost:** | £ 5,804 |

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## Headline

- Effective control of apple powdery mildew can be achieved through a combination of the use of potassium bicarbonate's eradicant properties with the protectant properties of a *Bacillus subtilis* product.

## Background and expected deliverables

Powdery mildew (*Podosphaera leucotricha*) in apple is a regular problem in many orchards. Conventional control relies on synthetic fungicides and cultural practices such as cutting out primary mildew. These methods can be time consuming and expensive, so alternative methods of control are being sought.

One alternative method is the use of potassium bicarbonate which has eradicant properties. Experience of its use in other crops suggests that repeated applications are required as it is not persistent and offers no protection from infection.

The aim of this project was to assess the efficacy of potassium bicarbonate at eradicating powdery mildew infection on apple.

The expected deliverables from the project include:

- The assessment of the efficacy of potassium bicarbonate at controlling apple powdery mildew.

- The assessment of the physical compatibility of potassium bicarbonate with a range of adjuvants and alternative protectant fungicides.

- The assessment of the effect of different combinations of products and adjuvants at gaining effective control of apple powdery mildew.

Regarding this final point, improving the use and efficacy of potassium bicarbonate may help to give greater control of powdery mildew in apple orchards. This naturally occurring substance has a low risk of pathogen resistance because it acts by dehydrating the mildew mycelia and is therefore likely to be used in the long term. If increased control of powdery

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mildew is achieved through the use of adjuvants or sulphur, this will help to protect potassium bicarbonate from resistant strains of powdery mildew arising.

## Summary of the project and main conclusions

The first part of the project assessed the physical compatibility of potassium bicarbonate with Flowable Sulphur, Nu-Film-17 (pinolene based), Nu-Film-P (pinolene based) and Slippa (silicon based). At label recommended rates, no physical incompatibility problems occurred with any of the products tested.

The second part of the project assessed the effect of combinations of these adjuvants and products, along with a *Bacillus subtilis* product, on the occurrence of powdery mildew over two seasons, using Cox as the standard variety. Sixteen treatment combinations (Table 1) were applied to a Cox orchard and the effect on powdery mildew was recorded.

Potassium bicarbonate and sulphur applications were made at pink bud and petal fall (as recommended in HDC project CP 48). The *Bacillus subtilis* product was applied at the same time and also one week after petal fall.

Each treatment was applied to blocks of five trees and replicated four times in a randomized block experiment.

Table 1: Treatment combinations

| | None | Nu-Film-17 (1ml/L) | Nu-Film-P (1ml/L) | Slippa (1ml/L) |
|---|---|---|---|---|
| Potassium bicarbonate (15g/L) | 1 | 2 | 3 | 4 |
| Potassium bicarbonate (15g/L) + Flowable Sulphur (5.5ml/L) | 5 | 6 | 7 | 8 |
| Potassium bicarbonate (15g/L) + *Bacillus subtilis* product (20ml/L) | 9 | 10 | 11 | 12 |
| None | 13 | 14 | 15 | 16 |

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Assessments of powdery mildew were made weekly until the end of July. In the first year, leaves were selected randomly and assessed for the presence or absence of mildew. In the second year, the percentage of new shoots showing symptoms of mildew was recorded.

In all treatments, powdery mildew levels increased throughout the season. However those treatments that did not include potassium bicarbonate had greater levels of the disease present at the first observation (4-5%) than the treatments where potassium bicarbonate was applied (0-2%). Treatments where the *Bacillus subtilis* product was applied with potassium bicarbonate had the lowest initial levels of inoculum present (0-1%).

The addition of Flowable Sulphur to potassium bicarbonate did not improve control compared to potassium bicarbonate alone. In both cases incidence increased equally to the end of the assessments. For these two treatments, the use of any of the adjuvants did not appear to enhance the action in reducing mildew.

Where a *Bacillus subtilis* product was added to potassium bicarbonate, a reduced incidence of mildew was observed, but only in the first year of the project. Potassium bicarbonate is an eradicant with no protectant properties whereas the *Bacillus subtilis* product acts as a protectant. The initial reduction in mildew levels due to the potassium bicarbonate was enhanced by use of a protectant which resulted in a continued low level of infection rather than an escalating one.

Disease levels were greatest where potassium bicarbonate was not applied at all and only the individual adjuvants were applied. There was an indication that where the two pinolene products (Nu-Film-P and Nu-Film-17) were applied, initial levels of mildew were reduced compared to where the silicon based product (Slippa) was applied and to the control where nothing was applied. However, this difference was not statistically significant.

It is apparent that potassium bicarbonate has an effect on the observed incidence of powdery mildew in apple, effectively reducing incidence of the disease. It is also apparent from the results that although initial levels are controlled, after the use of potassium bicarbonate has stopped, incidence of the disease can then increase as the potassium bicarbonate offers no protectant action.

The addition of sulphur, Nu-Film-P, Nu-Film-17 or Slippa did not increase efficacy of potassium bicarbonate in controlling powdery mildew. However the use of a Bacillus subtilis product increased control of the disease.

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From these results it can be seen that it is important to reduce initial disease inoculum through the use of potassium bicarbonate early in the season. Additional use of a *Bacillus subtilis* product as a protectant can help to reduce disease levels through the season.

It is surmised that effective control of powdery mildew can be achieved by continued use of potassium bicarbonate to eradicate inoculum coupled with a protectant product (*Bacillus subtilis*) later into the season to maintain protection.

## Financial benefits

Good control of apple powdery mildew is essential if apple producers are to attain the necessary yields of Class 1 fruit to remain commercially viable. The results of this project have identified sustainable control measures.

## Action points for growers

- Use potassium bicarbonate to eradicate occurrences of powdery mildew in apple.
- Use a *Bacillus subtilis* product as a protectant for powdery mildew in apple.
- The *Bacillus subtilis* product Serenade ASO currently has a Specific Off-Label Approval (SOLA) for use on apples. This expires in November 2012.

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