Bio-regulators improve fruit size and colour and reduce crop-load and annual bearing of Honeycrisp™ apples

C. G. Embree and D. S. Nichols

Agriculture and Agri-Food Canada, Atlantic Food and Horticulture Research Centre, 32 Main Street, Kentville, Nova Scotia, Canada B4N 1J5. Received 2 April 2004, accepted 9 November 2004.

Embree, C. G. and Nichols, D. S. 2005. Bio-regulators improve fruit size and colour and reduce crop-load and annual bearing of Honeycrisp™ apples. Can. J. Plant Sci. 85: 453–455. Honeycrisp™ [Malus × domestica (L.) Borkh.] can be a very profitable cultivar if fruit quality is high. Some crop-load bio-regulators were evaluated for improving fruit quality and annual flowering. Ammonium thiosulphate applied at full bloom reduced crop-load, increased fruit weight, fruit colour and return bloom. Fruitone N® combined with Sevin XLR® reduced the percent of fruit in the 40–60% colour category and also crop-load. Fruitone N® alone reduced crop-load.

Key words: Honeycrisp™, fruit thinning, crop-load, return bloom


Mots clés: HoneycrispMC, éclaircissage, nombre de fruits, retour de floraison

The demand for high-quality Honeycrisp™ apples for specialty produce markets in North America is increasing (Courtier 2001). Outstanding consumer recognition and very high returns to the industry could launch this cultivar to a leading position in North America and possibly around the world. To produce high-quality large apples, a reduction in crop-load is recommended (Forshey 1976). Lower crop-loads can also reduce biennial bearing. Biennial cropping patterns in some fruit trees will develop if the number of fruit per tree is not reduced during early fruitlet development in heavy cropping years (Monselise and Goldschmidt 1982). Blossom thinning is reported to be one method of increasing fruit diameter in the current season and flower bud formation for the subsequent season (Budan and Faust 1986). For Honeycrisp™ there have been no published results on the effects of timing of blossom thinning. Fruitlet thinners are commonly used to reduce fruit density when growers are reasonably certain that fruit set is adequate (Wertheim 2000). In Nova Scotia (45°03’00”N – 64°46’00”W) Honeycrisp™ is prone to setting very heavy crop-loads, which often result in large crops, low quality, biennial bearing and reduced tree vigour (Nichols and Wright 2003).

Honeycrisp™ producers urgently need cost-effective methods of mitigating these production problems. The objective of this study was to establish the efficacy of blossom and fruitlet bio-regulators on Honeycrisp™ fruit set, yield, fruit quality and return bloom.

On May 24, 2002, when Honeycrisp™ were in the full pink stage of flower development, candidate test trees were selected for uniform bloom density throughout the tree. In a cooperating grower orchard, the 24 Honeycrisp™ apple trees selected had been planted at 1.2 m (within row) × 5.5 m (between row) spacing on M.26 rootstock in 1996. The trunk circumference was measured at 30 cm above the soil surface and all blossom clusters (assumed to have five blossoms each) on each tree were counted. Blossom density was calculated by dividing the number of blossoms by the trunk cross-sectional area (TCA). Each tree was ranked according to blossom density then allocated to one of four replicate blocks based on blossom density.

Treatments were randomly assigned to individual trees within each block. The treatments included an untreated control, and applications of ammonium thiosulphate (ATS) [12% wt/vol nitrogen, 26% wt/vol sulphur (1.25 % vol/vol)], Sevin® XLR [480 g L−1 a.i.1-naphthyl methylcarbamate (434 mg L−1)], Fruitone N® [3.1%1-naphthaleneacetic acid (7.4 mg L−1)], Sevin® XLR [480 g L−1 a.i.1-naphthyl methylcarbamate (434 mg L−1)] + Fruitone N® [3.1%1-naphthaleneacetic acid (5.0 mg L−1)], and MaxCel™ [1.9% wt/wt N-(phenylmethyl)-1H-purine-6amine (19.8 g L−1)].

Abbreviations: ATS, ammonium thiosulphate; DAFB, days after full bloom; TCA, trunk cross-sectional area
A full-bloom treatment of ATS was applied on Jun. 01, when more than 90% of the blossoms were fully open. The whole tree was sprayed using a backpack sprayer in the late morning when the temperature was approximately 15°C. All other treatments were applied 16 d after full bloom (DAFB) when fruitlet size was approximately 10 mm. These materials were applied with a hand gun powered by a truck-mounted sprayer. Weather conditions were sunny with a temperature of 20°C during the afternoon of treatment. The spray applications were classified as dilute and the trees were sprayed to leaf run-off. Initial fruit set was determined for each tree by dividing the number of developing fruitlets at 24 DAFB by the number of blossoms (Table 1). Following the normal fruitlet drop at 51 DAFB remaining fruit were counted again to determine final percent fruit set, and thus the thinning efficacy (Table 1).

All apples were harvested at 131 DAFB, stored in air at 2°C for 2 d, weighed and graded to determine average fruit weight and percent distribution into each size and colour category. Grades for Honeycrisp™ colour were those adopted by Scotian Gold Cooperative Ltd. These grades are based on the percentage of apple surface with bright orange-red colour and they comply with or exceed the Canadian grade standards.

In 2003, all blossoms were counted about a week before full bloom to determine the effect of the 2002 treatments on return bloom. At 44 DAFB when normal fruitlet drop had finished, fruitlets were counted to determine if trees with a heavier bloom also had a greater fruit set even though all trees had been sprayed by the owner with a combination of 6 mL L⁻¹ Sevin® XLR + 1.6 g L⁻¹ Fruitone N®. This thinner had been applied at 15 DAFB using a commercial airblast sprayer and based on a 60% tree row volume. Data were analyzed using the statistical program Genstat 5 (Genstat 5 Committee 1993).

ATS applied at full bloom reduced crop density at 24 and 51 DAFB in 2002 (Table 1). Fruitone N® also reduced crop density, but only at 51 DAFB. Fruit weight at harvest was increased by the ATS treatment relative to the control. The larger fruit size contributed to adequate yield levels despite the lower crop density. The ATS treatment resulted in slightly more than 80% of fruits graded in the size category of greater than 70 mm in diameter, compared to the untreated control, which resulted in only 44% in this category. Crop-load was reduced by Fruitone N® applied with and without Sevin® XLR.

Both ATS and Sevin® XLR + Fruitone N® reduced the percentage of fruit graded into the 40–60% orange-red colour category (Table 1). ATS increased the amount of fruit graded at > 80% colour.

Only ATS stimulated an increase in bloom the year following treatment (Table 1). That year the number of fruit present at 44 DAFB was also higher for ATS-treated trees even though a fruitlet thinner had been applied across all treatments by the grower.

Specific target crop density levels need to be identified so that a high percentage of the fruit will be fully marketable. The blossom thinner ATS was found to be an effective crop bio-regulating tool for Honeycrisp™; however, it was recognized in previous experiments that adequate crop density reduction with blossom thinners is difficult to achieve consistently (Byers 1997).

The positive influences on fruit quality and return flowering measured for Honeycrisp™ concur with those reported by Koike et al. (2003) for manual thinning of Fuji apple. Our results also indicate that blossom thinning is more effective than fruitlet thinners for achieving these goals. Since the most widely used blossom thinner, ATS, can cause severe phytotoxicity, new materials and reduced rates at different times and in combination with fruitlet thinners need to be tested. These preliminary results show the importance of finding a fully reliable thinning strategy for the assured production of high quality Honeycrisp™ apples.

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