

Effect of MaxCel on Fruit Set, Fruit Size, and Fruit Characteristics of Summerland McIntosh Apples, 2005 Results

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In 2003, a new benzyladenine (BA) thinning product, MaxCel, was introduced to replace Accel. The new product appears to have distinct advantages over the older BA product. Specifically, MaxCel contains no gibberellins (GA), contains more BA, the label was changed to apply more active ingredient, and the formulation was changed to improve foliar penetration and increase formulation stability. Evaluation of this new product over the past several years revealed that it may act quite differently from the product that it replaced in two very important ways. First, it appears to be a more potent and effective as a thinner. Second, it may have a greater influence on fruit quality at harvest than might be anticipated. In 2005, we continued to evaluate MaxCel as a thinner and effects on fruit quality when used as a thinner.

Each year, fruit growers are presented with different challenges during the chemical-thinning period. We attempt to provide fruit growers with a number of options that can be used alone or in combinations to meet thinning needs ranging from minimal thinner use to a combinations of thinners, timings, additives, and concentrations that would represent an aggressive program. One of the tools that has been suggested for use to growers is to use dormant oil in combinations with thinners to improve penetration and increase the response. We have been testing this product over the past several years see if this is an options that can be used with either carbaryl or BA to enhance the thinner response. We continued this evaluation in the 2005 experiment.

Materials & Methods

Seventy mature Summerland McIntosh/M.9 were selected at the University of Massachusetts Cold Spring Orchard Research & Education Center, Belchertown, MA. At the pink stage of flower development two limbs per tree 8 to 10 cm in diameter were selected, tagged, and measured. All spur blossom clusters were counted and recorded on the tagged limbs, and bloom density was calculated. Trees were organized into seven groups (replications) of 10 trees each, based upon blossom cluster density and proximity in the orchard. Treatments were applied on June 1 when fruit size averaged 9.1 mm. Treatments were applied as presented in Table 1 using a commercial airblast sprayer at tree row volume dilute of 100 gal/acre. Buffer trees were maintained between trees to assure that no tree received drift from an adjacent tree. At the end of June drop in July, the fruit on all tagged limbs were counted and recorded. On September 19, four replications were harvested and fruit were evaluated. The remaining three replications were harvested on 20 September. A 30-apple sample was harvested randomly from the periphery of each tree. Fruit were weighed and then red color was estimated to the nearest 10%. Further, the intensity of red color was evaluated to determine if it was intense enough to allow the fruit to be classified as U.S. Extra Fancy. The percent U.S. Extra Fancy was determined by counting all fruit that had at least 50% red color and the intensity was great enough to meet the U.S. Extra Fancy grade.

A subample of 10 fruit, representative of the harvested sample, was selected. Flesh firmness was measured on two sides of each fruit using an Efegi penetrometer. Juice collected while doing the firmness determinations was pooled and the soluble solids was determined using a hand-held refractometer. Fruit were cut at the equator, dipped in an iodine-potassium iodine solution, and a starch reading was made using the Cornell generic starch chart.

Results & Discussion

The bloom on trees used in this experiment was quite uniform (Table 1). Both MaxCel and carbaryl thinned Summerland McIntosh. The results are similar regardless of whether expressed and fruit per cm limb cross-sectional area or as percent set (fruit per 100 blossom clusters). The significance attributed to

carbaryl is somewhat misleading since it is undoubtedly due to when carbaryl is combined with MaxCel. When used by itself little or no thinning was achieved with MaxCel. When carbaryl was combined with MaxCel, significant and somewhat comparable thinning resulted. The results are quite interesting and confirm the observations made in the past that it is essential to combine MaxCel with carbaryl to achieve significant and meaningful thinning. Carbaryl is a thinner that has been in general use since the 1960's, and NAA plus carbaryl is a combination that growers have depended upon to achieve thinning on more difficult-to-thin varieties or under less desirable thinning conditions. In this experiment, neither carbaryl used by itself or with 7 ppm NAA provided any thinning. When carbaryl and MaxCel were combined significant and nearly perfect thinning was achieved. This appears to confirm the observation that the combinations of MaxCel with

Table 1. Effect of MaxCel, carbaryl, oil and combinations on fruit set of 'Marshall McIntosh' apples. 2005.

Treatment ¹	Blossom density (no. clusters/cm ² limb cross-sectional area)	Fruit set (no./cm ² limb cross-sectional area)	Fruit set (%)
Control	15.6 a	8.3 a	57 a
MaxCel 50 ppm	15.5 a	8.6 a	57 a
MaxCel 100 ppm	16.2 a	6.9 abc	42 abcd
Carbaryl (1 lb/100 gal) (C)	16.3 a	8.4 a	55 ab
MaxCel 50 + C	15.9 a	5.5 bcd	39 bcd
MaxCel 100 + C	15.9 a	5.3 cd	33 cd
Carbaryl + 1 qt/100 gal oil	15.7 a	8.2 a	52 ab
MaxCel 50 + C + Oil	15.5 a	6.9 abc	46 abc
MaxCel 100 + C + Oil	15.7 a	4.0 d	29 d
NAA 7 ppm + C	16.4 a	8.0 ab	55 ab
Significance			
BA	NS	1**	1**
Carbaryl	NS	1*	1*
BA x Carbaryl	NS	NS	NS

¹Treatment applied June 1 when fruit size averaged 9.1 mm.

Table 2. Effect of MaxCel, carbaryl, oil and combinations on fruit quality and fruit characteristics of 'Marshall McIntosh' apples. 2005.

Treatment ¹	Fruit weight (g)	Flesh firmness (lb)	Soluble solids (%)	Red color (%)	U.S. Extra fancy (%)	Starch rating
Control	133 d	15.9 a	12.2 a	63 ab	74 a	5.6 ab
MaxCel 50 ppm	147 cd	16.1 a	12.3 a	59 bc	63 abcd	5.5 abc
MaxCel 100 ppm	173 ab	16.1 a	12.2 a	57 cd	50 d	4.8 d
Carbaryl (1 lb/100 gal) (C)	143 d	15.5 a	12.2 a	62 abc	69 abc	6.0 a
MaxCel 50 + C	160 bc	15.7 a	12.3 a	61 abc	56 bcd	5.1 bcd
MaxCel 100 + C	172 ab	15.9 a	12.4 a	57 cd	49 d	4.8 d
Carbaryl + 1 qt/100 gal oil	140 d	15.9 a	12.3 a	65 a	72 a	6.0 a
MaxCel 50 + C + Oil	149 cd	16.1 a	12.5 a	59 bc	54 cd	5.3 abcd
MaxCel 100 + C + Oil	178 a	15.8 a	12.6 a	53 d	30 e	4.9 cd
NAA 7 ppm + C	142 d	15.5 a	12.3 a	62 abc	70 ab	6.0 a
Significance						
BA	1***	NS	NS	1***	1***	1***
Carbaryl	NS	NS	1*	NS	1*	NS
BA x Carbaryl	NS	NS	NS	NS	NS	NS

¹Treatment applied June 1 when fruit size averaged 9.1 mm.

carbaryl may be the most consistent thinning approach available to orchardists.

Over the past few years, we have emphasized the important role that weather plays in thinner response, especially the weather the 2 to 4 days following thinner application. Generally, good thinning response can be achieved if the temperature following treatment reaches at least into the low to mid 70's during this post-application period. Several investigators have suggested that night temperature plays an important role in thinner response. In this investigation, night temperatures dipped into the low to mid 50's the first 3 days after application, resulting in a rather low average daily temperature. Therefore, in evaluating the projected temperatures following thinner application in selection of a suitable thinning treatment, it may be appropriate to include projected night temperature in the evaluation process. Most researchers believe that

carbohydrate status in the tree following thinner application is an important modifying factor in thinner response, and night temperatures play an important role in the ultimate carbohydrate status within the tree.

MaxCel significantly increased fruit weight at harvest (Table 3). It is well documented that chemical thinners aid in increasing fruit size by reducing competitions among competing fruit due to reduced crop load. Thinning with the combination of MaxCel plus carbaryl undoubtedly contributed some to the increase in fruit size. However, since increases in fruit size by MaxCel alone where thinning was modest at best, were nearly as large as those where MaxCel is combined with carbaryl and thinning did occur, one must conclude that the majority of the fruit size increase can be attributed directly to MaxCel. The size-promoting effect of MaxCel (BA) is well documented in the literature, and this is accomplished

Table 3. Temperature at the University of Massachusetts Cold Spring Orchard Research & Education Center from the time of the first application to 14 days following application.

Date	Temperature high (F)	Temperature low (F)	Temperature mean (F)
June 1	75	52	61
2	75	51	60
3	77	52	63
4	87	57	71
5	90	59	75
6	83	57	68
7	88	64	75
8	91	62	76
9	91	65	76
10	84	68	73
11	90	67	76
12	88	68	74
13	89	68	77
14	85	56	75

primarily by increased cell division. No treatment increased flesh firmness. However, since MaxCel increased fruit size substantially, and large fruit are known to have lower flesh firmness, it is logical to conclude that MaxCel positively influenced flesh firmness and its effect was off set by increased fruit size. One can speculate that the increased cell numbers caused by BA were responsible for maintaining flesh firmness. If fruit of comparable size were tested, BA-treated fruit probably would have been firmer.

Over the years that we have used BA-containing thinners, we have found a somewhat consistent linear reduction in red color with increasing BA concentration, especially on McIntosh types such as McIntosh, Macoun, and Empire. When evaluating

color, we also record if the color is intense enough to make the U.S. Extra Fancy grade. Usually the effect of BA on reducing color is more prominent when intensity of red color is taken into account, affirming that BA reduces both the amount of red color and its intensity. This was confirmed in 2005. BA had a highly significant effect on reducing starch rating, indicating that BA delayed ripening. An experiment very similar to the one reported here was done last year on McIntosh. In that experiment BA also retarded fruit ripening, as determined by starch rating. If this is the case, then part of the reduction in red color reported in this experiment must be related to reduced color associated with less mature fruit. The delay of ripening on McIntosh is very interesting and should be followed up.

