

Use of Plant Growth Regulators for Improving Lemon Fruit Size - 2007¹

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Abstract

Lemons were treated with several plant growth regulators for the 2007-08 season, with the hope of improving fruit size. These PGR's included Bluestim, Intracapt and MT1350. Although there were some increases in yield, these were just trends, and were not statistically significant. Similarly, there was no improvement in fruit size, or changes in fruit color or fruit shape with application of the treatments. This is the second year where there were no significant differences due to treatments, suggesting that the materials applied are not particularly effective on lemons.

Introduction

The desert lemon industry is facing increasing competition from both foreign and domestic sources. Lemons from Argentina were considered to be quite a threat, until regulatory and disease issues prevent that fruit from being shipped to the US. In recent years, lemons from Chile have captured a large portion of the Japanese market; a market that is quite profitable for the desert lemon grower. Now we are seeing increasing competition from Mexican lemons. Lemons from Spain, South Africa, Australia and the Bahamas sometimes appear in the produce departments of US grocers.

From within the US, stored lemons from District 2 (Coastal California) compete with desert fruit in the early part of the season. Use of gibberellins has allowed the Coastal California fruit to have a longer storage life when the market is at its highest. Meanwhile, the advent of lemons from District 1 (San Joaquin Valley) can shrink profits later in the year.

What is a desert lemon grower to do? Although increasing market share is always desirable, the lemon producer has no influence on that. Good fruit quality and early season size are the only ways to command a higher price. Most growers can achieve good quality with appropriate insect and mite control, and fertilization. But fruit size can sometimes be a problem. Figure 1 illustrates the fact that large fruit are more valuable in the market between September 1st and March 1st, when desert fruit is typical available.

It is apparent that desert lemon growers require a substance that will increase fruit size, is registered and is consistent. Since 1999, several purported plant growth regulator compounds have become available for use on citrus, and many claim to improve fruit size. These include synthetic auxins, compounds containing natural auxins,

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and other plant growth regulators. Our objective for this study is to test several of these compounds for their consistent efficacy in improving lemon size...

Materials and Methods

This experiment was established in 2005 at the Yuma Mesa Agriculture Center, in blocks 8 and 9. 2007-08 Treatments are as follows:

- Untreated Control
- Intracept - 32 oz. per acre in mid-May and again in mid-June – Intracept is a chelated micronutrient and plant growth enhancer to be applied at planting or at the beginning of stressful growth stages such as first true leaf, flowering, and fruit set. Manufactured by Northwest Agricultural products.
- Bluestim - 4 lb. per acre in mid-May and again in late-August - Bluestim is a glycine betaine product that is meant to help the plant resist stress, and is manufactured by Verdera (a Finnish corporation) and distributed for Monterey Ag. Resources.
- Bluestim – 4 lb. per acre in mid-May, mid June and again in late August.
- MT 1350 @ 4 pts/acre in mid and late May. Masterfresh (Nutra-park, Inc., Madison, WI). Contains LPE (lysophosphatidylethanolamine), a naturally occurring lysophospholipid biomolecule derived from naturally abundant sources such as egg yolks and soybeans that purports to increase fruit size. The purpose of this treatment is to improve fruit size early during the cell division stage.
- MT 1350 @ 4 pts/acre in mid- and late-August. The purpose for this treatment is to improve fruit size during the cell enlargement phase, prior to the first harvest.
- MT 1350 @ 4 pts/acre in mid-September and late-October. The purpose for this treatment is to improve fruit size during the maturation phase, between the first and second harvest.

A treatment unit consisted of eight adjacent trees in a row, and experimental design was randomized complete block, with five blocks. Therefore, there were a total of 30 treatment units, (240 trees, 3.18 acres) included in the experiment. Each treatment consisted of 5 treatment units, one for each block, with a total of 40 trees, or 0.53 acres. Guard rows separated one treatment from the next. Irrigation is border flood, and normal cultural practices are used.

For all treatments, spray volume was 100 GPA, and the materials were applied using an air-blast sprayer. NUFilm surfactant was used in all cases.

Intracept was applied at a rate of 32 oz per acre on 5/09/07 and again on 6/15/07. There were two Bluestim treatments; the first was an application of 4 lbs. per acre on 5/9/07, followed by an additional equal application on 8/31/07. The second treatment consisted of an initial application of 4 lb. per acre on 5/09/07, followed by an additional equal application on 6/15/07, and a third equal application on 8/31/07. There were three MT1350 treatments; the first was an application of 4 pts per acre on 5/9/07 followed by an equal application on 6/5/07. The second MT1350 treatment was first applied on 8/17/07, with an additional application on 8/31/07. The third MT1350 treatment included applications on 9/14 and 10/31/07. All applications were made with an airblast sprayer @ 150 to 200 psi. All treatments were applied with 80 to 100 gallons of water per acre.

Despite the January 2007 freeze, 2007-08 yields at the entire Yuma Mesa Agriculture Center were high, therefore, there was an initial picking date of 10/08/07, where only fruit of size 165 and above were picked, followed by a “strip” harvest on 11-15-07. Fruit from each tree was harvested by hand using professional pickers from a local packinghouse. Fruit from each tree was harvested into plastic bins, each holding approximately 800 lbs. From those bins, about 40 lbs of fruit were removed into plastic sample tubs for determination of packout. Fruit from the tubs was optically sorted using a completely automated photographic sorter (Autoline, Inc., Reedley, CA). This sorter is trailer-mounted so that it can be towed to the citrus orchard study site. Each fruit that passes through the sorter was photographed and weighed. Weight, color, exterior quality (% blemish), fruit shape and fruit diameter data was collected for each fruit. Fruit were not physically sorted, but the data collected was stored in a laptop computer that is an integral part of the sorter. Data collected from the sorter were later analyzed and the percentage of fruit from

the eight fruit sizes and fruit grades (fancy, choice and juice) as well as fruit peel color and shape were determined. Our results typically show that fruit is larger than is the case if the packout was determined at the packinghouse. This due to the fact that we measure each fruit shortly after it is removed from the trees. In typical packinghouse reports, the percentage of large fruit is less, because fruit shrinks as it moves through the house, and the reports are taken after the fruit is degreened, washed, waxed and dried. Throughout this experiment, we found no effect of the treatments on fruit grade, shape or peel color, In general, exterior fruit quality ranged from 70 to 75% fancy, about 20% choice, and 5 to 10% juice.

All data was analyzed using SPSS 11.0 for Windows (SPSS Inc., Chicago, Illinois).

Results

Yields for the 2007/08 season appear in Figure 2. For the 10/8 harvest, yields ranged from 156 lbs. per tree for the trees treated with Bluestim in May, June and August, to 216 lbs. per tree for the untreated control trees. Trees treated with Intracept averaged 193 lbs per tree, while trees treated with Bluestim in May and August averaged 180 lbs of fruit. The three MT 1350 treatments led to 200 lbs per tree for trees treated twice in May, 176 lbs of fruit for trees treated twice in August, and 191 lbs. per tree for trees treated once in September, and again in October. Despite the range of yields, we found no significant effect of the treatments upon first harvest yield.

For the second harvest on 11/15/07, yields ranged from 128 lbs per tree for the trees treated with Bluestim in May, June and August, to 188 lbs. per tree for the trees treated with Bluestim in May and August. Trees treated with Intracept averaged 173 lbs of fruit for the second harvest, while those trees treated with MT1350, irrespective of treatment time had about 165 lbs of fruit harvested. Trees that were not treated had about 135 lbs. of fruit. Again, we found no significant effect of the treatments upon second harvest yield.

For the 10/8/07 harvest, we saw no effect of the treatments on fruit packout (Fig. 3). From three percent to 11% of the fruit was size 75 and 39% to 48% of the fruit was size 95. All treatments had between 25% and 31% fruit of size 115, between 12% and 18% fruit of size 140, and 4% to 7% fruit of size 165. Less than one percent of the fruit from any treatment was less than size 165.

For the 11/15/07 harvest, we again saw no effect of the treatments on fruit packout (Fig. 4). From eight percent to 15% of the fruit was size 75 and 29% to 41% of the fruit was size 95. All treatments had between 20 and 24% fruit of size 115, between 17% and 21% fruit of size 140, and 9% to 15% fruit of size 165. Less than four percent of the fruit from any treatment was less than size 165.

Discussion

The 2007/08 harvest season marks the third and final year of this experiment. Unfortunately, it also marks the third year in which we have had no consistent positive results from the application of plant growth regulators for the purpose of improving fruit size of lemons. It is hard to know why this might be the case, although hot, dry growing conditions and slow tree and fruit growth during the summer might be a culprit. Based on this work, it is impossible to recommend that any of the compounds we have tested be applied to commercial lemon groves.

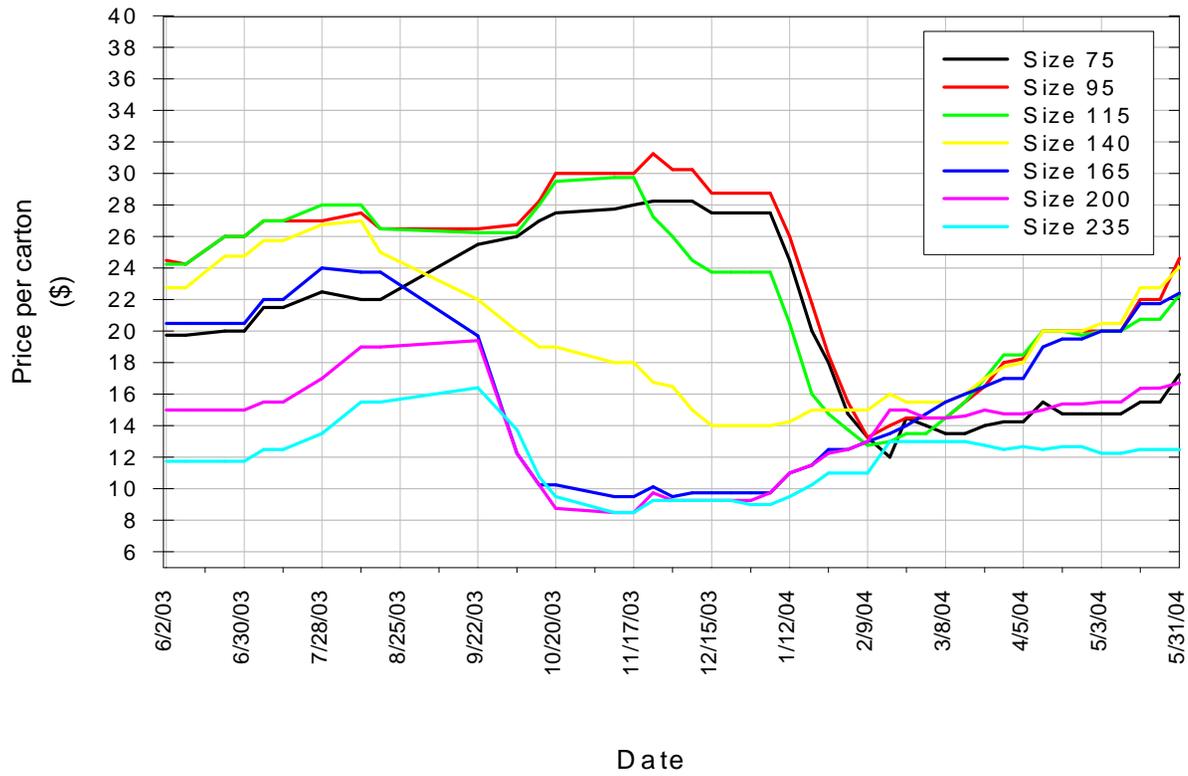


Figure 1. 2003-04 Los Angeles terminal market prices for fancy grade lemons.

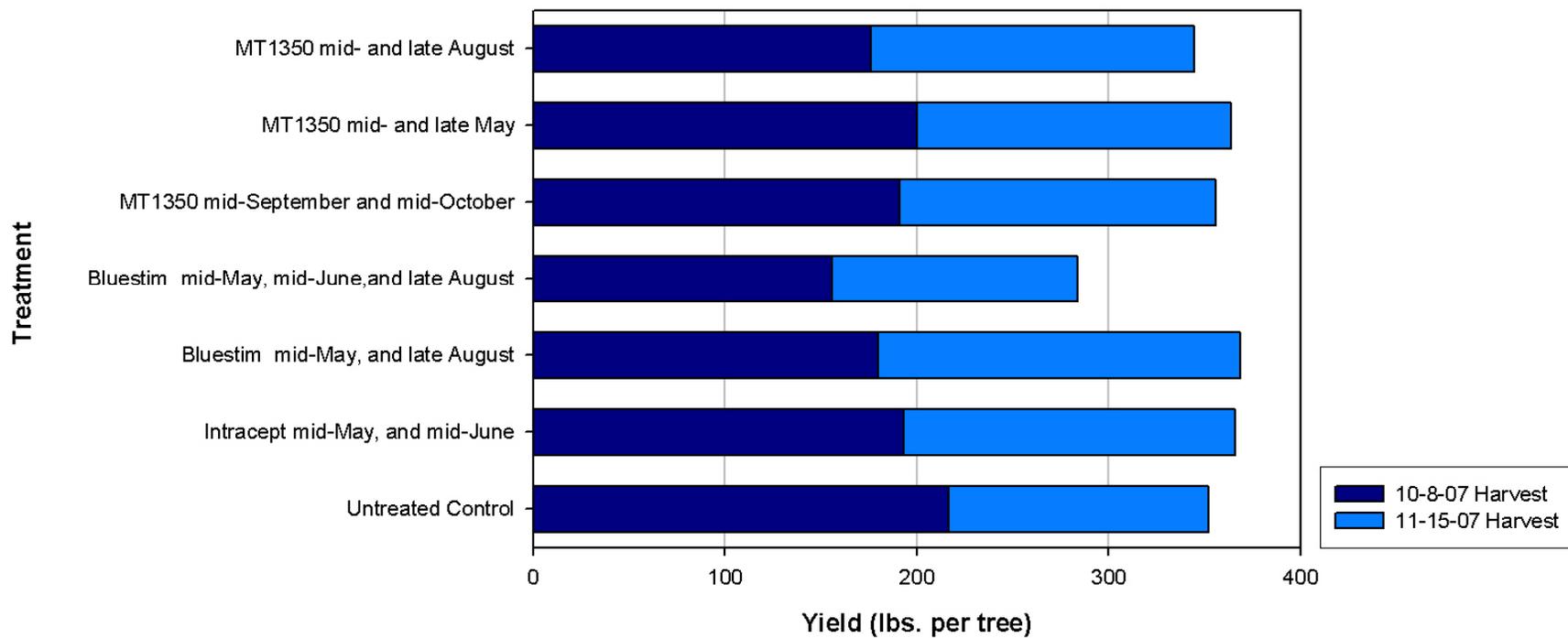


Figure 2. Yields of lemons treated with various plant growth regulators for the 2007-08 season. There was no significant difference between the treatments.

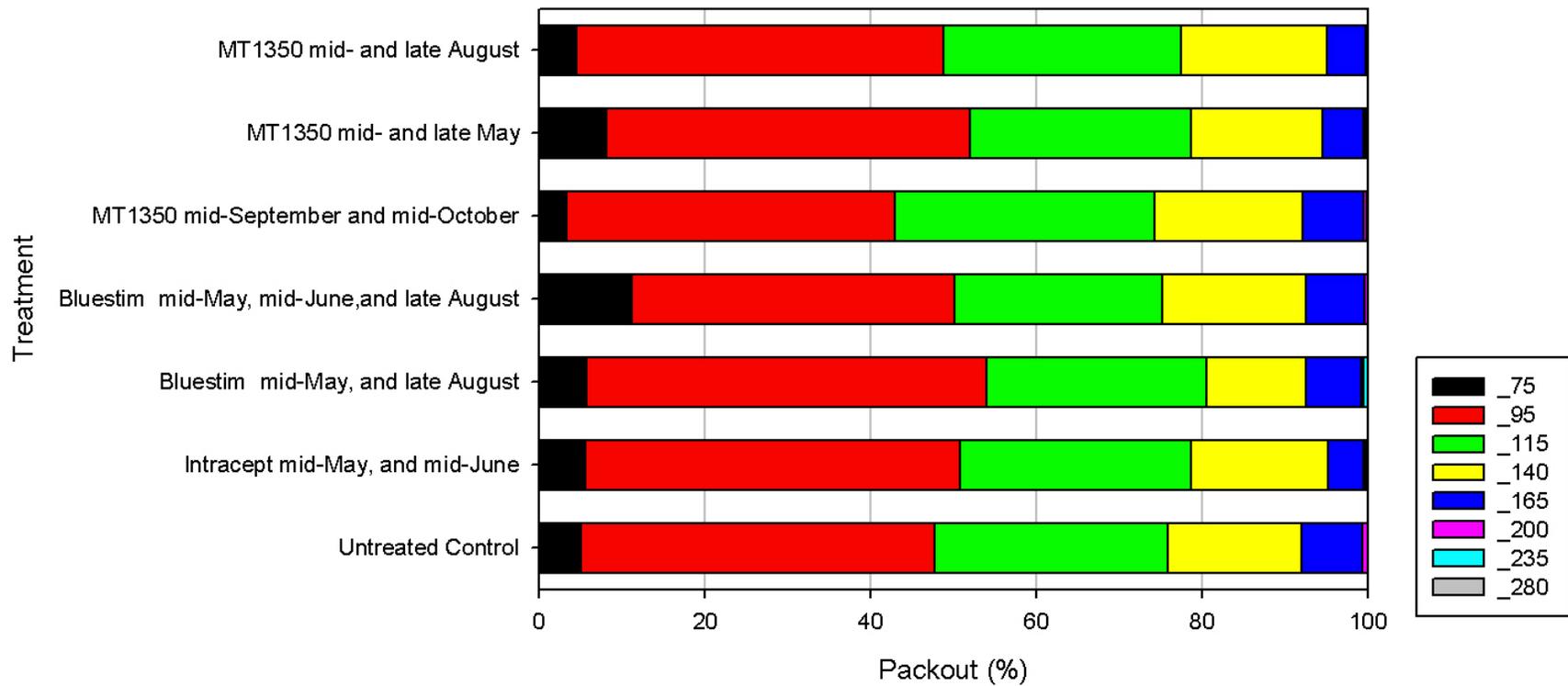


Figure 3. Packout of lemons treated with various plant growth regulators for the 10-8-07 harvest date. There was no significant difference between the treatments.

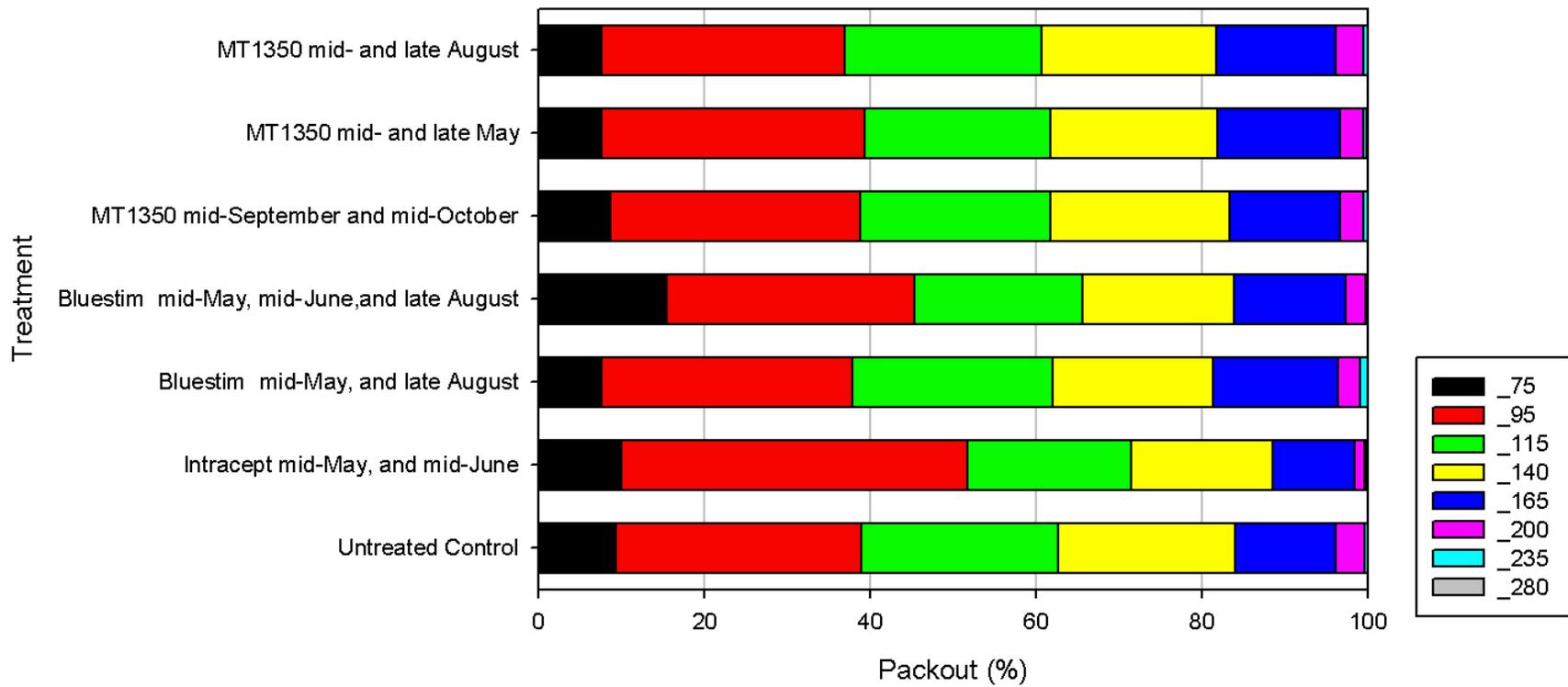


Figure 4. Packout of lemons treated with various plant growth regulators for the 11-15-07 harvest date. There was no significant difference between the treatments.