I. Introduction

The lemon trees in all of the groves have improved dramatically. They are in much better condition than a year ago. If the grove care program continues to maintain the trees in healthy condition, production will increase this year, and yields should continue to steadily increase in future seasons.

All citrus trees exhibit some level of alternate bearing. In Agros Citricos, the 2007-08 crop is on the down (“off”) side of the cycle – the previous 2006-07 crop was theoretically on the up (“on”) side, despite the fact that it was light overall. The reason that there was a light crop last year even though it was the “on” side of
the cycle was that the trees were in weakened condition in early 2006, so they had to try and recover while carrying a crop load at the same time. Most of the recovery, therefore, occurred in the last half of the year after the main crop was picked.

The current crop of lemons should be larger than the previous crop. The pattern will be erratic – some blocks will increase production by a large amount, and some will show significantly lower production than last year. Overall, the blocks that increase production will outweigh those that lose, so the total production from all groves together appears to be higher at this point.

II. Flowering

The Agros Citricos Team expressed great concern over the apparent lack of flowers this year. It is obvious that indeed there was not a single, major flowering event. Normally, this is due to a “weak induction period”, where weather conditions during the time of year when flowers are normally induced are not favorable for strong formation of flowers. Apparently, this was the case in November and December of 2006, where rainfall was much higher than normal – over 250 mm.

Also, induction is normally weak following an “on” year in the alternate bearing cycle. While the total production from all groves last year hardly seems to have been an “on” year, it is important to consider the historic pattern when analyzing tree growth cycles. The fact was that the flower induction for the 2006 crop was strong, so the trees had many flowers last year which then set as much fruit as the trees could hold. The lack of production last year was due to the diminished carrying capacity of the trees, not the intensity of the bloom.

So, even though the production was low last year, it was still the “on” side of the alternate bearing cycle. Weak flower bud induction following an “on” year is typical, and the weather conditions accentuated the effect. Therefore, instead of induction of a single intense bloom event, there were numerous small induction
periods, so the resulting bloom was scattered and prolonged with only a few flowers appearing at any one time. While we were in Reyes on this trip, we identified 6 different waves of flowers that had emerged and set fruit as of the date of the visit. The first 4 blooms this year actually occurred before the main wave of flowers would have emerged last year.

This situation is not due to any of the grove care practices that have been applied in the last year. The effect is entirely related to the combination of the “off” part of the alternate bearing cycle and the weather conditions in the fall and winter of 2006. Again, the trees are very healthy, and capable of producing a good crop.

II. Fruit Set

Because the trees are very healthy at this point, the fruit set percentage was much higher than normal – since there were few flowers, the trees set fruit on as many as possible. Normally, only 1-3% of the flowers produce fruit. This year in Agros Citricos, the fruit set percentage is unbelievably high – I have never seen anything like it. While the flowers were few, the majority of the flowers that were produced did set fruit.

Undoubtedly, this is due to the condition of the trees. Since the leaf surface of the trees is so much greater than in the past, there is a much higher level of stored carbohydrates in the trees. Normally, high carbohydrate levels occur at the end of
the “off” cycle – after a light crop. The high carbohydrate levels help trigger strong flower bud induction. Since last year was the “on” part of the cycle, carbohydrate levels would be normally be low at this point in time. However, the trees have retained a majority of the leaves from last summer and fall due to the excellent Greasy Spot control, so they are building carbohydrate levels rapidly as they move into the 2007 growing season. This, combined with weak induction of the main bloom, is responsible for the repeated bloom events, and high level of fruit set on the flowers that are formed.

There are a lot of fruit on the trees that set just recently. All of the trees have thick canopies of leaves at this point, and they will become even more densely foliated through the summer. As a result, the newer fruit is not easy to see. Close examination of the trees showed a good percentage of the fruit is not obvious at this point, which is creating the appearance of a light crop. In the next 60 days, these small fruit will become more apparent.

III. **Likelihood of Subsequent Flowering and Fruit Set is High**

**Spring Bloom:** As of February 17, 2006, most trees in Pica Pica and Polenquin (the only groves visited on that trip) had not flowered at all. This year, as of March 5, there have been up to 6 flowering events, with a significant amount of fruit set already. Since the induction of flowers for the Spring bloom was weak, and there have been repeated induction cycles, more flower production is likely, especially when one considers that last year the main bloom in many of the Agros Citricos blocks occurred after March 5. Our trees in Florida have not bloomed strongly yet this year either, so there is a strong indication that additional flowering events will occur in Agros Citricos. Our Florida trees have done much the same thing this year – scattered early bloom with a high percentage of fruit set, with the main bloom still yet to occur.

The Agros Citricos trees at this point are very healthy. The fertilizer has been applied according to schedule, the pruning program is up to date, and there are very few leaves that will drop due to Greasy Spot. Therefore, the trees are ideally
situated for high fruit production, as anticipated, and additional spring bloom may be very likely.

**Summer Bloom:** In many blocks, the amount of fruit set from the Spring flowers that have occurred through the time of the trip and shortly after will be very good. In these, the quantity of flowers and subsequent fruit from the summer bloom period following the dry season will probably not be particularly heavy.

![In other trees, where the induction and subsequent fruit set is lighter from the Spring crop of flowers, a second bloom at the end of the dry season is very likely. Polencin and some areas of Santa Rosa seem to have a particularly light Spring Bloom crop, so the Summer Bloom will be especially significant there. There may also be additional Spring Bloom in these blocks.](image)

A recommendation was made that for all the blocks, the irrigation program during the dry months in the immediate future should assist in flower bud induction conditions. The trees should be irrigated in a way that encourages them to reach a deeper dormancy status prior to the onset of the rainy season, taking care to not stress the trees to the point that there is fruit drop. If successful, additional Summer Bloom flowers should be induced.

Another possibility to increase flower bud induction of the Summer Bloom may be to apply urea or phosphorous acid shortly before and after the first rains of the summer rainy season. This is the point where flower buds are normally induced as the trees come out of rest and begin the next growth cycle. Urea and phosphorous acid have been shown to increase induction in Florida as cool periods that trigger rest during the winter transition into warm periods. The same effect may be possible in Agros Citricos as the spring dry season ends. We will research this question to determine whether this approach may hold promise.

A similar situation to what is occurring in Agros Citricos happened in Florida last year. The trees were battered by hurricanes, so there was a lot of leaf loss. The 2005-06 crop was an “on” year, so the induction of flowers for the 2006-07 crop was weak. There was a prolonged dry season in the spring of 2006 while the trees were recovering through good fertilization and grove care, so when the rainy season started in June of 2006, there was a strong second bloom. In many blocks,
there is more second bloom fruit than from the first bloom. Since the second
bloom crop is so heavy, the fruit is of good quality and harvesting is feasible.

The same situation is highly probable in the Agros Citricos groves. The trees are
in excellent condition, and they will do everything possible to produce fruit. The
strategy should always be to take good care of the trees at all times – don’t get
captured up in adjusting grove care to reflect the apparent size of the crop. Healthy
trees will simply produce more fruit, no matter what happens with weather,
growth cycles, and so forth. If the crops from the spring blooms are light in
places, the trees will almost assuredly produce a heavier than normal second
bloom, thereby increasing the overall fruit production for the year.

IV. Repeated Blooming + Healthier, Larger Trees + High Percentage of Fruit Set
= More Fruit in 2007

The combination of all of the
above factors should result in
higher fruit production from
the groves as a whole for the
2007-08 crop. The younger
trees in Pica-Pica, Polencin,
and Reyes have grown rapidly
in the last year, and all of them
are carrying fruit. Many have
heavy crops since, as younger
trees, they are not as affected
by alternate bearing cycles.
Plus, they will probably
produce a good second crop
from the summer bloom.

These trees will make a very
significant contribution to the
total fruit production this year.

There are blocks, particularly
in Santa Rosa, in which fruit production will be much lower than in 2006. Most
are blocks where the trees had outgrown their allotted space so were heavily
pruned. Where this occurred, a large part of the bearing surface was removed, so
flowering and fruit set is very light to nonexistent. These trees will recover
rapidly, and with the maintenance of a good pruning program, will resume heavy
fruit production in the coming year.

Finally, there are many trees where the amount of fruit set per cubic meter of
canopy volume is certainly less than last year. However, these trees have grown
larger in the last year as well, so the canopy volume has increased. More than
likely, the production per hectare from these trees will not drop as much as it might appear, and will probably increase over last year.

From the overall standpoint, the improvement in appearance of the trees is truly dramatic. They are lemon trees, and lemons will produce fruit if they are healthy. More hectares of Agros Citricos trees have increased in size and productivity than were pruned heavily to restore containment. Therefore, the yields of Agros Citricos will in all probability increase over last year, and will increase even more dramatically in the following year as the “on” part of the bearing cycle occurs, provided that grove care remains as effective as it has been in the last year. The production increases are basically on track with last year’s prediction.

V. A Note on Harvesting

The multiple blooms will have a bearing on harvesting operation. If the pickers remove too many undeveloped fruit during harvesting, yields will suffer (although oil content per kilo may increase). Also, the volume of fruit that matures after the typical first harvest period will probably be more than usual. Therefore, the harvesting operation will
need to be scheduled and supervised in ways that allow developing fruit to remain on the trees until the optimal size has been reached to maximize yields.

VI. Program Development

There are a number of efforts under way to improve the grove care programs even further. The most significant involve fertilization and pruning.

Fertilizer Program

There is much potential for development of the fertilizer program for Agros Citricos. Factors that will affect the annual programs are:

- As the younger trees grow, the roots continually invade new soil, so young trees have access to the natural fertility. After the trees reach containment size, their roots will distribute throughout the soil area. Therefore, an adjustment in fertilization may be necessary to reflect this change.
- The trees in Agros Citricos are very vigorous – much more so than in other lemon growing areas of the world or even Mexico. Therefore, the fertilizer program must assist with balancing vegetative growth with reproductive cycles and fruit maturation.
- As the Greasy Spot has been brought under control, the trees are retaining leaves for a much longer period of time. When leaves dropped prematurely, the nutrients stored in them were lost. Now, since trees have more leaves, the nutrition balance will be different.

In order to begin an examination of fertilizer programs, an area of Reyes has been devoted to fertilizer program experiments. Next to an area of the grove that was fertilized normally, the team set aside a small area where fertilizer was applied at double the normal rate, and one where no fertilizer was applied at all. These three areas were examined, and the result to date is that the area with the normal rate has the most fruit set and good leaf development. The trees in the area with double the rate are excessively vigorous, with extreme growth of long shoots in the tops of the trees, and relatively light fruit crop. This area was pruned more heavily than the other two in 2006 as well. The area with no fertilizer has less fruit and leaves than either of the fertilized treatments.
This experiment basically confirmed that the existing fertilizer program as designed and performed is appropriate for the groves. There was nothing to indicate that adjustments are necessary. The experimental treatments will continue through this year to observe the longer-term effects, however.

**Pruning**

In some areas with the best soil in Santa Rosa, trees had grown so much that they were meeting in the middle. While they produced the largest crops of lemons in 2006-07, the situation is untenable because it is impossible to travel down the rows.

In late 2006, the trees in these areas were pruned back to the normal containment size of trees in a mature grove. In doing so, most of the bearing surface was removed. The response was to re-grow rapidly in the tops of the trees, which quickly shaded out the centers. So, there are very few leaves on the insides of the trees, and fruit production is low. The situation is similar to the trees receiving the high rate of fertilizer in Reyes.

In some blocks of Santa Rosa last fall where the trees had grown into the centers of the rows, every other middle was pruned, leaving bearing surfaces untouched on the alternate middles. In these areas, there is a good crop of fruit in the unpruned middles – perhaps heavier than normal. In the pruned middles where the bearing surface was removed, there is almost no fruit. This year after harvest, both middles will be pruned so that they can both resume full production. We will continue to observe this area to evaluate the feasibility of this approach. This situation may occur again, despite best efforts, since the trees in Agros Citricos groves are very vigorous.

Growers in other areas of the world use a hand-pruning method in which major limbs of the trees are removed 1.5-2 m from the ground in such a way that the tops of the trees are opened to allow sunlight to penetrate the interior of the tree. The sunlight penetration stimulates inside growth, which is more fruitful. Two approaches were defined at Agros Citricos this trip to experiment with possible ways to achieve this effect.
In Santa Rosa, the Team will hand-prune 5 rows of trees using the open center method. A representative tree in Santa Rosa Limoneira Section 1, Block 3, Row 4, Tree 2 North was identified as an example in the block where the experiment is to take place.

In the double-fertilizer block in Reyes, there are many more leaves in the lower outside of the tree since the sides were not pruned heavily recently. Therefore, the Team will use a machine on 10 rows and “top” the trees down to 3 meters, which will remove virtually all of the vigorous upper shoots and hopefully open up the center of the trees. The experiment is to see whether topping back to larger branches will allow inside growth to develop before top growth again shades out the centers. To compare, 5 rows each of the normal fertilizer and no fertilizer treatments will be pruned in the same way.

Both of these approaches are designed to improve the productive capacity of trees that have filled their allotted space in the grove, thereby increasing the production potential over the long term. Therefore, the outcome will be important in subsequent years.

In the meantime, the blocks that require more severe pruning to restore the trees to their containment size should be pruned as soon as possible after harvest. This will allow regrowth early enough in the summer to obtain some fruit production the following year. If these larger trees are pruned late in the season, the regrowth will occur too late to develop flowers the following year.

A summary of the pruning prioritization would be as follows:

1. First, separate blocks into those that have a heavy Summer Bloom crop from those that have a light Summer Bloom crop. Blocks with a heavy
Summer Bloom crop should not be pruned until after the fruit is picked in January or February.

2. Then, for the blocks that have a light Summer Bloom crop, separate them into blocks that require heavy pruning vs. those that need only light pruning.

3. Of the blocks that require heavy pruning, separate them into blocks that have grown together in the middles vs. those that need to be pruned to lower the height.

4. Immediately after harvest of the main crop in these blocks, start pruning those that require heavy pruning. For blocks that have grown together in the middle, prune only one side of the trees. For blocks that were pruned the prior year on only one side, prune both sides and the top if necessary. For blocks that require heavy pruning to lower the trees, prune the middles first, then prune the tops.

5. After the blocks are completed that require heavy pruning, move to the blocks that require less pruning, and prune both middles and tops. Try to have these completed by late October. By graduating steadily towards blocks where pruning is less severe, the disruption of flower bud induction will be less as the late October period is approached.

6. From late October through the winter, perform light pruning with machines and hand pruning of sprouts where necessary. This is a good time to remove vigorous top shoots. Light pruning of middles of younger blocks can also be done at this time without interfering with production.

7. Finally, after the Summer Bloom fruit is picked, prune the blocks that were postponed in the spring only if it is required – otherwise delay pruning until the fall after the next main crop is picked. If spring pruning is required, it is not necessary to stop during flowering. Continued light pruning can also be performed in the spring.

Lemons require a lot of pruning. Basically, pruning can be performed throughout the year except during the summer, when wet middles impede travel of the machines. Light pruning, regardless of the time of year when it is performed, will not affect fruit production. Heavy pruning, again regardless of the time of year it is performed, will always reduce fruit production in the following year. Therefore, timely pruning is essential, and will become more of a challenge in the future as more trees reach their containment size. Also, good Greasy Spot control and aggressive fertilization to increase production will promote very vigorous growth, which will amplify the consequences of delayed pruning.

VII. Team Development

The Agros Citricos Team has greatly improved in their capability and understanding over the past year. The excellent appearance the trees is entirely due to timely fertilizer and spray applications, and improved effectiveness of other production practices.
In 2005, the production program was initially developed for the first time with full Team involvement. Discussions about the various practices during the year led to a program tailored to the Agros Citricos groves.

In 2006, “program performance” was the theme. The objective was to follow the various program practices on a timely basis to achieve the desired effectiveness of each individual program. The dramatic improvement of the trees indicates that the Team committed themselves to this goal, and it was achieved.

In 2007, “program integration” should be the objective. The next step in Team development would be to improve the way that the various program components are integrated together to create a “flow” of people, materials, and equipment that transitions smoothly from one program to the next throughout the growing and harvesting periods. The fact that they accomplished such a significant advancement last year shows clearly that they are now ready to move things to the next level.

The transition from a situation where groves were marginally productive to a situation where high fruit production will continue now and in the future, and then to one where profit becomes the primary objective, is a realistic and achievable goal at this point. However, if we had only focused on profit in the beginning, the Team could not have grown as they have – their issues were more basic in nature than balancing cost vs. income.

By focusing on the issues at the most fundamental level, we have been able to gradually build an informed, capable Team. Their commitment to success is obvious – their advancements this year were the result of hard work and diligence. They now have the assurance that they are capable of managing the groves in a way that the trees will be vigorous, healthy, and productive - this is no longer a question - and it is potentially a significant source of power for them. Their performance proved that it is possible for them to operate at the levels necessary to achieve success.
Therefore, the time is right to focus on integration of practices in ways that will additionally elevate the amount of fruit produced even further while improving the cost:benefit ratio. That will result in the advancement of profit along with production – the ultimate goal. This can only be achieved by continuing to work with the Team in ways that deepen their understanding and capabilities.

VIII. Summary

Greasy Spot control must still be the primary focus. The spray program to control Greasy Spot was proven this year, and the level of control now makes it possible to focus on other aspects of the production program. However, it is not a one-time event.

Greasy Spot will remain the central issue throughout the life of the Agros Citricos groves. The disease cannot be eradicated or suppressed. The only possible approach is to protect the leaves from infection with well-timed copper sprays. Therefore, full support must be provided to continued maintenance of the level of control achieved this year.

As the trees grow, more tanks of spray will be necessary, which will stretch the equipment and labor capabilities, so good equipment maintenance and replacement programs should be established. Also, the record-keeping and reporting initiated last year should be continued in order to reveal possible timing issues throughout the control season.

The Team proved themselves last year, and the trees show the results. The Team is ready for the next level of management development, which is integration of program management. Since they have proven that they are capable of managing concurrent programs, integration should receive the focus for this year. The question should be, how can the Team supervise and support multiple operations effectively?

The overall appearance of the trees is remarkably better than it has ever been, and the trees basically improved as much as they could over the last year. However, the productivity of the trees is not as good as it ultimately can be, so continued improvement is possible and necessary. Since the program results are based primarily on the choices of individuals on The Team as well as the tools that are provided to them, additional incremental gains in management capabilities will be the primary determining factor in the future advancement of the business, provided that they are supplied with the proper information, equipment, and other means of support.