Overall report-Egypt Assignment- April 28-May 11, 2012

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Pruning

Proper control of vegetative growth is essential for the maintenance of healthy, productive citrus groves. Even though citrus trees can tolerate shade and still flower and fruit, maximum flowering occurs when leaves are fully exposed to the sun. Therefore, pruning to avoid crowding is extremely important for optimum flowering. The amount of fruit that is set has a very significant effect on fruit quality. There is a positive correlation between the number of fruit per tree and fruit quality. When the number of fruit per tree is low, the peel texture, shape of fruit, and often fruit color are poor. Quality of individual fruit varies significantly, even on the same tree. Inside heavily shaded fruit have less total soluble solid than outside exposed fruit. Insufficient light contributes to reduced total soluble solid concentration of inside fruit nourished by heavily shaded leaves. Pruning is also an important factor affecting fruit production and quality. Crowded conditions result in poor light and reduction in fruit yield, size, and external quality. Therefore, good management dictates the need to prune before the occurrence of these undesirable effects. It is well established that shoots with fruit do not flower the following year. A heavy fruit crop tends to deplete carbohydrates and results in a small crop and increased vegetative growth the following year. Pruning after a heavy crop additionally stimulates vegetative growth and reduces fruit yield the following year. Pruning after a light crop and before an expected heavy crop can increase fruit size and help reduce alternate bearing problem. Pruning usually increase fruit size and packout of fresh-market fruit by reducing cropload, thus increasing net cash returns to growers. When pruning should begin will depend on tree spacing. Good results have been obtained when done in late winter. Pruning can delay fruiting of young, nonbearing trees.

Growth regulators

Application of plant growth regulators in appropriate situations can provide significant economic advantages to citrus growers. Depending on cultivar and timing, plant growth regulators may improve fruit set, increase fruit size by reducing cropload, extend the harvest season by delaying rind aging, and reduce preharvest fruit drop. Gibberellic acid (GA) is recommended for citrus hybrids that are weakly parthenocarpic and without sufficient cross-pollination to improve fruit set. Applied from full bloom to two-third petal fall, GA can effectively set and produce an excellent crop of seedless Robinson, Orlando, Minneola, or other self-incompatible mandarin hybrids. Applied in winter during floral induction to cultivars that routinely flower heavily but set poor crops such as navel, Ambersweet, and Ortanique, GA reduces flowering and often results in increased fruit set. Application of GA to citrus fruit approaching maturity enhances peel firmness and delay peel senescence. Naphthalene acetic acid (NAA) is used to reduce excessive fruit set. The advantage of NAA thinning in heavily cropping trees is increased fruit size. The greatest response has been shown when the average fruit diameter is around 1 cm (6 to 8 weeks postbloom). Thinning of Murcott and other tangerine varieties with NAA was found to increase fruit size and percent packout and balance alternate bearing.

Resetting

For maximum efficiency of a grove, it is essential that every tree location is occupied by a tree and that every tree be healthy. Prompt replacement of dead and declining trees means higher average long-term returns from the grove. If the declining trees remain in the grove, they keep getting weaker and yield less fruit each year and therefore the potential production capacity for the grove keeps declining even though production costs remain the same. It is very important to remove and replace such trees once it is clear that they are declining and they are not profitable. However, the reason for the decline should be found and the condition should be

corrected so that the replacement tree does not suffer the same fate. Resetting in a mature grove seems justified only when a minimum of 2.5 m between canopy driplines, not from trunk-to-trunk, is available for canopy development of the new trees. Resets should be watered, fertilized, protected from pests and diseases, and weeded regularly. Because of their frequent flushing cycles, young trees are more sensitive and more attractive to pests than mature trees. Therefore, special care is needed for resets.

Irrigation of citrus trees

Citrus trees can't grow and produce fruit in the desert without frequent irrigation. Irrigation is of particular importance during the February-May period, which coincides with the critical stages of leaf expansion, bloom, fruit set, and fruit enlargement. Growers should accurately determine when and for how long to irrigate. جدول ري سليم With proper irrigation scheduling, tree growth and fruit yield will not be limited by water stress or water excess. If trees are stressed in the spring, leaf drop can be severe and young fruit will fall off and thus reduce yield.

Citrus water requirement or evapotranspiration (ET)

Daily average ET for citrus varies from 2 to 5 mm/day from winter to summer. On some clear, high radiation, hot days, ET can be as high as 6 mm/day for large trees. ET = 8,000 – 20,000 liters/acre/day
Large citrus trees may use up to 150 liters/day in July and August. Devices for monitoring soil moisture are available. أجهزة لرصد رطوبة التربة Among them, are tensiometers and capacitance probes. When placed in the plant root zone حيث توجد الجذور أكثر نشاطا, they indicate the soil water status that plants are experiencing.
90% of feeder roots are in the top 50 cm. Water from drip system wets only a small portion of root system in sandy soils. Irrigation coverage is important in reducing stress in sandy soils. Don't overirrigate. In the fall and winter, don't start irrigating until 50 to 66% depletion of the available water. In spring, irrigate at 25 to 33% depletion. Know irrigation requirements of grove and soil. Use tensiometers or some soil measuring device. Running irrigation system for a long time (>6 hours) may drive water below the main root zone and wastes water. Consider partial deficit irrigation in winter. Mild water stress in winter can help improve flower induction. Temporary leaf wilt at midday is acceptable. However, excessive stress can weaken the tree and reduce cold hardiness. Provide good coverage under the tree canopy

Nutrition of citrus trees

Nitrogen (N) and potassium (K) are the most important nutrients for citrus trees. An adequate level of N is required for vegetative growth, flowering, and fruit yield. K also plays an important role in determining yield **الإنتاجية**fruit size, and quality (الجودة). Fertilizer ratios نسبة of N to K_2O are usually 1:1. However, a ratio of 1:1.25 is recommended for high pH or calcareous soils الحموضة العالية أو التربة الجيرية
Leaf sampling and analysis is a useful management tool for fertilizer decisions and for adjusting fertilizer programs.أخذ العينات والتحليل هو أداة مفيدة لاتخاذ قرارات الأسمدة
Optimum growth and yield of high quality fruit cannot be obtained without adequate nutrition. The most successful fertilizer program should be based on tissue analysis, knowledge of soil nutrient status through soil analysis. The deficiency or excess of an element will cause disturbance in plant metabolism and lead to poor performance.
Plant analysis has proven useful in confirming nutritional deficiencies, toxicities or imbalances, identifying "hidden" toxicities and deficiencies where visible symptoms are not manifested, and evaluating the effectiveness of fertilizer programs. However, if initial plant sampling, handling, and analysis of samples were faulty, the results would be misleading. If properly done, leaf analysis can point the way toward more economical and efficient use of fertilizer materials, avoiding excessive or inadequate application rates.
For more details, consult UF-IFAS publication SL 253, "nutrition of Florida citrus trees," at http://edis.ifas.ufl.edu/pdffiles/ss/ss47800.pdf

Leaf analysis standard for assessing current nutrient status of citrus trees based on concentration of mineral elements in 4- to 6-month-old-spring-cycle leaves from non-fruiting terminals.

Element	Deficient Less than	Low	Satisfactory	High	Excess More than
Nitrogen (N) (%)	2.2	2.2-2.4	**2.5-2.8**	2.9-3.2	3.3
Phosphorus (P) (%)	0.09	0.09-0.11	**0.12-0.17**	0.18-0.29	0.30
Potassium (K) (%)	0.7	0.7-1.1	**1.2-1.7**	1.8-2.3	2.4
Calcium (Ca) (%)	1.5	1.5-2.9	**3.0-5.0**	5.1-6.9	7.0
Magnesium (Mg) (%)	0.20	0.20-0.29	**0.30-0.50**	0.51-0.70	0.80
Sulfur (S) (%)	0.14	0.14-0.19	**0.20-0.40**	0.41-0.60	0.60
Chlorine (Cl) (%)	------	------	**Less than 0.5**	0.5-0.7	0.7
Sodium (Na) (%)	------	------	**Less than 0.2**	0.2-0.5	0.5
Iron (Fe) (ppm)	35	35-59	**60-120**	121-200	250
Boron (B) (ppm)	20	20-35	**36-100**	101-200	250
Manganese (Mn) (ppm)	18	18-24	**25-100**	101-300	500
Zinc (Zn) (ppm)	18	18-24	**25-100**	101-300	300
Copper (Cu) (ppm)	4	4-5	**6-16**	17-20	20
Molybdenum (Mo) (ppm)	0.06	0.06-0.09	**0.1-1.0**	2-50	50

Soil analysis is useful for determining the pH and concentrations of phosphorous (P), calcium (Ca) and magnesium (Mg). تحليل التربة مفيد لتحديد درجة الحموضة

Leaf analysis provides the best available guidelines for managing citrus nutritional programs. If soil test P is in the low-medium range, apply P fertilizer at a P_2O_5 rate up to 50% of the N rate. If soil test Mg is medium or lower, apply Mg fertilizer at a rate equal to 20-25% of the N rate. Numerous N rates and timing studies were conducted by scientists (علماء وباحثين) over many years under a wide range of soil types, tree ages, varieties, and rootstocks, and cultural conditions, the results showed: N rates in excess of 90 kg/acre were not justified, except for very productive groves. Excess N could reduce yield. 2/3 to ¾ of the tree's nutritional requirements should be made available between February and early June, with most of it in place during flowering and fruit-setting period. The remaining portion can be applied in Sept.-Oct. Fertilizers can be applied dry on the soil, through the irrigation system (fertigation(الرسمدة) and foliarly. Fertigation (application of fertilizer through irrigation systems directly to the root zone وضع الأسمدة من خلال نظام الري has been widely adopted by growers. This is very good. Water and fertilizer use efficiencies are increased and water, fertilizer, leaching of chemicals, and negative environmental impact are significantly reduced وتخفيض التلوث البيئي

Advantages of fertigation: مزايا

Substantial labor and time savings توفير اليد العاملة و الوقت

Nutrients are already in solution. They are available to plants sooner than when applied dry on the soil surface. Increased fertilizer efficiency فعالية وكفاءة and reduced environmental pollution وتخفيض التلوث البيئي through multiple applications of small doses. Fertilizers are placed in the wetted areas of the root zone where the most active roots are located. حيث توجد الجذورالأكثر نشاطا

Nutrients can be applied precisely when needed and at the amounts needed with time clocks or computers. Luxury consumption of nutrients by trees is minimized. ترف استهلاك

Fertigation requirements متطلبات

Extra equipment (filter, injection device, tank, backflow prevention device) must be added to the irrigation system..لمياه الري) يجب أن تضاف معدات (التصفية ، جهاز الحقن، وجهاز منع ارتجاعي Need a properly designed irrigation system that provides uniform water distribution. يجب أن يصمم نظام الري بشكل صحيح
توزيع لمياه الري موحد

Injected fertilizers must be soluble and must remain in solution throughout the operating period of the irrigation system.

Foliar feeding

When properly conducted, foliar fertilization was found to increase yield, enhance fruit quality, الجودة provide drought tolerance, and improve tolerance to diseases and pests. .تحسين مقاومة الأمراض والآفات
In sandy and calcareous soils, foliar applied fertilizers are 4 to 20 times more effective when compared with soil applied fertilizers. Foliar sprays of micronutrients (Mn, Zn, B, and Cu والنحاس) are a more effective, more economical, and a quicker way to supply these nutrients than soil application (when included with postbloom foliar sprays at about full expansion of the new flush). Sulfate forms are less expensive and nitrate forms appear to facilitate the uptake of micronutrients.

Foliar nutrition makes sense when soil conditions prevent nutrient uptake, when small amounts of nutrients are needed which makes ground application inefficient كميات صغيرة من المواد الغذائية مما يجعل وضعها على الأرض غير فعال when nutrients are not mobile in the tree, when transient deficiency نقص عابر , when nutrients are needed fast, and when application is profitable مربحة

Effect of foliar urea

Foliar applications of low-biuret urea (10 kg N/acre) in late Dec-early Jan (6-8 weeks before bloom) have been known to increase flowering, fruit set, and fruit yield.

Effect of additional foliar potassium

Postbloom foliar applications of potassium nitrate or mono-potassium phosphate (4 kg/acre K_2O) in late April have been found to increase fruit size and yield.

Calcareous soils

Calcareous soils are alkaline (have pH values greater than 7) because of the presence of free $CaCO_3$. Calcium carbonate ($CaCO_3$) can occur naturally in soils or can be added with alkaline irrigation water. Special nutritional management is required to grow citrus successfully on calcareous soils. The presence of $CaCO_3$ affects the availability of almost all nutrients.

Nitrogen (N)

Applying a portion of the required N fertilizer foliarly (urea, potassium nitrate, calcium nitrate) will improve the N status. Applying N with irrigation water (fertigation) and scheduling irrigation to maintain the N in the root zone is a sound method to reduce N leaching losses.

Phosphorus (P), potassium (K) & magnesium (Mg)

In cases where soil-applied fertilizer is ineffective, the only means of increasing leaf K and Mg concentration is through foliar application of water-soluble fertilizers, such as potassium nitrate, monopotassium phosphate, or magnesium nitrate. A solution of 8 kg KNO_3 per 400 liters of water has been shown to raise leaf K, especially if applied two or three times during the year. For citrus on calcareous soils, apply nitrogen and potassium fertilizer at a 1N:1.25 K_2O ratio.

Zinc (Zn) & manganese (Mn)

On alkaline (high) pH soils, soil applications of Zn and Mn fertilizers are ineffective. The least expensive way to correct effectively Zn and Mn deficiencies is through foliar sprays. Regardless of the form of carrier or chelate applied.

Iron (Fe)

Iron is considerably less soluble than Zn or Mn in high pH soils. Thus, inorganic Fe contributes relatively little to the Fe nutrition of plants on calcareous soils. Existing Fe chlorosis can be corrected through soil application of Fe chelates. Foliar application of iron compounds has not proven satisfactory on citrus trees because of poor translocation within the leaf. Furthermore, foliar sprays of Fe have the possibility to cause fruit and leaf burn.

Iron chelates	**effective ph range**
Fe-EDTA	4 to 6.5
Fe-HEDTA	4 to 6.5
Fe-DTPA	4 to 7.5
Fe-EDDHA	4 to 9.0

Sulfur (S) products used as soil amendments

Soil acidulents can improve nutrient availability in calcareous soils by decreasing the soil pH. Soils with visible lime rock or shell in the root zone would require repeated applications of a high rate of acidulent. Examples of S-containing acidulents include elemental sulfur (S) and sulfuric acid (H_2SO_4). These compounds act to neutralize $CaCO_3$ with acid. Ammonium sulfate [$(NH_4)_2SO_4$] acidifies the soil by converting NH_4^+ to NO_3^- during nitrification. The sulfate ion (SO_4^{2-}) alone possesses no acidifying power. Elemental S is the most effective soil acidulent. Although not an acidic material itself, finely ground elemental S is converted quickly to sulfuric acid in the soil through microbial action.

Summary of citrus nutrition on calcareous soils

1. Calcareous soils are alkaline because they contain free $CaCO_3$.

2. The availability of N, P, K, Mg, Mn, Zn, and Fe to citrus trees decreases when soil $CaCO_3$ concentration increases to more than 3% by weight. These soils generally have a pH value in the range of 7.6 to 8.3.

3. To avoid ammonia volatilization, fertilizers containing ammonium-N or urea should be moved into the root zone with irrigation, or be incorporated into the soil.

4. The least expensive and most effective way to correct Zn and Mn deficiencies of fruit trees is through foliar application of inorganic or organic chelated forms.

5. The easiest way to avoid lime-induced Fe chlorosis is to plant trees budded on tolerant rootstocks to calcareous and high pH soils.

6. The most effective remedy for lime-induced Fe chlorosis on non-tolerant rootstocks involves the use of chelated Fe.

7. Sulfur products that act as soil acidulents can potentially improve nutrient availability in calcareous soils.

$CaCO_3$ neutralizing power of several sulfur sources

Sulfur source	**Amount needed to neutralize 1,000 kg $CaCO_3$**
Elemental sulfur	320 kg
Concentrated sulfuric acid (66° baume)	260 liters
Ammonium sulfate 21-0-0-24s	900 kg

Management practices to improve fertilizer efficiency

♦ Adjustment of N rates based on expected fruit yield and guided by leaf analysis data.
♦ Selection of fertilizer formulation to match existing conditions.
♦ Careful placement of fertilizer within the root zone.
♦ Split application fertilizer amounts, fertigate more frequently and use good irrigation management to increase maximize fruit production and minimize leaching.

For more details, consult UF-IFAS publication SL 253, "Nutrition of Florida Citrus Trees," at http://edis.ifas.ufl.edu/pdffiles/ss/ss47800.pdf

Citrus budwood certification

The citrus budwood certification program in Egypt is needed to control graft transmitted diseases, their rate of spread, and prevent the introduction of new diseases into Egypt.
The budwood program has at least two purposes:
1) Elimination of detrimental virus diseases
2) Selection of outstanding parent trees to improve yield and fruit quality.

Cultivar/rootstock

The most important determinant of fruit production and quality under the control of the grower is the selected cultivar (variety).

Beside the cultivar, many horticultural characteristics are influenced by the rootstock including tree vigor and size, fruit yield, fruit size, maturity date, and fruit quality. One of the best known examples is the small fruit size of 'Valencia' budded on Cleopatra mandarin rootstock. Cleopatra mandarin is well suited for use with tangerines, Temple orange and tangerine hybrids. Cleo is not widely used for grapefruit and 'Valencia'. Sweet orange and grapefruit cultivars on Cleo generally produce small fruit and are not precocious. Low yield results from poor fruit set and size and fruit splitting. Scions on Cleo are most productive on heavier soils. Larger fruit with thicker, rougher peel, and lower concentrations of soluble solids and acids in the juice are generally associated with cultivars budded on fast-growing vigorous rootstocks such as Volkamer lemon. However, this rootstock imparts high vigor to the scion and induce high yield. Tangerine fruit from trees grown on vigorous rootstocks tends to be puffy, hold poorly on the tree, and have high incidence of granulation.

Purpose and importance of rootstocks

Reduction in juvenility. Trees grown from seeds are slow to bear fruit, do not fruit regularly and uniformly, and may not be true to type.
Environmental adaptation. Citrus rootstocks differ in their tolerance to various soil factors, pests, diseases, and environmental stresses (drought, flooding, salinity).
Horticultural adaptation. Rootstocks affect tree water relations, mineral nutrition, growth, fruit production, and fruit quality.
Rootstocks have favorable effect on fruit yield, tree size, fruit sweetness, fruit size/shape, tree anchorage, tree longevity, and more benefits.

Scion-rootstock compatibility

Murcott (honey tangerine) trees may not be compatible with Carrizo citrange rootstock and may decline or die in less than 10 years with a budunion disorder. Lemon trees may also decline at young age when budded on trifoliate orange hybrids such as Carrizo citrange and Swingle citrumelo. Some incompatibility can be virus induced. Therefore, always plant registered, certified trees that are healthy and clean of viruses.

Advantages and disadvantages of several citrus rootstocks

Citrus volkamerina
"Volk" is a lemon hybrid
Poor fruit quality (low sugars and acids)
Poor cold tolerance
Susceptible to blight and nematodes
Not susceptible to tristeza and exocortis

Vigorous tree with high fruit yield

Rangpur (*Citrus reticulata hybrid*)
Used as a lime substitute in some countries
Similar to rough and volkamer lemons, but sensitive to exocortis and tolerant to salinity.
Sensitive to blight, nematodes, and cold
Drought, salt and tristeza tolerant
Not popular in florida, but #1 in brazil

Sour orange (*C. Aurantium*)
Tolerant to phytophthora, cold weather, citrus blight, exocortis, salinity, high pH and calcareous soil
Intermediate in drought tolerance, flood tolerance, tree vigor, yield, fruit size
Sensitive to citrus tristeza virus

Smooth Flat Seville
Formerly known as Australian sour orange.
A sour orange-pummelo hybrid?
Tolerant to blight, tristeza, exocortis, phytophthora, calcareous alkaline, and clay soils
Intermediate tree size
Fruit yield and juice quality are slightly lower than sour orange

Kinkoji
Similar to Smooth Flat Seville
Tolerant to flooding and clay soils, but intermediate tolerance to high pH soils
Tolerant to tristeza, phytophthora, and exocortis
Intermediate tree size, yield, juice quality and fruit size
Sensitive to nematodes

Sun Chu Sha mandarin
From China
Seems to be tolerant to blight, tristeza, freeze, drought, high pH, and clay soils
Large tree and good yield
Very good juice quality that is similar to Cleopatra mandarin, sour orange, Carrizo citrange, and Smooth Flat Seville
Sensitive to phytophthora and nematodes

US-812
Hybrid of Sunki mandarin and trifoliate orange
Tolerant to blight, tristeza, nematodes, phytophthora, freeze, high ph and calcareous soils
Intermediate tree size, but with high yield and very good fruit quality

US-942
Hybrid of Sunki mandarin and trifoliate orange
Good soil adaptability and tolerance to tristeza, blight, and phytophthora
High productivity. Better yield than Carrizo, US-802, US-812, US-897, Swingle, and Sun Chu Sha
Very good juice quality. Better juice quality than Swingle, Carrizo and Sun Chu Sha.
Small tree size

Scouting for pests & diseases
The Egyptian citrus industry should use integrated pest management (IPM) strategies. IPM depends on grove scouting and close observations to determine the need and timing for pesticide applications as well as

modification of cultural practices to minimize damage. Scouting for early warnings of pests and diseases is very important in citrus operation. Scouting not only helps growers control pests more efficiently, but also lowers the use of pesticides and the chances of pesticide resistance. Use a common sense approach to solve the problem at its source. Use exclusion methods, improved sanitation, and good security and sanitation measures to prevent pest or disease introductions to Egypt and from one area to another area within Egypt. As an example, use pheromone traps and other kind of traps such as yellow sticky traps to detect entrance of and capture new exotic pests including adult psyllids which are the vector of the citrus greening disease.

Citrus canker

Citrus canker, caused by a bacterial pathogen *Xanthomonas axonopodis*, is a serious disease of most citrus varieties. The disease causes necrotic lesions on leaves, stems, and fruit. Severe infestation can cause defoliation, premature fruit drop, twig dieback, general tree decline, and very bad blemishes on fruit. Citrus canker is highly contagious. Movement of infected or exposed trees, seedlings, propagative material, and fruit is the primary means of spreading the canker pathogen over long distances. Contaminated clothing, tools, ladders, containers and fruit boxes, and other items associated with harvesting and postharvest handling of fruit are also potential sources of infection.

The following practices can reduce canker spread and severity: frequent inspection, copper sprays, windbreaks, leafminer control with systemic insecticides, spray oils and/or other insecticides, especially on young trees (up to 4 years)

Sanitation is very important. Quaternary ammonium disinfectants are available for use on equipment, clothing, and even bare skin.

Citrus greening

Citrus greening or Huanglongbing (yellow shoot disease) is caused by systemic phloem-inhabiting bacterium, *Candidatus* liberobacter. The bacterium infects all citrus species, cultivars and hybrids and some citrus relatives. Symptoms of Asian form are leaf chlorosis with a blotchy mottle. Twig dieback occurs, and the affected trees decline to a non-productive state. Fruit is small, lopsided, with the basal end often remaining green, and the seeds are usually aborted. The fruit has a bitter, salty taste.

Citrus greening is graft transmissible. The distribution of the bacterium within an infected tree can be irregular so not all buds contain the bacterium or transmit the disease. Citrus greening bacteria are transmitted by the citrus psyllid. The Asian citrus psyllids, *Diaphorina citri*, is adapted to warm humid climates and occurs in many areas. The best control for citrus greening is exclusion. It may take a while before citrus greening infections are noticed. Bacterium may be undetectable in tissues without symptoms and incubation time may be long. After infection, it may take more than 3 years for the visual symptoms to show up. Citrus greening is one of the most destructive diseases of citrus. Once established, the management of the disease to achieve continued production of citrus is difficult and expensive. Citrus greening can rapidly destroy productive citrus plantings. If trees are infected while young, they often have no fruit production.

Problems with citrus greening: Defoliation, dieback, premature fruit drop, low yield, small leaves, fruit with bitter taste

Threat to Egypt?

Susceptible citrus varieties? Yes

Presence of the citrus psyllid? No

Ability to easily detect? No. Bacterium may be undetectable in tissues without symptoms. After infection, it may take more than 3 years for the visual symptoms to show up. Foliar symptoms can be confused with symptoms caused by nutritional deficiencies or other disorders.

Thrips

Flower thrips, *Frankliniella bispinosa* and *f. Kelliae*, have been identified as causing injury to developing flowers of navel and Valencia oranges. Damage can result in abortion of the flower or small fruitlet. High populations of these thrips can cause economic loss in navel or Valencia orange by reducing fruit set.

Examine groves during flowering at least twice each week to identify periods when high populations of thrips (i.e., *frankliniella* spp.) are migrating into the trees. Timing of one pesticide application to protect the major flowering period between maximum bud swell and full bloom should be considered when thrips are abundant. Remember, the recommended insecticides are toxic to honeybees, which also are active around citrus blooms. The orchid thrips (*Chaetanaphothrips orchidii* and *Danothrips trifasciatus*) and the greenhouse thrips (*Heliothrips haemorrhoidalis*) cause rind blemish problems on developing fruit (i.e., ring spotting or irregular russeting) on immature clustered fruit or where a leaf or twig is in direct contact with a fruit.
Adult citrus thrips are small, orange-yellow insects with fringed wings. They feed actively on tender leaves and fruit, especially under the sepals of young fruit. When monitoring citrus thrips, you must be able to distinguish them from flower thrips, which feed on flower parts. Citrus thrips is of greatest economic importance on navel oranges and lemons. On fruit, the citrus thrips puncture epidermal cells, leaving scabby, grayish lesions on the rind. Fruit are most susceptible to scarring from shortly after petal fall until they are about 4 cm in diameter. Citrus thrips populations can vary greatly from year to year. Monitor to determine if treatments are needed in a particular year. Navel oranges are more susceptible to damage than are Valencia oranges, which often do not require treatment.

Aphids

The most common aphids in Florida citrus are the green citrus aphid (*Aphis spiraecola*), the cotton or melon aphid (*A. gossypii*), and the brown citrus aphid (*Toxoptera citricida*). Brown citrus aphid is particularly important as a vector of citrus tristeza virus. Aphids are dependent on the availability of newly expanding leaves for their development and reproduction, so these insects may be problems during periods of new citrus growth, primarily spring and fall. Aphids are largely controlled by many generalist natural enemies such as ladybeetles, hoverflies, and lacewings that normally maintain their populations, and those of other flush-feeding insects, below levels that warrant treatment in producing groves. Excessive honeydew accumulation on leaves will result in the growth of sooty mold fungus that blocks light and reduces photosynthetic activity. Treatment is warranted in young groves (< 4 years old) if a large portion (i.e., > 25%) of expanding terminals is infested. Surveys for aphids should be conducted early in flushing cycles when most terminals are still in the feather stage. Systemic materials applied to the soil will give good control with minimal impact on beneficial species, but the time required for uptake of these materials by the tree restricts their usefulness as preventive, rather than responsive, treatments.

Citrus Leafminer

Adults of the citrus leafminer (*Phyllocnistis citrella*) are tiny moths that hide within the canopy during the day and emerge at night to lay eggs individually on young, expanding leaf flushes. The larva emerges directly into the leaf tissue, mining first along the midvein, then back and forth as it makes its way to the leaf margin where pupation occurs. Populations of leafminer build rapidly on the spring flush. Leafminer populations vary with the flushing cycles and subsequent flushes are often severely damaged. On young trees, use of the soil-applied neonicotinoid insecticides is the most effective means of preventing mining damage on the new flush and has little direct effect on natural enemies. Soil drenches directly to the base of the tree with neonicotinoids have been shown to provide up to 12 weeks control of leafminer. Injection through the irrigation system is less effective because a large portion of the material falls beyond the root zone. Compared to soil-applications, foliar-applied insecticides provide a shorter duration of protection lasting only about 2 weeks depending on weather conditions and the uniformity of flush pattern. Soil applications of neonicotinoids should be made about 2 weeks prior to leaf expansion to allow time for the pesticide to move from the roots to the canopy. The only products currently available for leafminer control on large trees are foliar insecticide sprays. While a number of products are effective against this pest, achieving control of leafminer using foliar sprays on large trees is difficult because of the unsynchronized flush typically encountered during summer and fall. However, since leafminers affect only developing leaves, coverage of peripheral leaves in the canopy should be adequate to exert suppression when applying foliar pesticides. Foliar sprays should be timed to coincide with the appearance of the first visible leaf mines that occur immediately following the feather leaf stage or about 13

days after budbreak. At this time, insecticide applications will provide protection for most of the leaves in the new flush.

Weed management in citrus groves

Weeds can reduce the growth, health and survival of young trees, or the time to come into bearing and ultimately fruit production. The more competitive the weeds, the more adversely they alter citrus tree physiology, growth, fruit yield and quality. Weeds alter economic status by competing with trees, particularly young trees, for water, nutrients, and even light in the case of climbing vines, which can easily cover trees if left uncontrolled. Weeds also have various effects on tree performance including reduced efficacy of low volume irrigation systems, and interception of soil-applied pesticides. Be careful about poor weed control. It can sometimes be expected from postemergence applications of herbicides to weeds under stress conditions due to poor uptake and translocation of applied herbicides. For the control of well-established perennial weeds, a postemergence herbicide with systemic metabolic activity should be used with preemergence soil residual products.

For more details on citrus pests and diseases, consult UF-IFAS publication SP 043, "Florida Citrus Pest Management Guide" at
http://edis.ifas.ufl.edu/topic_book_florida_citrus_pest_management_guide

Summary of Recommendations

♦Prune trees to avoid crowding, optimize flowering, increase yield, and improve fruit quality.
♦Application of plant growth regulators in appropriate situations can provide significant economic advantages.
♦Depending on cultivar and timing, plant growth regulators may improve fruit set, increase fruit size, extend the harvest season by delaying rind aging, and reduce preharvest fruit drop.
♦Prompt replacement of dead and declining trees will maximize the efficiency of a grove and will bring about high average long-term returns from the grove.
♦Growers should properly place drip irrigation tubing/lines just inside the driplines of the trees where most of the feeder roots to maximize irrigation efficiency.
♦Growers should accurately determine when and for how long to irrigate their citrus trees.
♦With proper irrigation scheduling, tree growth and fruit yield will not be limited by water stress or water excess.
♦Nitrogen (N) and potassium (K) are the most important nutrients for citrus trees. An adequate level of N is required for vegetative growth, flowering, and fruit yield. K also plays an important role in determining yield fruit size, and quality.
♦Adjust and evaluate the effectiveness of fertilizer programs through leaf analysis.
♦Keep using fertigation, but frequently inspect and maintain properly all components of the irrigation system.
♦Use only soluble fertilizers in fertigation to avoid system clogging.
♦The use of backflow prevention device should be mandatory for fertigation system to avoid water source contamination with fertilizers.
♦Include foliar feeding or foliar nutrition in the fertilizer program.
♦Foliar sprays of micronutrients (Mn, Zn, B, and Cu) are a more effective, more economical, and a quicker way to supply these nutrients than soil application.
♦Foliar applications of low-biuret urea in late Dec-early Jan (6-8 weeks before bloom) have been known to increase flowering, fruit set, and fruit yield.
♦Postbloom foliar applications of potassium nitrate or mono-potassium phosphate in late April have been found to increase fruit size and yield.
♦The easiest way to avoid lime-induced Fe deficiency/chlorosis is to plant trees budded on tolerant rootstocks to calcareous and high pH soils.
♦The most effective remedy for lime-induced Fe deficiency/chlorosis on non-tolerant rootstocks involves the use of chelated Fe.

♦The citrus budwood certification program in Egypt is needed to control graft transmitted diseases and prevent the introduction of new diseases into Egypt.
♦Egyptian citrus growers and nurserymen should experiment and try more citrus rootstocks such as Smooth Flat Seville and Kinkoji as substitutes for sour orange, Sun Chu Sha as a rootstock for tangerines, and US-812 as a rootstock for oranges.
♦The Egyptian citrus industry should use integrated pest management (IPM) strategies. Growers should scout for pests and diseases to determine if there is a need for pesticide application or not.
♦Use exclusion methods, improved sanitation, and good security and sanitation measures to prevent pest or disease introductions in Egypt.
♦Use pheromone traps and yellow sticky traps to detect and capture new exotic pests including adult psyllids which are the vector of the devastating citrus greening disease.
♦Timely management of citrus pests and diseases is very critical to the survival of the Egyptian citrus industry.
♦Properly control weeds, which compete with citrus trees, particularly young trees, for water, nutrients, and light and may increase pest and disease problems.