



Limette

Irrigation

Irrigation is most necessary for citrus plants, in containers even as for orchards.

Commonly citrus is grown in orchards, mostly sandy soils are predominant. These soils permit a good drainage, preventing water clogging conditions and thus root damage. Also those soils heat up much better than heavier soils, but are more prone to heat loss in freezing conditions.

Also those soils loose water more quickly as the soils containing higher amounts of clay or loam.

So light soils require a better and much effective irrigation schedule as in heavier soils, were more humidity is stored in the ground. So we should discuss irrigations systems and schedules first.

Irrigation systems

Well, the oldest irrigation system, or better principle is called flooding. The trees were grown beside channels or on raised beds, sometimes the trees were even grown in channels or flooding pans. Irrigation is scheduled by tensiometer measurements. A Tensiometer is a clay cone, mounted onto a long iron tube, at top a pressure meter is mounted. The tube is then digged deep into the soil, above the ground water table and filled with water. The pressure meter is set to zero. As the amount of humidity drops in the ground, water goes by the osmotic principle through the clay cone into the soil. The sinking water level in the tube makes the pressure meter at top of the tube move. At a defined point below atmospheric pressure irrigation will be scheduled.

In Flooding the water pumps feed the irrigation water to the channels or pans, till these areas are flooded. After that point, irrigation pumps are disactivated and thus letting the water penetrate the soil. Flooding has the disadvantages of being very ineffective. The water penetrates the soil not in uniform manner, the trees can be stressed by flooding, and permit the danger of phytophthora infections. Also very large water amounts are needed.

But those principle has a simple advantage: the large water amounts give a good freeze protection in freezing conditions, but must be counter-weighted to the high phytophthora danger.

The next system is the use of over head sprinklers. We all know these water canons, which rotate in the typical hissing noise, spreading large amounts of water to a radial area. The cannons need less water than flooding, but the irrigations system need more technical preparations. Irrigation tubes must be build up to establish a irrigation line system. Also the sprinklers must be placed well to cover as much area as possible, without to much overlapping or having non-irrigated areas. The system has the disadvantage of covering the trees with water, so commonly the branches, fruit and foliage is wetted by the irrigation, providing favorable conditions for

foliar fungi infections, as even steams and branches can get to wet, favoring phytophthora and other fungal diseases. But as for flooding, these system provides very good freeze protection, because the freezing water gives heat to the air, thus minimizing freezing temperatures in the canopy areas and building up a frost cover, as long as irrigation is not switched off.

Also over head sprinkles make it possible, to inject fertilizers to the system, providing all trees with nutrients, and the covering with water gives a good control of water each area of orchard will get. One of the highest disadvantages is the high maintenance effort for the orchard owner, because personal work is need to repair damages by animals, weather and climatic effects, and the removal of clogging of the sprinkles, which is common because limestone and fertigation salts will precipitate at the sprinkler nose. Also smaller irrigation tubes can be clogged by algal or other microbiological waste in the lines.

A variation is the use of micro sprinkler irrigation systems. As above a irrigation line system must be established before, usually plastic lines were dragged along the planting rows, were the small tubes were connected to. At the end of these small tubes the micro sprinklers were mounted and fixed in the ground under the trees. Usually three up to four sprinklers were mounted for each tree. The spinklers have several available spray patterns, from radial, to 180° and 90° angles, also a single jet is possible. So mounting of the sprinklers is a labor cost work, because the sprinklers must be placed to cover the whole root zone, without wetting the stem, to prevent fungal infections of the stem. Also the smaller sprinklers clog much more easy then the larger over head sprinklers, and provide no frost protection, because provide not enough heat and water mass in the orchard for protection. But they need less water, provide a very effective tree based irrigation schedule, needing less water as all above used systems. Also, several different irrigation line systems can be established, basing onto the ground were the trees were build, so partial irrigation can be done, much better adjusted to the water need in the grove. And with several fertilizer injection point a very good nutrification of the grove can be done, by nearly perfect fertigation.

The last and most effective system is the drip irrigation system. As for micro sprinklers, a plastic irrigation line system is need, where the drip-emitters were attached to. As for the micro-sprinklers the drippers were mounted below the canopy in the root zone, were the largest mass of feeders roots are present. Four to six drip-emitters were mounted, and give water to the



Tensiometer in a Citrus Orchard



Micro-Sprinkler close-up

Bilder nur in Print-Ausgabe

Bilder nur in Print-Ausgabe

ground drop by drop. The water will penetrate the soil, and the water will spread by small soil capillaries thus wetting the soil in the best effective way. Also, these drip-emitters clog as often as the micro-sprinklers, so here redundancy must be provided by mounting more drippers, avoiding unirrigated areas in the root zone. Also labor must be taken, to check emitters and irrigation lines regularly. Also the system is difficult to establish, and most expensive, but use less water and has the highest efficient tree water supply, and with proper fertigation also the nitrification is very best for each tree.

Irrigation in Containers

Nurseries in Citrus producing countries often grow citrus in containers, rather than in field. Because container grown trees do not have the problem of root cutting if the trees must be transplanted, or sold for the orchard planting. So here the trees must be irrigated to, and if irrigation with fertilizer, so called fertigation, can be done without manual labor, this will be preferred. In Field, common irrigation systems can be used, but in Container grown nurseries over Head sprinkler do often wet only floor and foliage, but water will not penetrate the potting media under the foliage, thus watering this way was and is very inefficient. Micro sprinkler remain the best choice, because the different spray pattern, low volume dosage of water and the below foliage mounting make those sprinklers best for the commonly found iron benches in the container nurseries.

Also some irrigation suppliers recommend drip irrigation. Here in Germany the Brandmarks Blumat and Gardena sell equipment for drip irrigation. Blumat uses a self controlled Tensiometer principle, were drippers controlled by tensiometer cones were switched on or off. Gardena focuses on plastic irrigation tubes, which deliver water from a tap or water pump direct to the plant. Drippers were controlled by electronics or on a regular schedules by time controlled valves.

Both systems are not very likely to established in nurseries, were pots and table loads vary within orders and propagation schedule, but for planted greenhouses, or orangeries those systems might be best choice. Here both systems provide very good watering, and take less water than common irrigation by hose or watering can. Also those systems are very expensive, labor cost during establishment, provide in long term less labor and work, also watering schedules are more uniform, with less water draining away.

Both systems can be equipped with fertilizer injection systems, and the Gardena System can be extended with rain sensors and tensiometer sensors, so seem to be best for professional usage, but is expensive.

So usually most citrus trees in containers are waters by hose or watering can, manually. The owner waters his trees depending on visual water stress symptoms, a regular schedule or personal experience. All has advantages and back-draws. While a regular schedule requires a more light, less water holding potting media, the water stress sign schedule on the opposite requires a good water holding potting mixture. So manual irrigation needs experience, and a 'green thumb' for. One who wants to go for this, should be use first light soils, to avoid over-watering, and collecting experience in the water demand of his trees and symptomatic of light water

stress. Also a light potting media will help preventing water-clogging conditions, thus root damage by over-watering. Also he should get experience in checking soil humidity status by forcing his finger deep into the potting media, feeling if the soil needs water or not. Cool, humid feeling mean no water need, while dry, warm conditions show water demand. But this needs also a special kind of experience.

So other irrigation systems, like the Seramis System (See Limette Special No 1.) require also experience, but seem to be a good alternative for other or more expensive irrigation solutions.

Irrigation recommendations

While irrigation systems are recommended for nurseries, greenhouses and orchards, irrigation systems for only a few containers seem to be less needfull.

Irrigations systems should be based onto experience, and drip-irrigation is highest water saving, but commonly most expensive equipment. Followed is micro-sprinkler irrigation systems, because need less labor to establish and need commonly no further adaption to variations in nurseries or greenhouses. Only in Field micro-sprinklers need same labor cost placing efforts as drip-irrigation systems.

For container systems a over head sprinkler system cannot be recommended, only as system for freeze protection this might work.

Watering with watering can or hose require experience, based onto climatic environment and used potting media, and a person should gather the needed experience, to water the trees correct. So a light, good drainage potting mixture is recommended so avoid any root damage. Also light soils heat up much better and cool down much more easy than heavier soils, so even cool water from the irrigation line system can heat up in the pots much quicker in summer, than in heavy soils, same for winter, were the warmer water from the line system can cool down, thus forcing the plant not to much to activity.

Heavier soils need more experience, and cannot really recommended in first place.

With a light soil, irrigation can be done, till water drains from the bottom holes of the pot, but not to much, to avoid leaching of nutrients from the potting mix. So a slow watering, with less water and a prolonged irrigation time will wet the soil much better than giving the pot a large splash or water. The water needs a couple of time to penetrate all parts of the pot, and a large amount will quickly run through to pot, without wetting all the potting media perfectly.

Limette Info

As you may have found in this issue, now pictures are present. Please excuse the delay for this issue, but to get those pictures was difficult and without help of Dr. Robert Krueger from California impossible. So thanks to him, now pictures illustrate the Limette and will help to understand the informations in the issue. Only print issues will have pictures included.

Next Limette will discuss Citrus potting mixtures

Bilder nur in Print-Ausgabe

Irrigation Lines in a Citrus Orchard

Bilder nur in Print-Ausgabe

Fertigation of Container grown Citrus in the Nursery