

Plant management for generative or vegetative steering

Bert Houter & Elly Nederhoff
CropHouse Ltd , New Zealand
Elly@CropHouse.co.nz

Published in the *Grower* 62(5), 2007, p. 42-44

Funded by Horticulture NZ and MAF Sustainable Farming Fund

A good plant balance in greenhouse crops is important because it gives the best results in the long term. Plant balance is often expressed in terms of 'vegetative' or 'generative'. Many factors affect plant balance, and many actions can be taken to steer plant balance. Below we discuss plant management actions that a grower can undertake to correct plant balance. Remember that also other actions are available, e.g. climate control and irrigation control.

Plant balance

The term plant balance describes where plants put their energy in. It can be described in various ways: as the balance between *leaves and fruit*, or between *vegetative and generative*, or between *'source' and 'sink'*. It all has to do with *energy, leaves and fruit per square meter*. 'Source' refers to the amount of assimilates (sugars) that are produced in the leaves due to photosynthesis. 'Sink' refers to absorption of those assimilates in growing organs, such as fruit, plant head, young leaves and roots.

Vegetative and generative

The terms 'vegetative' and 'generative' can only be used for crops that produce flowers and/or fruit. If in a certain period, a plant puts most of its energy into leaves, and not much into fruit, we call this plant vegetative. At another point in time, the same plant can be heavily loaded with fruit, while leaf growth is limited. The plant is then called generative. Too vegetative or too generative are not desirable states, because the plant is not in balance and the long-term production will suffer.

A number of plant characteristics can be assessed to determine at an early stage if a plant tends toward vegetative or generative growth (see article 3). The best way is through crop recording, also known as crop registration. If detected early enough, the grower can take action before the plants get out of balance. The results over the whole season are better if the plants stay balanced throughout.

What influences plant balance?

Plant balance is influenced by many factors, including genetics (variety), grafting, plant density, plant stage, season, weather, environmental conditions, growing system, growing medium, root-zone conditions, irrigation regime and plant management. Some have an overwhelming effect.

Generally speaking, mild growing conditions stimulate vigorous leaf growth, which means vegetative growth. In contrast, harsh conditions stimulate the production of seeds ('to help the species survive'), which means generative development. In mild spring weather most plants tend to be vegetative, while hot summer conditions make them more generative. Under those circumstances the plants have to be steered in the opposite direction to keep them in balance.

Stem density

One of the first plant management decisions is about plant density, or better stem density. Because the overall light level is low in winter, it is better to have a wider stem density in winter than in summer. When radiation is high (summer), plants are better off in a denser planting where they shade each other a bit. Obviously plant density can't be changed during the year. This dilemma can be overcome in tomatoes by maintaining an extra stem in spring.

Controlling plant growth - part 6

This can be done in every third plant, resulting in 33% more stems per m². It can also be done in steps: first one extra stem in every fourth plant (25% more stems per m²), and some weeks later an extra stem on the plant in the middle (giving 50% higher density than at planting).

Cucumbers are replanted a few times per year. This allows planting wider in winter, and narrower in summer. Also the number of shoots can be varied in cucumber. Capsicum does not have the possibility of adjusting the stem density to the seasonal light conditions, but there are other means to control plant balance, e.g. number of fruit per stem.

Extra lateral in tomatoes

Stem density has a direct effect on plant balance. This can best be explained by 'source' and 'sink' (see above). Under high radiation, the photosynthesis rate is very high, so the 'source' is high. To keep the plants in balance requires a very strong 'sink', basically you need enough fruit to absorb all these assimilates. This implies we need much more fruit on the plant in summer than in winter. This does not happen naturally in tomatoes, because there is always one tomato truss for every three leaves, in summer and winter. In summer, tomato plants often look very meagre, with short and curled leaves, but with a surprisingly high production. These are symptoms of oversupply of source and shortage of sink. This problem cannot be cured, but it can be prevented.

To prevent it, the grower has to make sure there is enough 'sink' in summer. This is done by maintaining an extra lateral in spring. Note that source and sink are considered *per square meter*. An extra stem provides more fruit per m², so more 'sink', even as much as 25, 33 or 50%. Obviously the extra stem also increases the leaf area. But given that radiation (Watt per m²) remains the same, the source does not increase as much as the sink. Thus an extra stem improves the ratio of sink (fruit) to source (assimilates). It increases the production rate, and keeps the tomato plants in much better condition. The well-balanced plants will keep up the production after summer. Thus the total result over the whole year will be better.

Pruning very young leaves

In a very young stage, the leaves are still 'sinks', because they need sugars for growth. At that stage the young leaves and young trusses are in competition with each other for assimilates. In tomato plants, one of the three young leaves can be removed to ensure that the remaining leaves and the truss will get more assimilates. Research found that the benefit is larger for the truss than for the young leaves (see schematic drawing). This makes the young truss grow faster, which increases the production. This can only be done safely when the plant has enough leaf area. In fact it is done in times when there is a surplus of source and a shortage of sink, as described above for tomatoes in summer. Only small leaves are removed, up to half their mature size.

Also in cucumber some leaf pruning can be applied. For instance large leaves on the top are removed to get more light lower in the plants. This also affects plant balance.

Fruit thinning and truss pruning

Fruit thinning (or truss pruning in tomatoes) can be used to control the load on the plant, and to adjust the ratio of 'sink' to 'source' in various seasons.

Fruit thinning is an important tool in young cucumber and capsicum plants. These plants first need to build a strong plant body before they can produce. If planted in winter or early spring, the light level is still relatively low, so 'source' is fairly limited. Therefore some of the earliest fruit have to be removed, to make that the sugars are invested in vegetative growth.

Truss pruning and fruit thinning are also useful tools for plant balance control in late summer and autumn in tomatoes, capsicum, cucumbers and other crops. The light level can be high in late summer, but it will steadily decline in the following weeks. Since the new fruit (or truss) has a life span of several weeks, it will later experience poorer light conditions. A good proactive measure in late summer is to reduce the number of fruit (in tomato to apply some truss pruning). This avoids the problem of unbalance later in autumn, and keeps the plant in good shape until the end of the season.

Truss pruning for other reasons

Some tomato growers apply truss pruning in order to increase the size of individual fruit. If a larger grade is paid better than a smaller grade, they choose to sacrifice some fruit. If this is in summer, it is important to keep an eye on the sink-to-source ratio. Removing fruit may increase the surplus of assimilates, and aggravate the unbalance in the plants. The same holds for fruit with blossom-end rot. If plants are out of balance due to insufficient sink, it is better not to remove any fruit prematurely.

'Unloading'

The last action to mention in this article is plant control by 'unloading' the plants, i.e. to shed some fruit. If there are too many fruit on the plant for the average light conditions, the plants will suffer. In capsicum it is 'normal' that plant growth comes to a complete halt when fruit are growing out. This should not last too long. After all, capsicum plants need to grow further and produce new flowers to continue the production. An effective method of stimulating growth is by off-loading some fruit. Firstly, fruit ripening can be sped up by increasing the temperature. Secondly, some fruit can be harvested before they are completely ripe: harvesting green capsicums or partly-green tomatoes. The same principle applies to other crops too. Unloading will make more assimilates available for the plant. This will restore plant balance and benefit the production in the long-term.

