Building the Chassis

Producing a well-branched plant means knowing where and how soft or hard to pinch.

By Jim Faust

Final crop quality often depends on the chassis built within the canopy. The chassis refers to the architecture, or scaffold, that develops as a result of pinching. The scaffold is influenced by several factors including light interception, pinch technique and pinch timing. In this article, I will review the basic principles of branching and demonstrate how you can manipulate spring crops with pinch timing and technique.

Supply And Demand

A basic principle of branching is that the number of developing shoots is proportional to the amount of resources available to support those shoots. In other words, if the plant has a number of resources available, most axilliary buds below the pinch will develop into lateral shoots. In contrast, if resources are limited, fewer shoots will develop. The most important resource is light intercepted by the leaves; however, root growth and the supply of water and nutrients are also important.

Light

Light interception depends on the amount of light delivered to the canopy and the spacing of individual plants. When plants are grown under low light levels the number of branches decreases. Figure 1, above, shows the increase in branching of vinca bedding plants as the light level increases.

Spacing impacts branching by altering both light interception and the light quality delivered to axillary buds. Figure 2, right, demonstrates how spacing and plant size impact light interception. The actual data were collected on New Guinea impatiens (3- and 6-inches tall) grown in 4-inch pots and placed pot-tight (high density) or at staggered (low density) spacing. Light interception was calculated by making light intensity measurements above and below the canopy. Light interception obviously increases as plants get larger or spacing is tighter; however, it is very interesting to observe how the light delivered to individual plants increases as spacing increases.

While this may be intuitive, it is noteworthy to see that small plants placed at wider spacing decrease the total light interception from 87 to 56 percent, but the interception per plant increases 30 percent (0.087 to 0.113 moles per day per plant).

Figure 1. The architecture of bedding plant vinca grown under increasingly high light levels (left to right, 90-, 70-, 50- and 0-percent shade). (All photos courtesy of Jim Faust)

Effect Of Plant Size And Spacing On Light Interception Of New Guinea Impatiens

Arrangement	Light delivered (moles/day/m²)	Light interception (percent)	Light intercepted per plant (moles/day/plant)
Small plants at high density (pot tight)	10	87	0.087
Small plants at low density (staggered)	10	56	0.113
Large plants at high density (pot tight)	10	97	0.097
Large plants at low density (staggered)	10	70	0.140

Figure 2. Short (3-inch) and tall (6-inch) plants were grown in 4-inch pots and at placed pot-tight (high density) or staggered (low density) spacing. Light interception was calculated by making light intensity measurements above and below the canopy.

Similarly, large plants placed at wider spacing decrease light interception from 97 to 70 percent, while the interception per plant increases 45 percent (0.097 to 0.140 moles per day per plant).

Additionally, a tight canopy will reduce the amount of red light that filters down to the axillary buds. Buds that perceive filtered light (red less than far red light) do not break as well as buds that intercept direct sunlight (red light equals far red light). Thus, branching is inhibited by tight canopies.

Spacing is a critical economical issue, so we are not suggesting that plants be grown at luxurious spacing. Rather, we are trying merely to demonstrate that crowded plants have considerably lower light interception per plant and a low red-to-far-red light ratio; thus, it is to be expected that branching will also be greatly impacted. The take-home message is that the spacing at the time of pinching will impact the plant scaffold. Overly crowded plants at the time of pinch will certainly have lower shoot counts, so spacing needs to be considered in regard to the time of pinching.

Container Volume

The impact of container volume on branching is not often considered; however, plants grown in small containers may not branch as well as the same plants grown in larger containers. Figure 3, page 48, shows African marigolds grown in five different containers. All plants were grown at 6x6-inch spacing, and no pinch was performed. Container volume affects the water and nutrition available for plant growth. The gaseous environment in the growing media is also likely to be different. Interestingly, the changes in growth occur before any significant root restriction occurs, so

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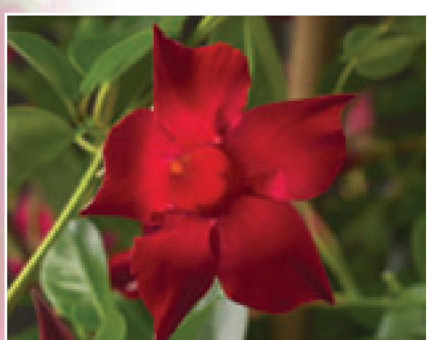

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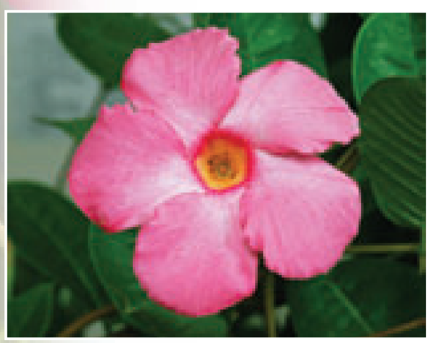

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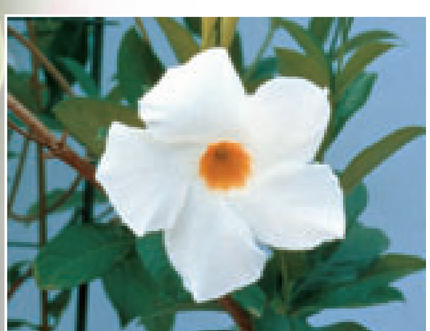

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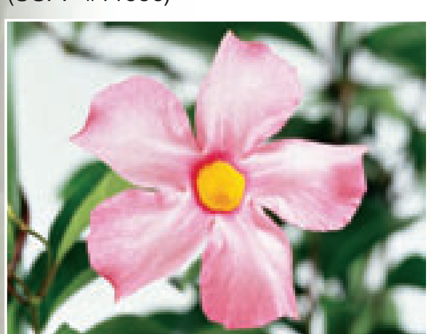

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being rootbound is not likely to be the causal factor. It may not be clear which factor is the most important, but it is clear that container size impacts branching, thus plants pinched prior to transplant may not branch as well as those pinched after transplant due to the container volume at the time of the pinch.

Pinch Height

While pinching appears to be a relatively simple concept, it really has a big impact on the final plant quality in terms of branch number, plant height, flower number and timing of flowering. To demonstrate this, we examined the effect of pinch height, pinch hardness and pinch timing on nemesia.

Pinch height refers to the node number remaining on the primary stem after the first pinch. The number of nodes left on the stem below the pinch obviously impacts shoot number, but it is less obvious that this also affects plant vigor and flowering. To demonstrate this, we transplanted several species and then pinched them low, medium and high. These are relative terms. If a species produces many nodes prior to setting a terminal flower, such as osteospermum, then a low pinch left three nodes, a medium pinch left six nodes and a high pinch left nine nodes below the pinch. If a species produces a lower node number prior to flowering, such as nemesia, then a low pinch left one node, a medium pinch left three nodes and a high pinch left five nodes below the pinch. The same amount of tissue was removed during each of the pinches. The pinches occurred on different days, since it took longer for more nodes to develop prior to pinching.

Figure 3. Four African marigolds transplanted on the same day into five different container sizes and grown until flower. The plants were all grown at 6x6-inch spacing. The larger container volumes resulted in plants that produced more secondary shoots, while the smaller container volumes had fewer shoots per plant.

Figure 4A, right, demonstrates the results observed on nemesia. The low pinch (to one remaining node) produced two shoots per plant, while the high pinch (to five remaining nodes) produced 10 shoots per plant. The node closest to the soil surface was always the most vegetative and the slowest to flower. Vegetativeness was quantified by recording the number of nodes that formed on the shoot below the terminal flower, so the bottom node typically formed shoots that had seven or more nodes. The highest node following the pinch was always the most reproductive, so these nodes produced shoots with 4-6 nodes.

In general, pinch height has little impact on time to flower but has a great impact on the number of flowering stems per plant. For example, when two nemesia cuttings were grown in a 4-inch pot, the plants that were pinched to one, two, three, four or five nodes had 3.7, 3.9, 5.9, 6.7 and 11.3 flowering shoots, respectively, per pot after 35 days.

Pinch Hardness

Pinch hardness refers to the number of nodes removed during the pinch, while the node number remaining on the stem after pinch remains the same (Figure 4B, right). Thus, a soft pinch resulted in one node being removed from the shoot, while a hard pinch resulted in three nodes being removed from the shoot. Hard pinches are done on later dates than soft pinches since additional nodes must develop on the stem prior to the pinch.

The time from pinch to first flower was 18 days regardless of the pinch hardness; however, the hard pinch had a later pinch date that resulted in extra production time. For example, the average shoot for the soft pinch flowered in 36 days, while the hard pinch averaged 44 days to flower. The shoots that develop on the hard pinched plants also had an additional 1-2 nodes per stem. Shoot number per plant was not affected by pinch hardness.

Examples Of Nemesia Pinch Techniques

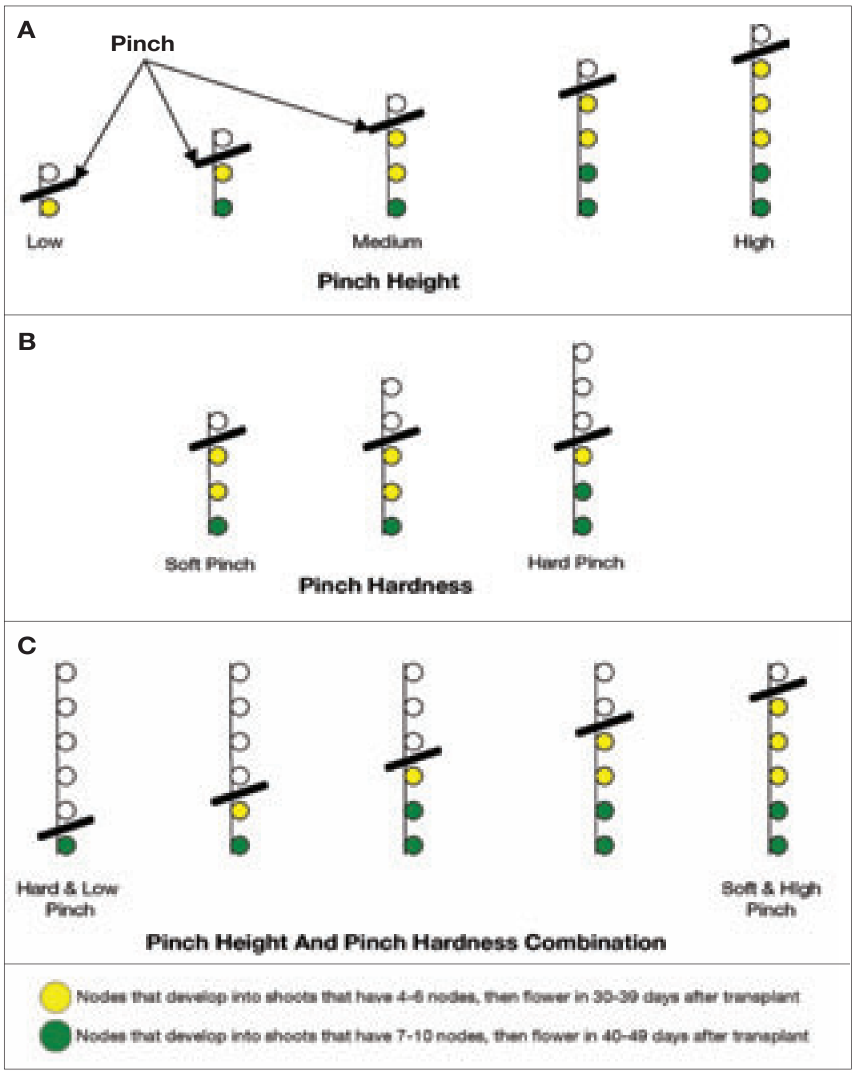

Figure 4. ***A: Pinch Height:*** *Plants were pinched to five different heights, so that one, two, three, four or five nodes remained on the primary stem following the pinch. In each case, only one node was removed during the (soft) pinch, thus the higher pinches occurred on progressively later dates.*
B: Pinch Hardness: *Plants were pinched so that one, two or three nodes were removed during the pinch, leaving three nodes to develop below the pinch. The harder pinches were performed on progressively later dates.*
C: Pinch Height And Pinch Hardness: *Plants were grown to six nodes then pinched to one, two, three, four or five nodes on the same date. Yellow circles represent nodes that were more reproductive, while green circles represent nodes that were more vegetative.*

In general, pinch hardness does not affect total shoot number, but does have a significant impact on the timing of flowering. For example, when two nemesia cuttings were grown in a 4-inch pot, the plants pinched to three nodes that had one, two or three nodes removed had 8.9, 8.5 or 4.8 flowering shoots per pot after 35 days (all three pinch treatments had 9-10 total shoots per pot). Soft pinches minimize time to flower, while hard pinches increase time to flower. This occurs because the uppermost node below a soft pinch produces a shoot that has a lower node count prior to forming a terminal flower.

Pinch Hardness And Pinch Height

In the preceding two examples, the different pinch treatments had to be performed on different dates. This third example demonstrates the interactive effects of pinch height and hardness on pinches performed on the same date. For example, all plants had six nodes at the time of pinch and had pinches that were hard and low to one node or soft and high to five nodes (Figure 4C, above).

The plants pinched to one node averaged 47 days to flower, while the other four treatments averaged 36 days to flower. The bottom node was always the slowest to flower, and when the plants were pinched to just this one node, flowering was quite slow. The bottom node produced shoots that averaged 8-9.5 nodes per stem prior to flowering, while the nodes closest to the pinch formed shoots that averaged 4.2-6 nodes prior to flowering.

Pinch hardness and height also had a significant impact on the number of flowering shoots per plant. For example, when two nemesia cuttings were grown in a 4-inch pot, the plants pinched to one, two, three, four or five nodes had 0, 3.7, 3.2, 7.2 or 11.3 flowering shoots per pot after 37 days.

In summary, branching within the scaffold will be improved if the light levels are relatively high and the canopy is open enough to allow light to penetrate into the axillary buds. Pinch height should be based on the number of shoots needed to produce a satisfactorily full plant, and then a soft pinch should be performed. This maximizes shoot production and minimizes time to flower. Pinching too low results in too few shoots (and may require a second pinch) and those shoots may be more vegetative than desired. Pinching too high can delay flowering by wasting time developing nodes on the primary stem rather than developing lateral shoots.

Typically, the worst-case scenario is to grow a plant with two low pinches. By this we mean to pinch the primary stem to a low node number and then follow up with another low pinch on the secondary stems. The resulting plant will have a relatively slow growth rate due to the small leaf area remaining after the pinch. Also, the shoot number will be low, and those shoots will be more vegetative, so flowering will be delayed. GPN

Jim Faust is associate professor at Clemson University, Clemson, S.C. He can be reached by E-mail at jfaust@clemson.edu.

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