

Final Report

Elvenia J. Slosson Endowment Fund for Ornamental Horticulture
2007-2008

Propagation and Commercial Introduction of “Arboretum All-Stars” Recommended Plants for California Gardens

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Introduction:

Since first conceived in 2004 the UC Davis Arboretum All-Stars outreach and education program has continued to build interest and enthusiasm with educators, consumers and wholesale growers in California. UC Davis Arboretum All-Star selections are chosen for their toughness and adaptability to the more strenuous climate conditions of the Central Valley compared to California’s coastal urban and suburban conditions. While these plants have performed well in the UC Davis Arboretum, little or no information is available to commercial nurseries about their propagation treatment preferences and growth in the nursery setting. In this project we have taken selected plants from our All-Star list and subjected them to rigorous trials at various hormone concentrations, repeated every two months over a full year. We feel this information will help nurseries seeking information on when and how to propagate these plants to be able to offer them to the gardeners of California. This information also is part of a larger effort by partner agents carrying out field testing and Master Gardener evaluation as well as the development and distribution of educational information both on-line and at the retail level. The long term goals of this project are to make these more water-conserving and “environmentally friendly” plants available through commercial channels and help gardeners of California create more sustainable and wildlife-friendly gardens.

Goals and Objectives:

This year we selected ten species from our All-Stars list that are not currently available in retail nurseries and tested them for ability to root at six times throughout the year, or every two months: November, January, March, May, July, September. Three different hormone concentrations of K-IBA (potassium salt of indolebutyric acid) based on information gleaned from previous testing and recorded in the Arboretum’s propagation database and available literature. Each treatment included approximately 20 cuttings of two types, either terminal (tip) or subterminal (subtip) sections of stems. Cutting condition, survival, time to rooting and rooting percentage were recorded. A further “rating scale” was developed to provide a system for comparing results

based on class comparison of rooting quality. Success or failure of terminal, sub-terminal, soft or semi-hard cutting material was also recorded. Successful cuttings were potted and grown on for transfer to field testing in Plant Science Department test plots, distribution to county Master Gardeners for testing or conserved for their use in Arboretum Nursery demonstration areas. Detailed records on plant source, supplier of original stock, special plant features and all propagation treatment information is available from Arboretum curatorial and nursery databases.

Cutting material was simultaneously delivered to Takao nurseries, our commercial partner, for testing of plants under commercial protocols, for bulking of stock plants and evaluation of the plant rooting and growth rate to determine if the species is amenable to commercial production. As part of this project, Arboretum education and horticulture staff also developed colorful commercial plant labels and point of purchase promotional information about the plants' growing requirements, their attractive features, their environmental benefits and the UC Davis Arboretum All-Stars program.

Propagation Results and Discussion:

Cuttings were collected from ten selected species at two month intervals throughout one year with six treatments of two cutting types (terminal and sub-terminal cuttings here referred to as tip and subtip) treated with three hormone concentrations of K-IBA 2500 ppm, 5000 ppm and 8000 ppm. Two species were given different levels based on previous Arboretum propagation trial data: *Cercocarpus* was treated at higher levels of 5000, 8,000 and 10,000 ppm and *Leucophyllum* 'Lynn's Everblooming' at 2500, 4000 and 8000 ppm. Summary of Propagation Treatments were used to calculate Average Rooting Values for each species and all treatments throughout the year are provided here and discussed below. Data was also used to calculate the percentage of cuttings in each treatment that received a score of 3 or 4, a score that represented a cutting that had rooted and was considered the smallest size rooting mass that would be acceptable for potting in a production environment. (See Photo Attachment 1-3). These probabilities of rooting were plotted and are shown below.

Root Rating System

- | | |
|---|---|
| 0 | No Roots, no callus |
| 1 | No roots but callus present or small roots just beginning to emerge |
| 2 | Very few roots (1-3) and small |
| 3 | Long roots, sometimes unbranched, or many shorter root |
| 4 | Well developed and often branched roots |

Individual species results

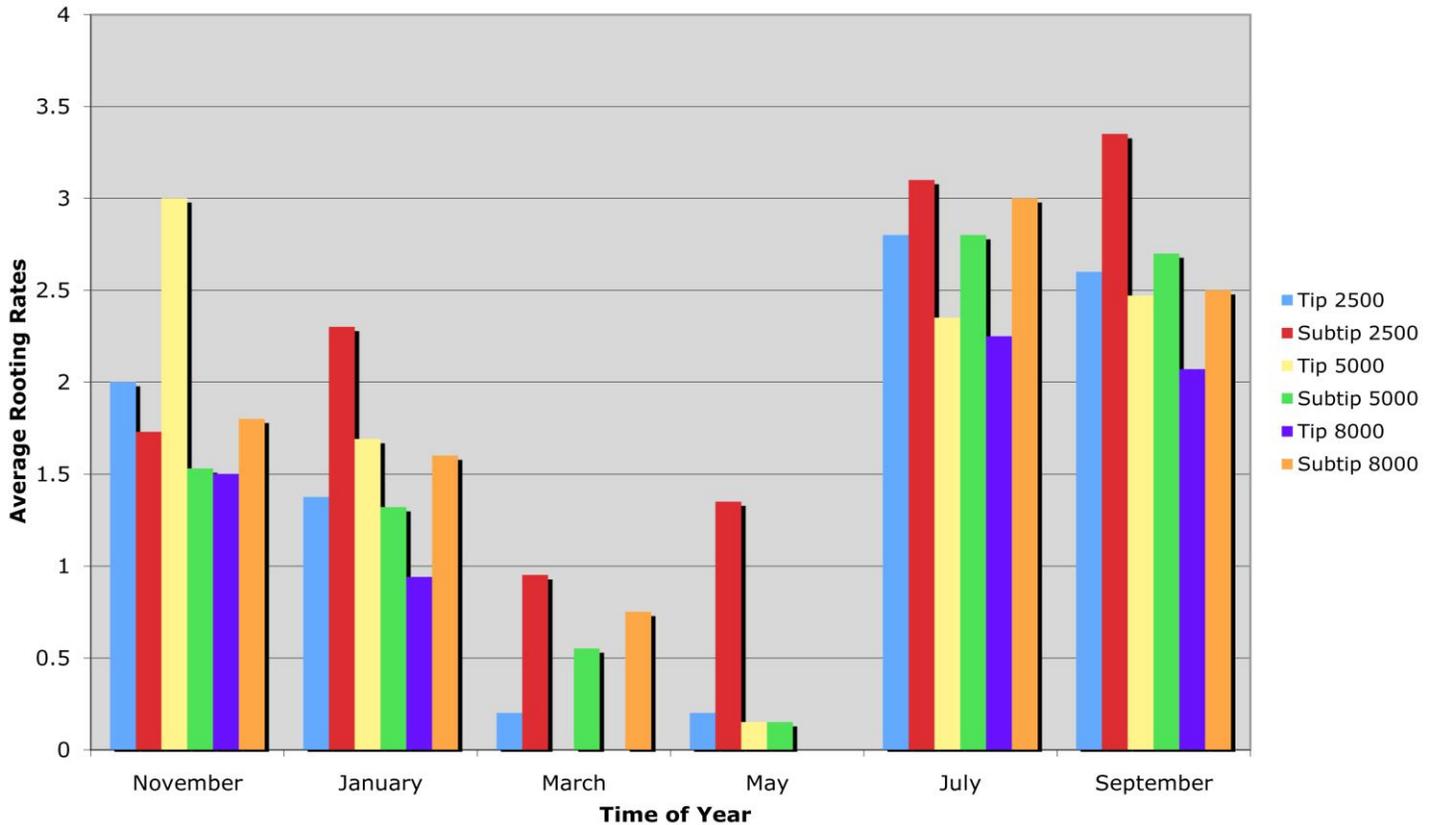
Aristolochia californica California pipevine

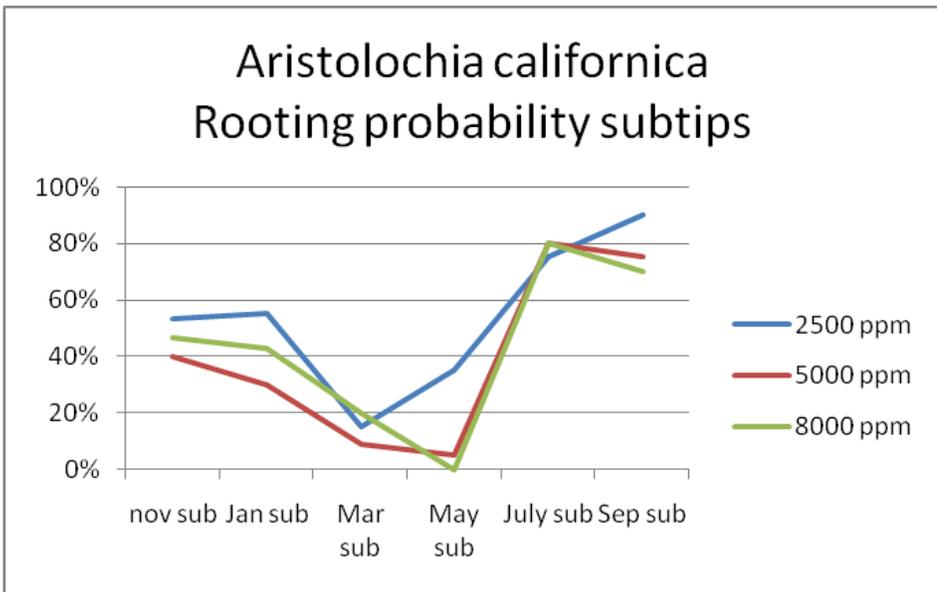
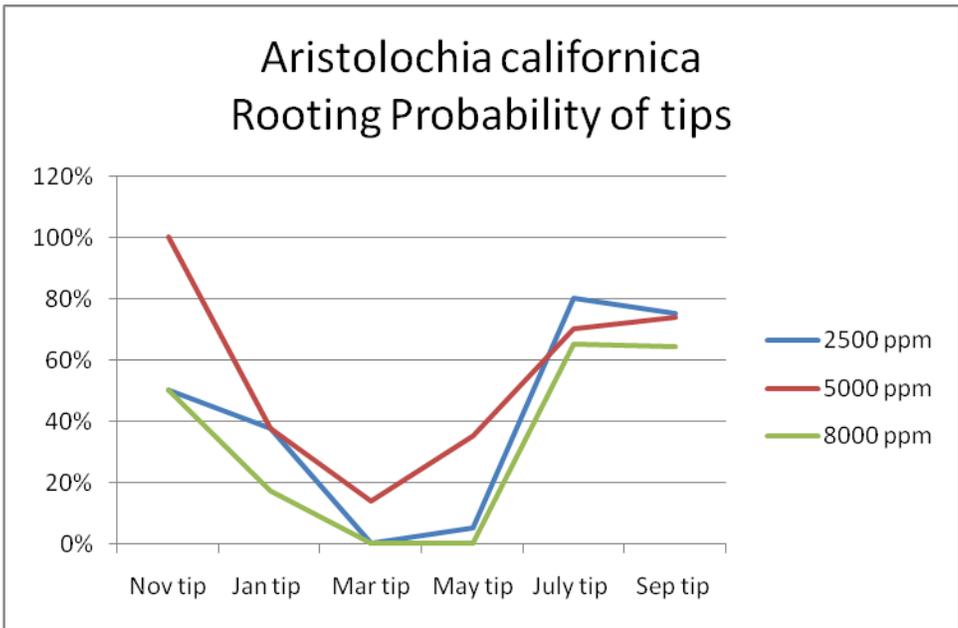
Overall *Aristolochia* cuttings did best in July and September trials—after flowering and once softwood growth had hardened a bit, but before dormancy. There was a clear trend also at this time that subtip cuttings produced slightly higher root rating averages, while average root ratings did not reach the desired “4” ratings of many well-branched roots. Cuttings with 2 and 3 ratings were potted and survived.

Cutting quality varied throughout the year with abscission of leaves initiating in November. In November we encountered difficulty in collection of tip cuttings because of the plant's habit of twining tightly to the tree trunk which resulted in damage in the harvesting stage. While subtip cuttings at 5000 ppm rooted acceptably the success across the range was better in July and September when the cuttings had leaves and new growth

hardened off. January cuttings were deciduous and appeared dormant with just the slightest amount of bud break, but no expanded leaves. There was hormone response but root quality considered unacceptable for production. March and May cuttings consisted of new growth still soft in both tips and subtips. Flowers and flower buds present in March but removed from cuttings. Response was poor with callus only. In May there were no flowers or flower buds. In July and October softwood were more hardened and some cuttings had mealybugs. Sub-terminal root rating averages reach acceptable levels (75% probability of a 3 or 4 rating). September material was even more hardened. Rooting probability patterns were very similar for both tip and subtip material.

Average Rooting Values for *Aristolochia californica* Cuttings





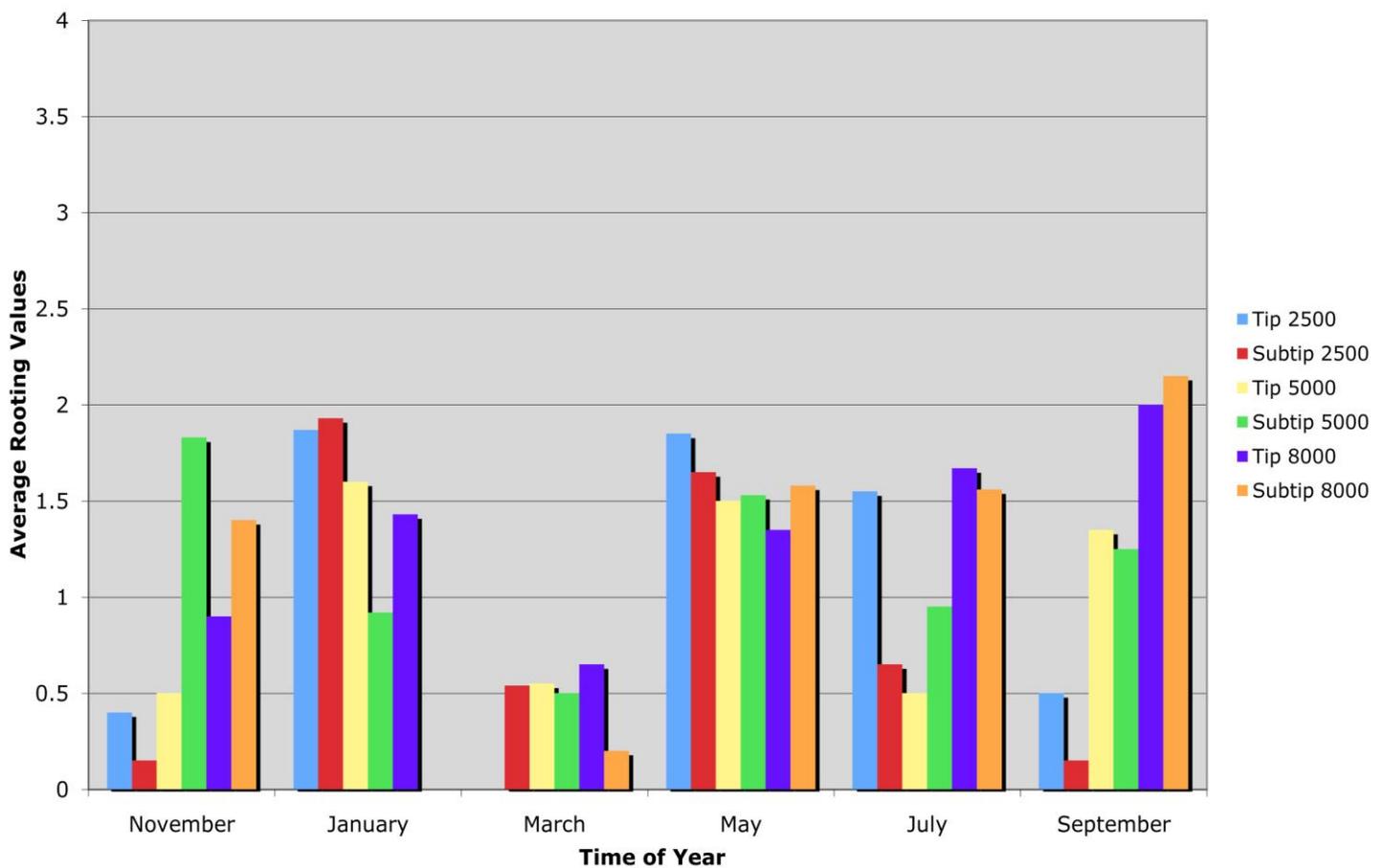
Carpenteria californica California bush anemone

With *Carpenteria* there was no clear trend of consistent response to hormone concentration over the year. In July, September and November higher concentrations of hormone improving root ratings although none of the treatments produced root ratings in the desirable 3 and 4 range. March demonstrated a drop in even callus production when plants were flowering. Results indicate that future work on *Carpenteria* cuttings should focus on fall and winter material and higher concentrations than 8,000 ppm. Both tip and subtip at these times yield cuttings with good root structure although few roots.

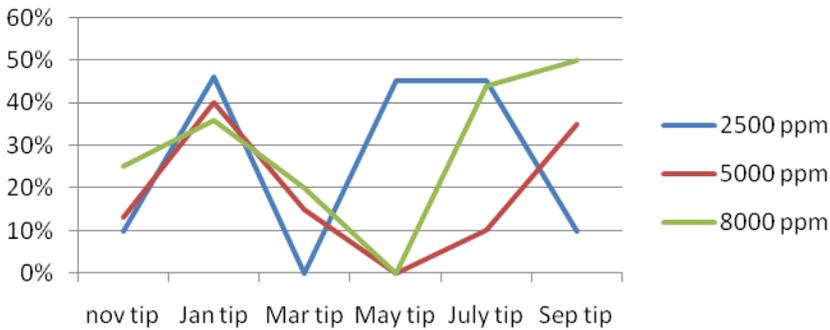
In November lack of material for subtips made collection difficult since *Carpenteria* puts out limited new growth off of old woody growth at this point in the year. The total number of cuttings was smaller than 20 per pot on average. Also, cuttings were held overnight in fridge with an undetermined effect. In January parent plants still had not pushed new cutting material since the November collection. Growth that had occurred was often not long enough to take both tips and subtip cuttings. Tip cuttings at 5000 ppm had few but well developed roots. March cuttings showed poor response presumably due to flowering hormones inhibiting

rooting. Subtip cuttings often had old woody material at the bottoms. In May material was succulent but firm. On subtips, some material had woody bottoms. Both tips and subtips had some roots but tips had better developed rooting than as subtips. July began the semi-hardwood months as new growth hardened off. Although cuttings were of uneven size and thickness, either too thin or too thick looking, the higher hormone (8000) yielded roots. Also, these cuttings had long internodes, with either only one or two nodes per cutting. September plants became infected with mealybugs and cuttings were either short or with one node and a long internode. Many cuttings were still were green and healthy, even though they hadn't rooted. Given a longer rooting period perhaps these would have had higher rooting values. Comparison of the probability of rooting within any treatment had surprising results. In the subtip 8000 ppm treatment 55% of the cuttings had average rooting values while 45% had 0%. Further separation and testing of grades of cuttings for health, pest associations, number of nodes involved and comparison base on diameter of stem material might lead to further refinement of this data and more consistent high rooting probabilities.

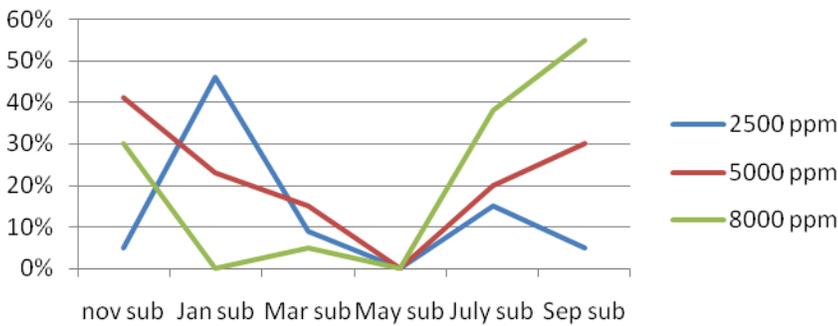
Average Rooting Rates for *Carpenteria californica* Cuttings



Carpenteria californica Rooting probability tip cuttings



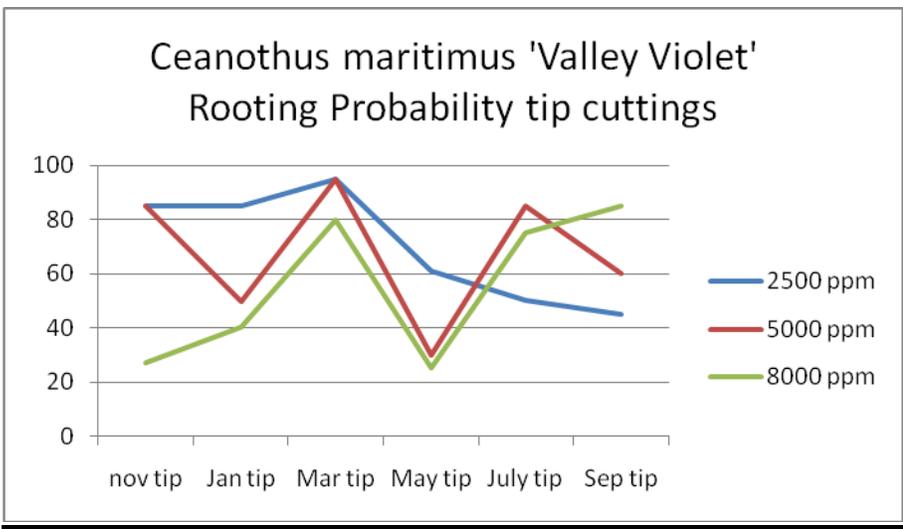
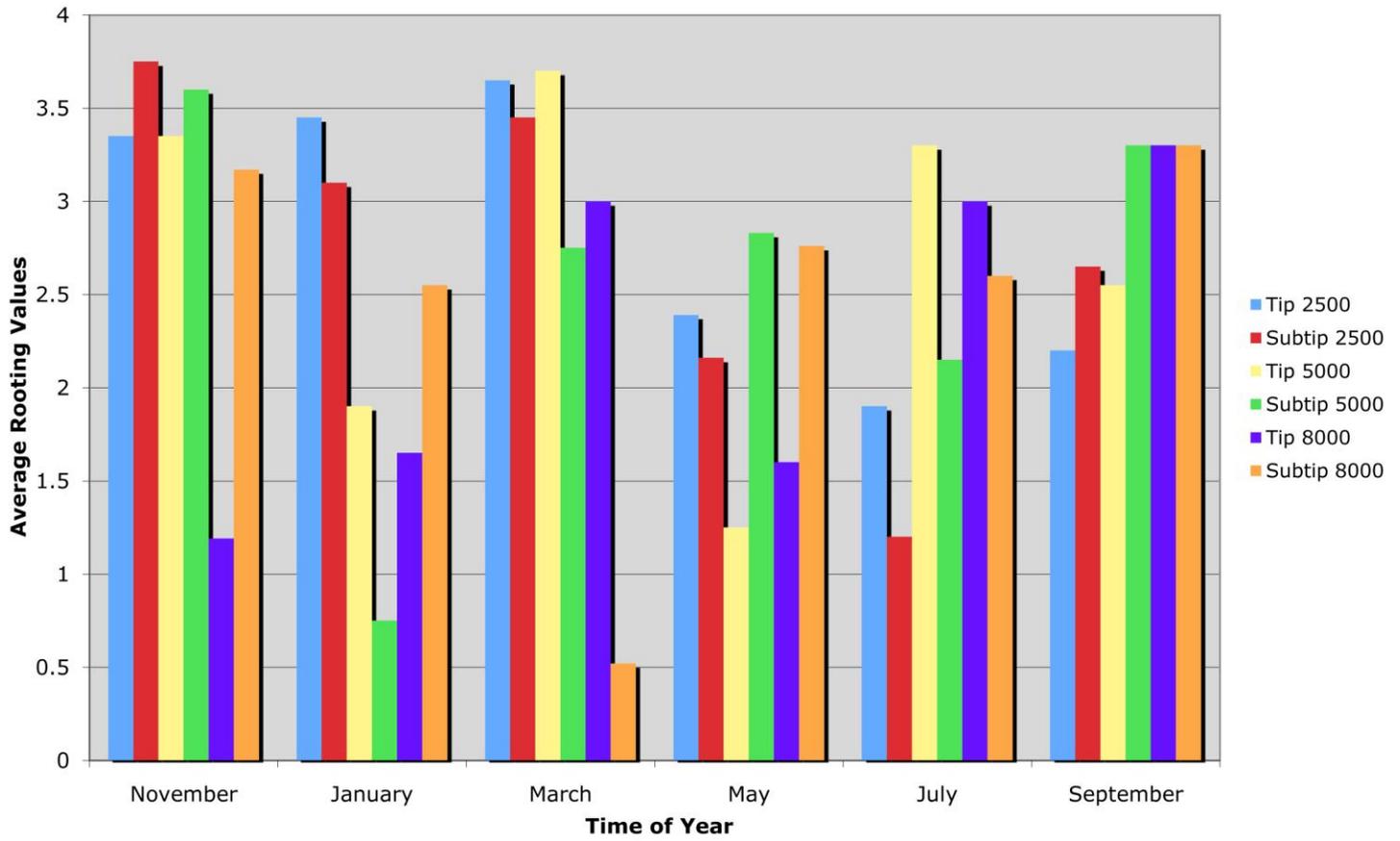
Carpenteria californica Rooting Probability subtips



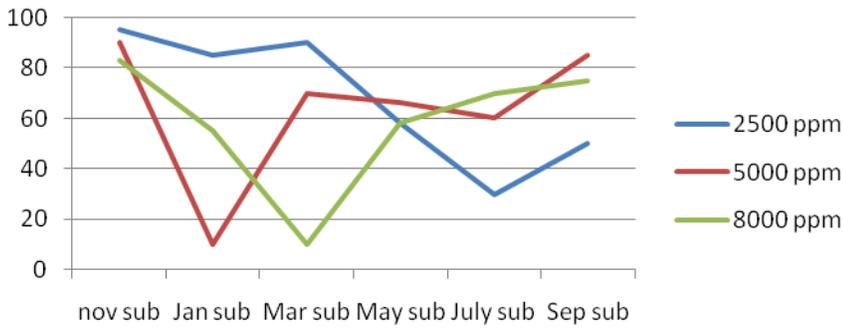
Ceanothus maritimus 'Valley Violet'

The overall trend for *Ceanothus maritimus* was good rooting all year, with a significant dip in May and July when the plants have fruits on them. Overall, 5000 ppm IBA tends to work the best throughout the year, with the exception of January. The only other major trend seemed to be that lower concentrations tend to drop in efficacy spring through summer. Fall and early spring seem the best times for propagation. In November and January stems already had flower buds that were removed. Although sub 2500 ppm had the best results numerically, sub 5000 ppm had the best root structure. In January non-flowering tip material was difficult to find. In March flowers and buds need to be removed and in May old buds and seedpods/fruits were removed. In July some of the lower rated cuttings were infested with scale, which could have inhibited their ability to root, since only R0's or R1's had scale. In September most of the tips had very small leaves and subtip 5000 had the best root structure.

Average Rooting Values of *Ceanothus maritimus* 'Valley Violet' Cuttings



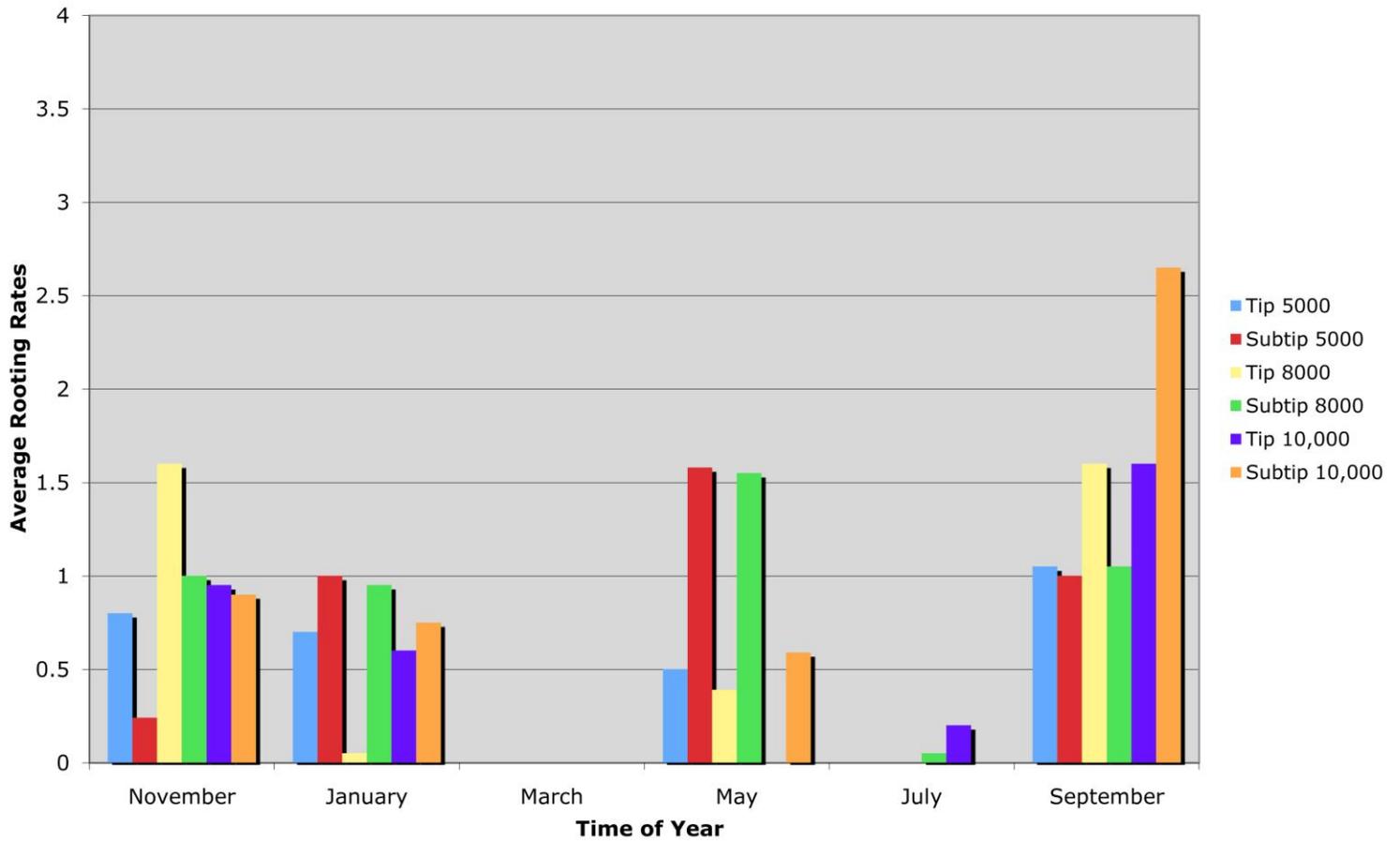
Ceanothus maritimus Valley Violet Rooting Probability subtips



Cercocarpus betuloides var. *blancheae*

Except for November and September treatments there was a trend toward subtip cuttings rooting better overall than tip. And, except for September, increasing hormone to 8000 ppm did not improve rooting. Best results were from the 10,000 ppm IBA subtip cuttings in September. All other cuttings throughout the year had extremely brittle roots that made transplanting them very difficult. But the 10000 ppm subtips in September had callus all the way up the stems and well structure and flexible roots that could be transplanted easily without damage. Results indicate perhaps even higher concentrations of hormone could give better results. In March flowers and buds needed removal and cuttings rotted before rooting could occur. May cutting material was semi-hardwood with many lenticels. The subtip 5000 and 8000 cuttings produced level one rated cuttings with huge amounts of callus tissue. In July it was hard to find material of a consistent type and we resorted to older material on tree branches plus newer soft material from suckers around trees. September was also semi-hardwood material as above. When removing cuttings from pots, there were many broken roots due to the brittleness of the roots—with the exception of 10,000 ppm subtips. Both tip 5000 ppm and 8000 ppm had a lot of healthy level one rated cuttings with large amounts of callus tissue. However many root broke off roots in their pot indicating that they would have been rated higher if not for their brittleness. 10,000 ppm subtip roots weren't brittle and no broken roots were found in the cutting pot.

Average Rooting Values of *Cercocarpus betuloides* var. *blancheae* Cuttings

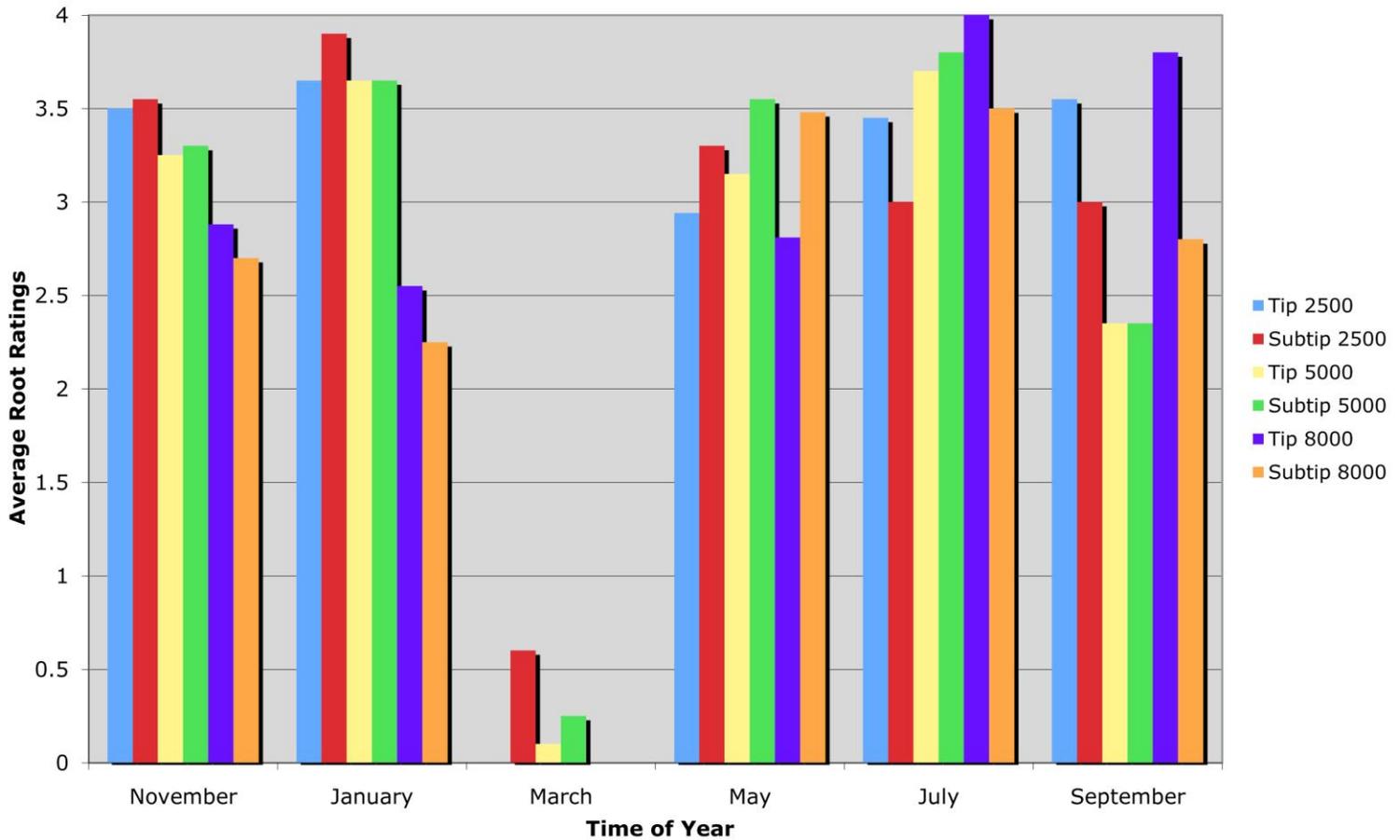


Because of the lack of any acceptable rooting success the probability rating charts are not included here. More work remains to be done on this species.

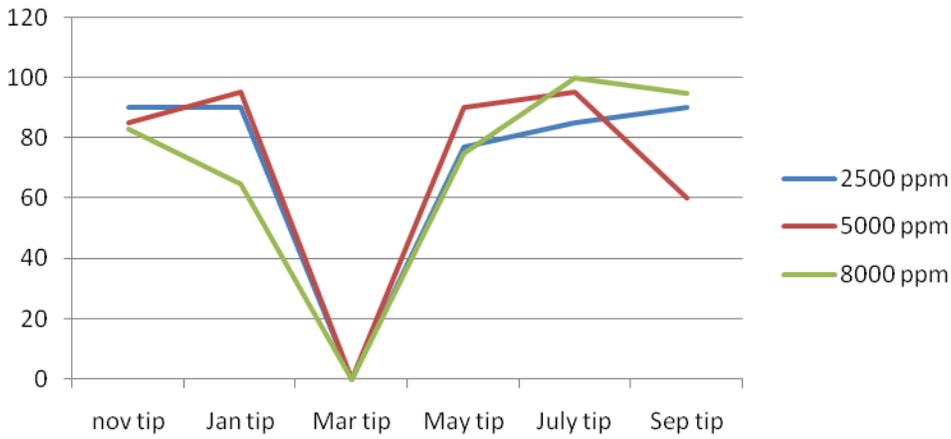
Crinodendron patagua lily-of-the-valley tree

Crinodendron was extremely easy to root, and can be rooted at most any time of the year with a high degree of success. In March heat problems in the greenhouse where mist benches were located possibly caused cutting dehydration and reduction in response. The high hormone concentrations did not consistently improve rooting late fall through spring. The trend for best rooting was low hormones and subtip in late fall through January, mid-hormone concentration subtips in May, and higher hormone concentrations in July. Response of subtip and tip as shown in probability graphs exhibited the same pattern over the year (See below)

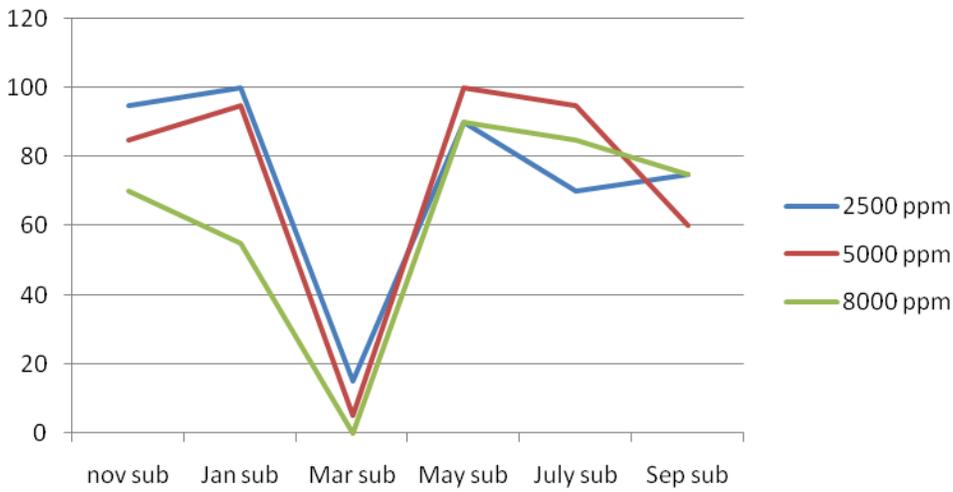
Average Rooting Values of *Crinodendron patagua* Cuttings



Crinodendron patagua Rooting probability percent tip cuttings



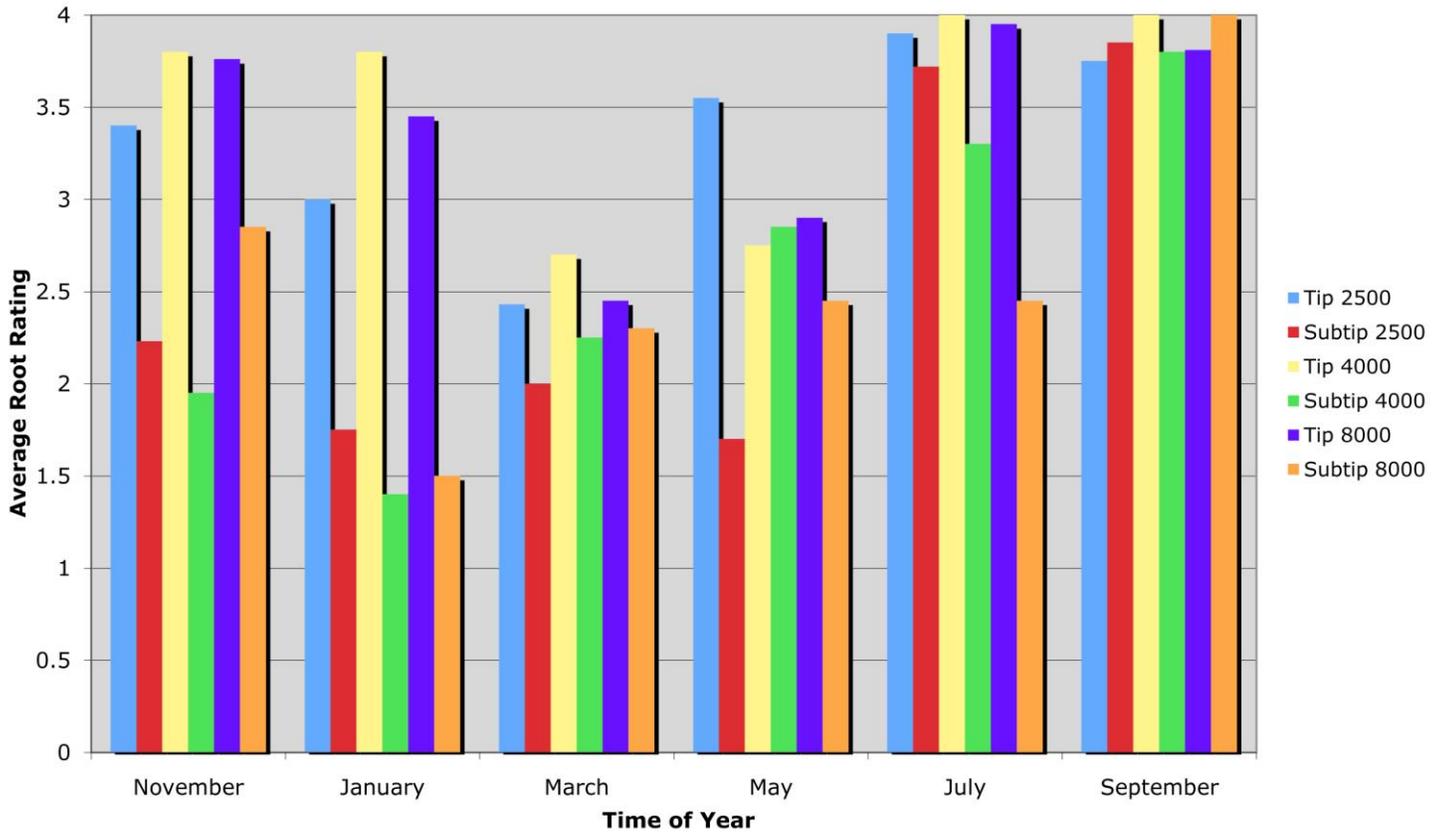
Crinodendron patagua Rooting probability percent subtips



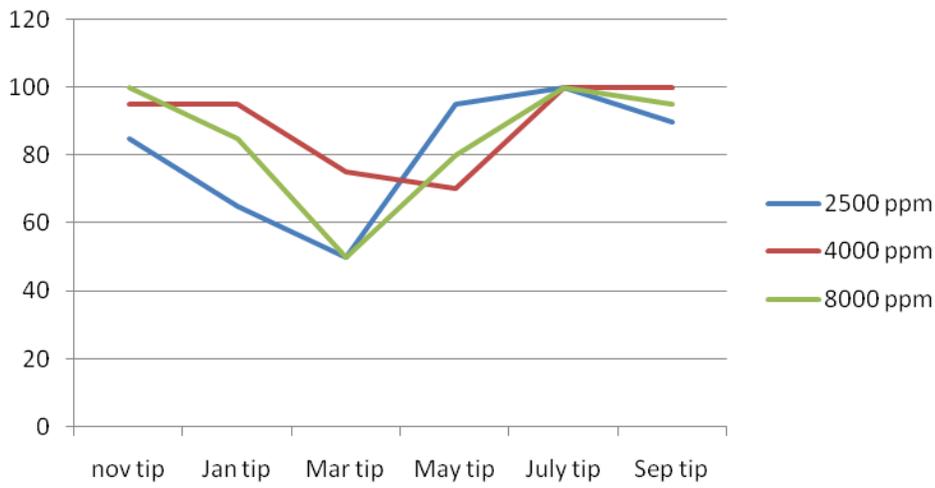
Leucophyllum langmaniae 'Lynn's Everblooming'

Cuttings of *Leucophyllum* did best mid-summer through early winter. November, January and March tip cuttings with tip cuttings at 4000 ppm IBA. In particular, leafy cuttings taken in September were very vigorous upon potting up—with all cutting having high root ratings. Unfortunately, pest problems were found on stock plants with black sooty mold and mealy bugs, which tended to carry over onto the cuttings. In November and January spent flowers and buds were removed and sooty mold and botrytis were present on some cuttings. Greenhouse problems in March resulted in high temperature that may have adversely affected results. By May new growth on plants resulted in some tip material being very soft. A lot of subtips contained semi-hardwood material that was almost to the point of hardwood and mealybugs were a problem. In July flower buds needed to be removed and some tips were soft and flimsy. September: Tip material very floppy, so longer cuttings were taken to keep the softest parts of the material above the rooting media. Also cuttings were given an extra 10 seconds in bleach solution to eliminate sooty mold. All September cuttings were vigorous and healthy upon potting up.

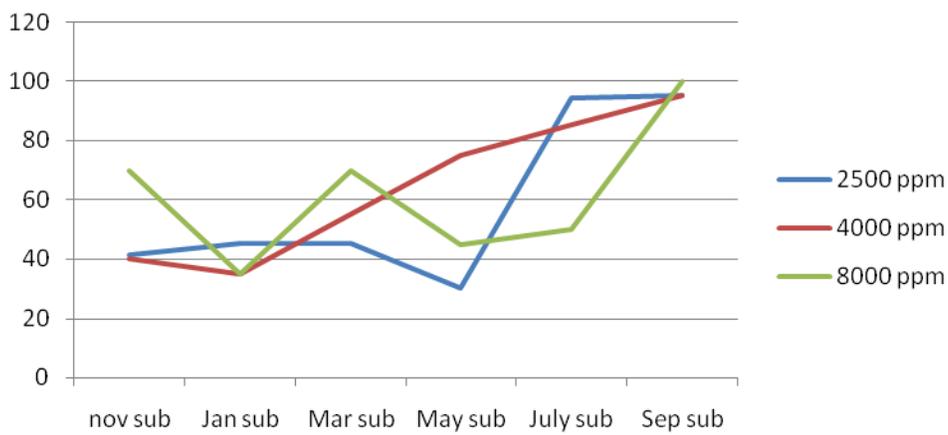
Average Rooting Values of *Leucophyllum langmaniae* 'Lynn's Everblooming' Cuttings



Leucophyllum 'Lynn's Legacy' Rooting probability percentage tips



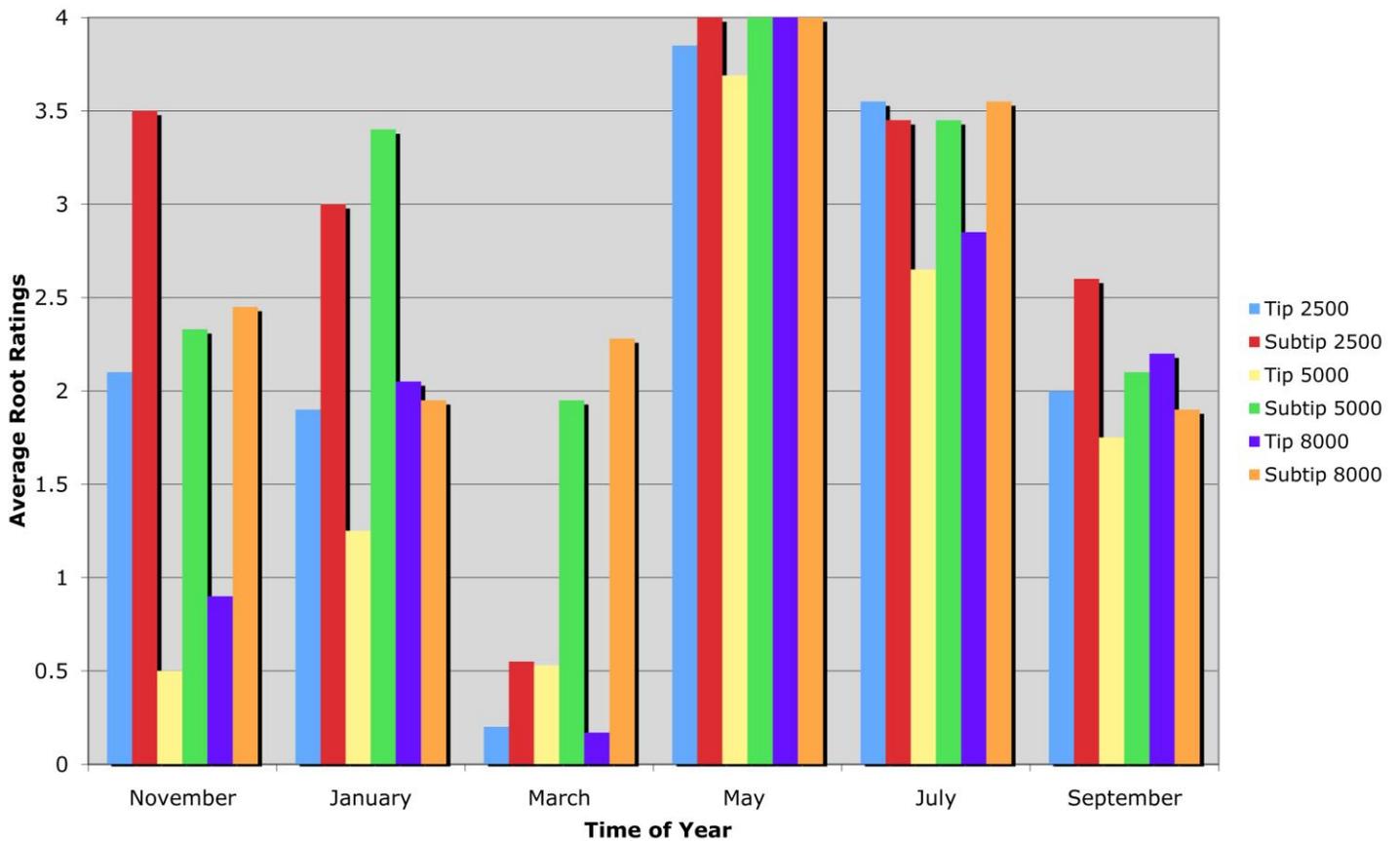
Leucophyllum 'Lynn's Legacy' Rooting probability percentage subtips

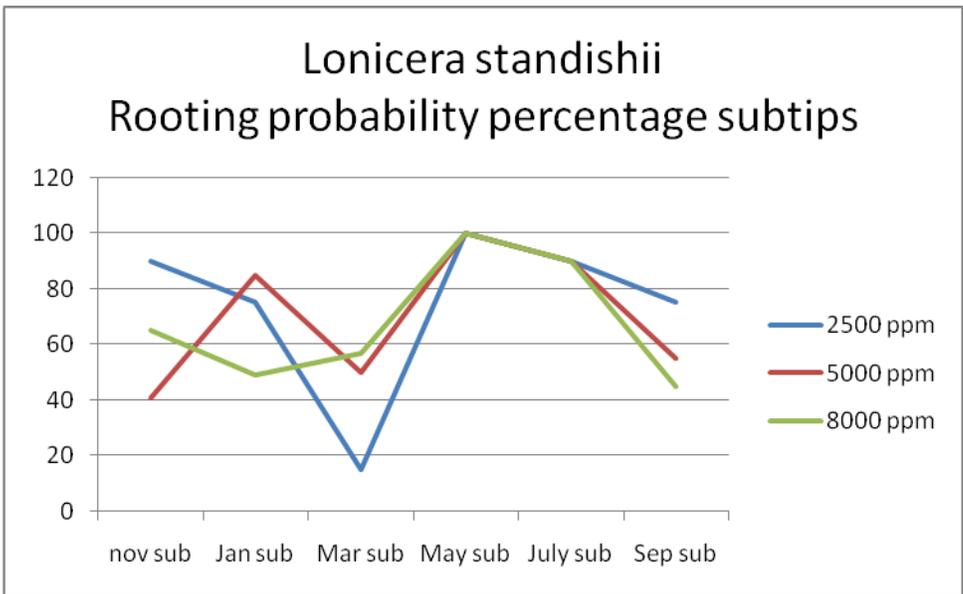
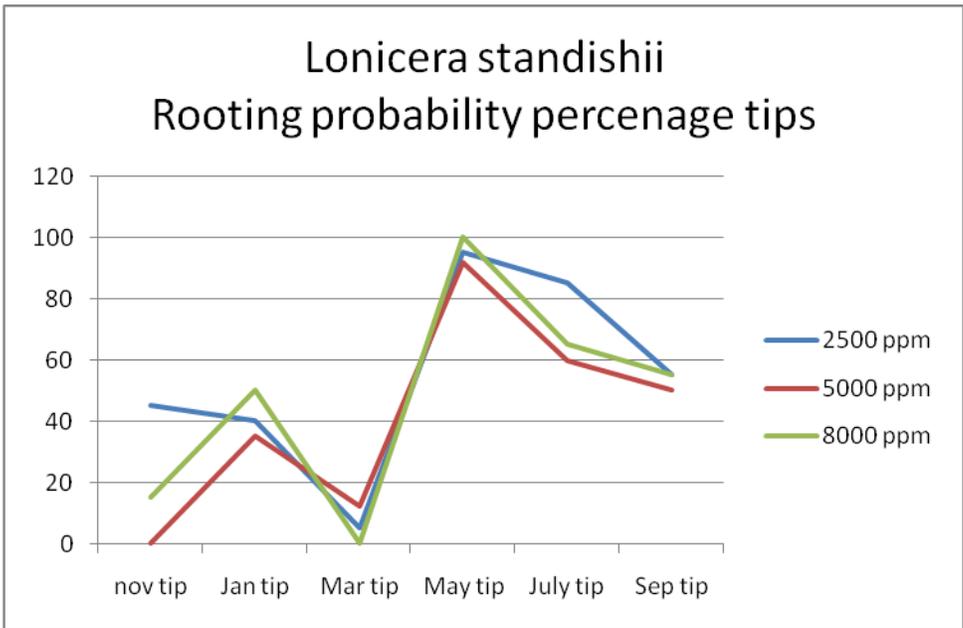


Lonicera standishii winter honeysuckle

Lonicera cuttings had best root ratings when taken late spring through mid-summer, although they are successful at all times of the year to some degree. In November September and March subtips were the more successful than tips. Our parent plants had aphids and demonstrated boron injury (from irrigation water) later in the season. Plants cultivated in areas with better water quality may yield better results. Roots develop very quickly for *Lonicera*. In November and January plants were going deciduous and all material was hardwood at this point. In January material was completely deciduous and in bloom and flowers needed removal. In March and May aphids and what was possibly evidence of virus were present. During this time tip 2500 ppm treated cutting had somewhat smaller, but well-developed roots instead of the long roots on other treatments which made them more manageable for potting up. In July and September leaves again showed signs of boron injury and spots on foliage. There was no healthy looking material on the parent plants, and stems that were long enough to obtain both tips and subtips were very difficult to find.

Average Rooting Values of *Lonicera standishii* Cuttings

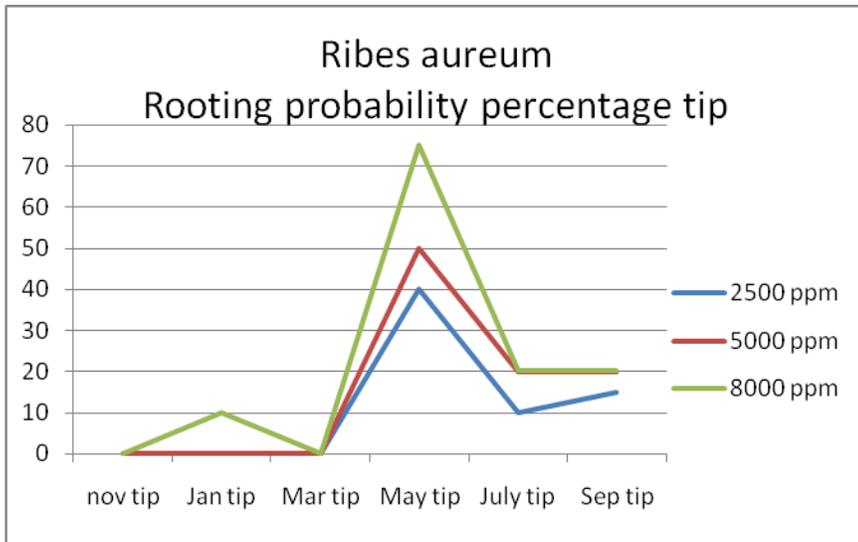
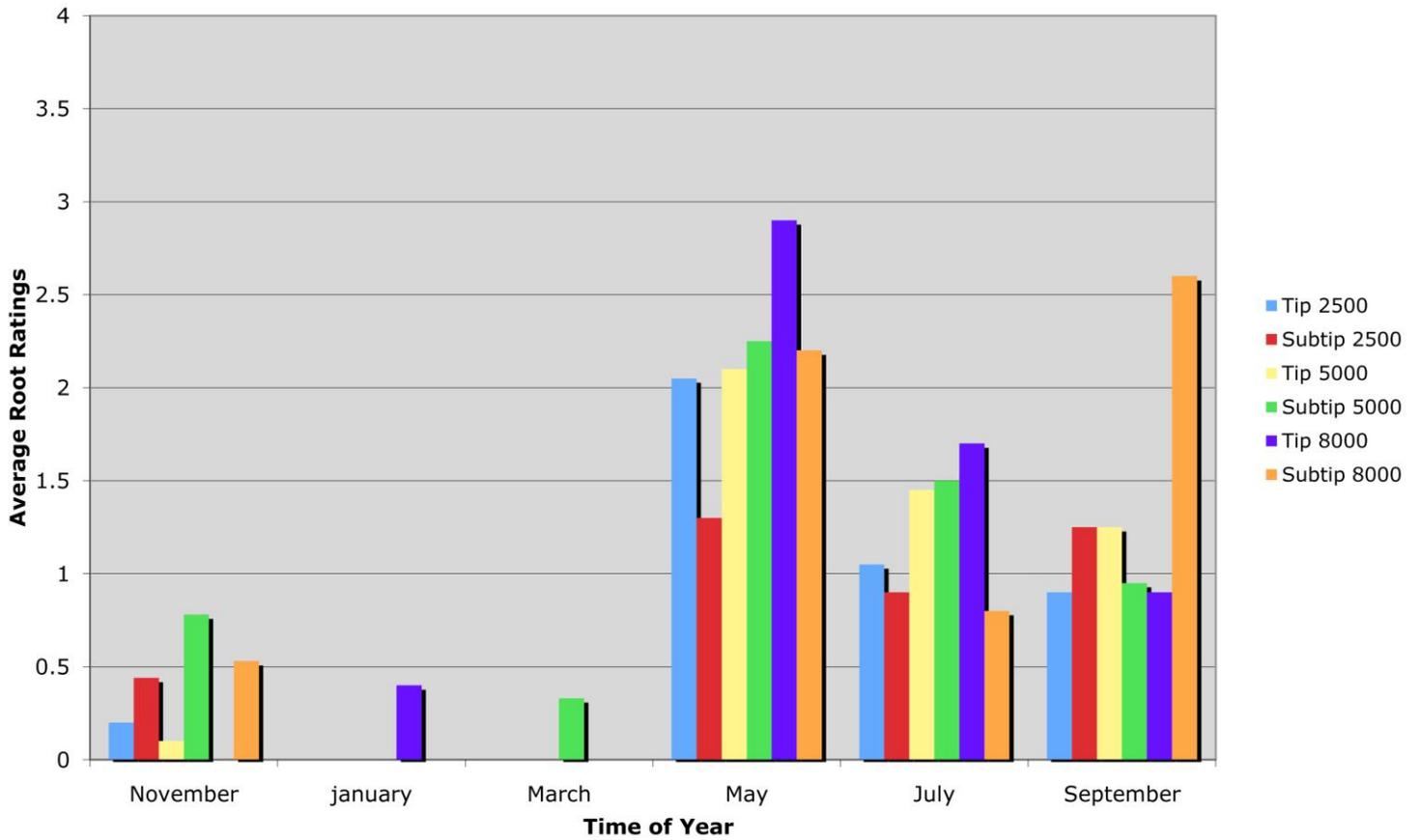


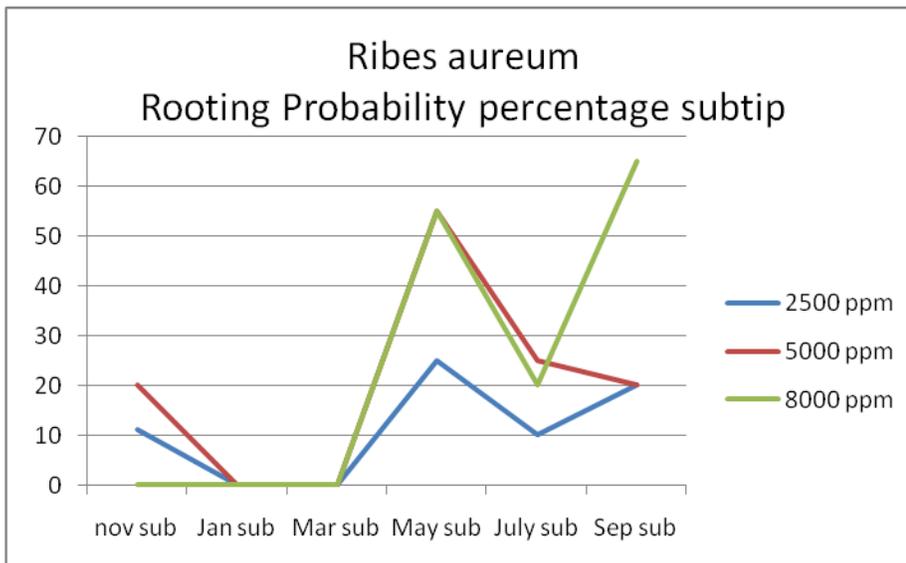


Ribes aureum golden currant

The best material for *Ribes aureum* cuttings seemed to be softwood that wasn't too new, that had been allowed to firm up a bit. This species seemed more susceptible to damping off than the other species tested and would rot before roots could form. A drier environment and an application of a fungicide at initial dipping time is recommended for those wishing to propagate this plant. Because treatments with the most successful rooting in May and September months were at 8000 ppm, it would be interesting to try even higher IBA concentrations to see if that had an improved effect on rooting. Cuttings taken after the parent plant enters dormancy as well as cuttings taken with soft, new growth did not root before decaying. November and January plants were deciduous and desired size of cutting material was in short supply. In March new softwood rotted in the bench before rooting. May produced the first good softwood. In July cutting material had matured to semi-hardwood and most of good quality—not too flimsy, not too thick. At this time all tip cuttings produced a significant amount of callus tissue only. In September the plant started to go deciduous, had few leaves, and necrotic spots on the leaves. Cutting size was variable with some thicker or thinner than would seem optimal.

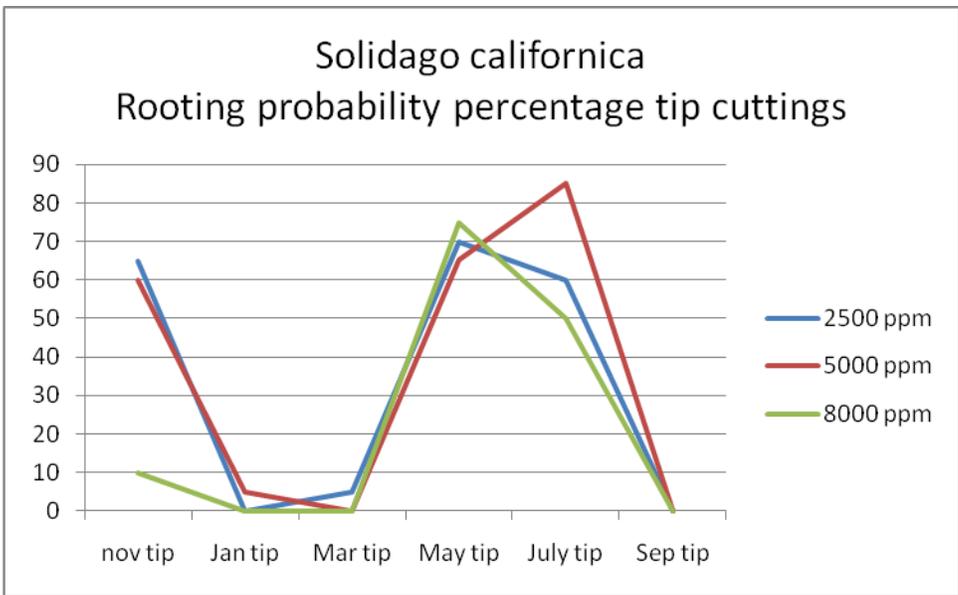
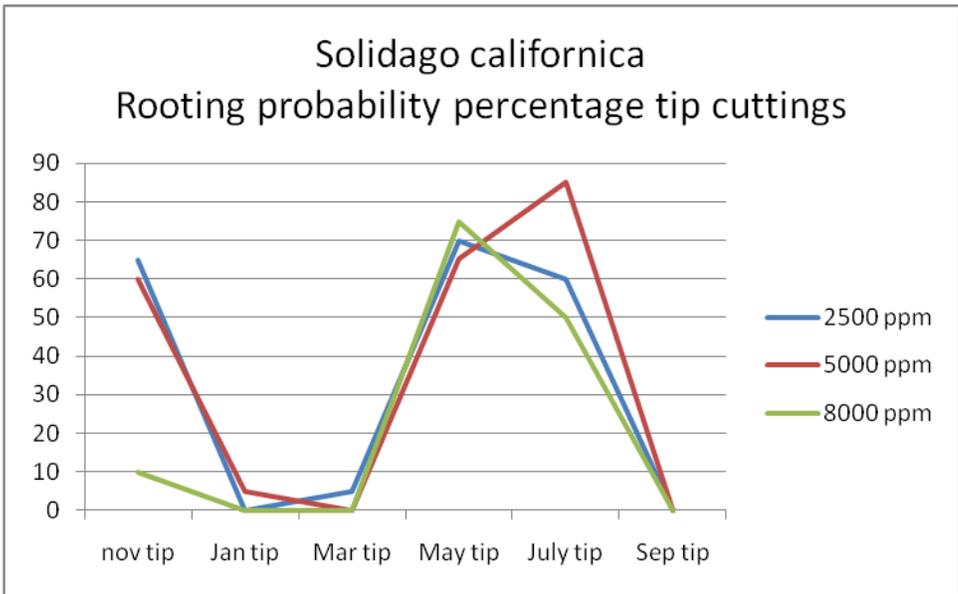
Average Rooting Values of *Ribes aureum* Cuttings





Solidago californica California goldenrod

The best time for *Solidago* cuttings was after they emerged from dormancy and had a chance for their material to firm up but before flowering. Once flowering begins, tip cuttings are not possible, and the subtip material under the inflorescence gives poor results. May was the optimal time for these cuttings, and subtip faired better than tip, with 5000 ppm IBA giving the strongest root structures. In November cuttings were made from semi-hardwood/hardened softwood and subtip cuttings had very few leaves. By January cuttings could only be taken from last seasons growth and were scraggly and of poor quality. A few cuttings were taken from early new growth, but the majority was the same semi-hardwood as before. Only a few subtip cuttings could be taken because of limited material. Material that was available was too short to allow for subtips to be made. March treatments used new softwood growth and the thickest material selected from stock plants. The month of May provided the best material of the year with softwood cuttings supple but firm. The 2500 ppm tips had the best roots of the tips, even though the overall average was slightly lower than tips at 8000 ppm IBA. Most cuttings rooted at the first node underneath the media—portions of stem above ground died back. The roots at this first node were of very good quality. Many cuttings appeared dead before they were knocked out of their pots. In July flowering plants produced terminal inflorescences that limited material selection. Only smaller soft, slender stems that weren't in flower could be taken to get both tip and subtip. Again many cuttings appeared brown above the media but sprouted at the base above the rooting zone. In September no tips were available—every stem had an inflorescence. For subtips, flowers and flower buds were removed from the axils when present. Most material showed signs of dryness and rigidity of stems was slightly higher than would seem optimal.

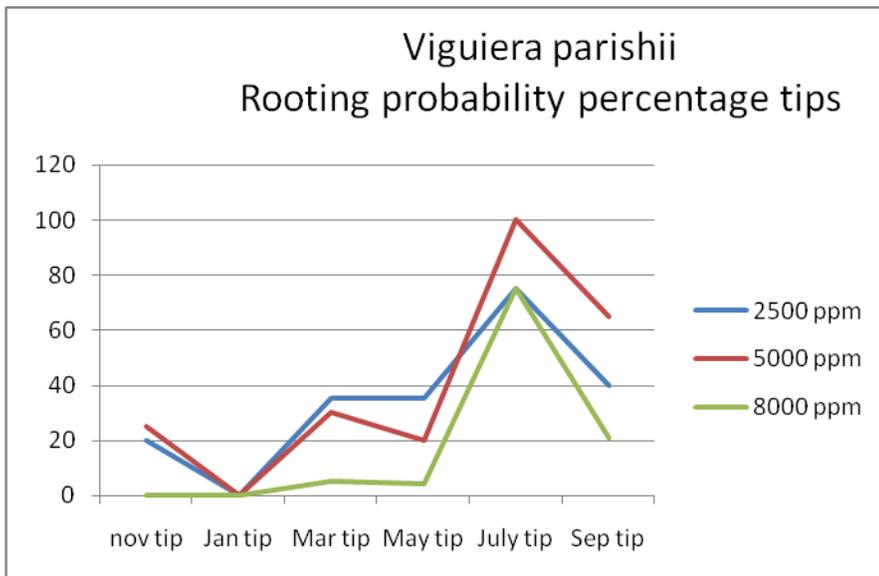
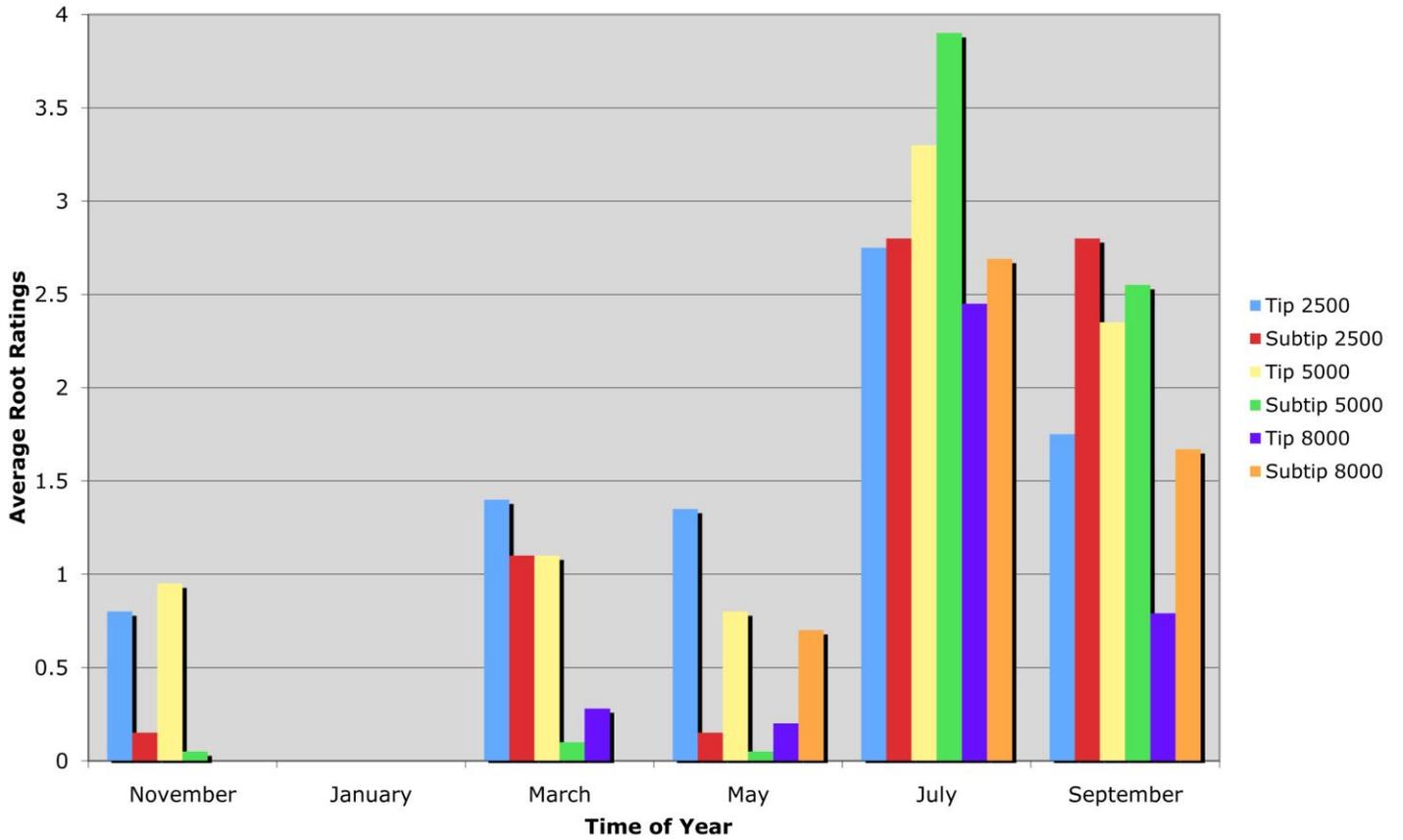


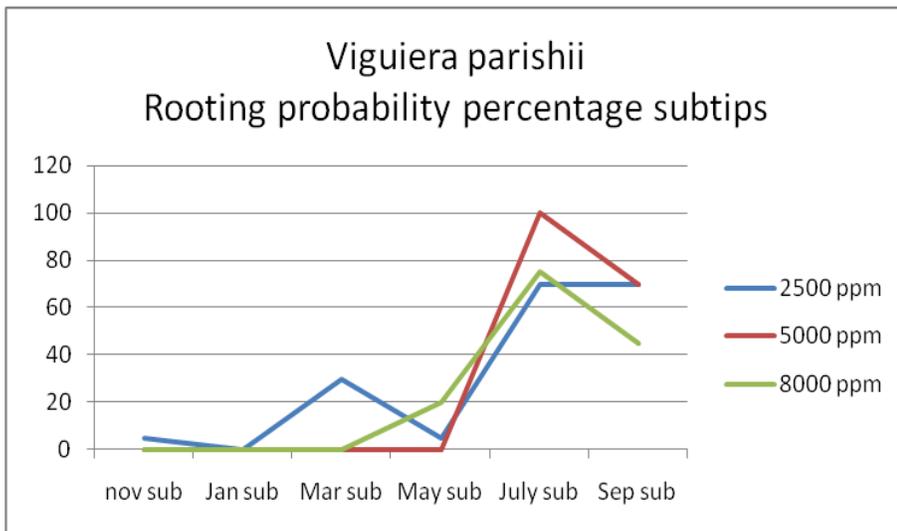
Viguiera parishii

Viguiera parishii has a lot of softwood material over the year that wouldn't seem to be as difficult to root as it is. The best results came from succulent material that had begun to firm up, and that was thicker in diameter. These cuttings also tended to basically just rot and liquidify under frequent mist. When the mist duration was cut in half, rotting was greatly reduced. A drier media and low duration mist cycle is recommended, and use of a fog chamber might yield better results. The best material was found July through September. In general, high hormone concentrations did not give good results—low to mid range was preferred. Also, tips did better most of the year except for July and September, which were the only months to give acceptable results. In November Flowers and buds were removed and some tip material was very flimsy. In January most material was very spindly, and from side shoots. In March much material was very soft. Even rooted cuttings had rotted off, most probably needed a drier mist environment. In May the tips appeared dehydrated and very limp after prepping. All cuttings basically rotted off. Mist duration was reduced by half after this point. In July cutting material was very thick; with larger stem diameter than other phases up to this

point and cuttings rigid, but still succulent. September tips were pretty flimsy and cuttings were given an extra 10 seconds in bleach solution to remove aphids.

Average Rooting Values of *Viguiera parishii* Cuttings





Cutting Distribution and Development of Point of Purchase Tags, Poster and Bench Cards

In related efforts to improve availability of a selected thirty All-stars were delivered to Takao nurseries for bulking and distribution. The following species were distributed for testing and selected ones “bulked” for availability to wholesale growers.

Bulbine frutescens
Callistemon 'violaceus'
Ceanothus maritimus 'Valley Violet'
Ceanothus x pallidus 'Marie Simon'
Crinodendron patagua, A94.0013 (5-1 gal)
Epilobium canum 'Everett's Choice'
Epilobium canum 'Everett's Choice'
Erigeron 'Wayne Roderick'
Festuca californica
Heuchera 'Lillian's Pink'
Heuchera 'Rosada'
Jasminum nudiflorum
Leucophyllum langmaniae 'Lynn's Legacy'
Lonicera standishii
Muhlenbergia dubia
Osmanthus x fortune 'San Jose'
Penstemon 'Margarita BOP'
Philadelphus 'Belle Etoile'
Rosemary 'Mozart'
Russelia equisetiformis
Salvia clevelandii 'Winnifred Gilman'
Saponaria x lempergii 'Max Frei'
Sedum palmeri
Sollya heterophylla, pink
Syringa x laciniata
Teucrium fruticans 'Azureum'
Viguiera parishii

Development of Educational Materials for Distribution to Retailers

Point of purchase materials have been completed including a training binder for wholesale partners, a poster, bench cards and expanded plant tags. Twelve selected species were featured on the poster to be placed in retail nurseries and bench cards highlighting the special features will be placed with plant display. Plant tags are being produced by Master Tag and are available for purchase by wholesaler partners. Examples of these “point of purchase” materials are below.

Figure 1. Example of Point of Purchase Materials: Bench Cards

Palmer's sedum

Sedum palmeri



© Mia Ingolia *Bright flowers adorn attractive rosettes of succulent, gray-green leaves.*

- Deep golden-yellow, star-shaped flowers in spring
- Drought and shade tolerant
- Low growing and can be used as a ground-cover for small areas



UC DAVIS
ARBORETUM
All-Stars

What is an Arboretum All-Star?
Arboretum All-Stars are the UC Davis Arboretum staff's top recommended plants for California gardens.

What makes a plant an Arboretum All-Star?
Each All-Star plant must have the following features:

- Attractive for most of the year
- Thrives in California conditions
- Tested in the UC Davis Arboretum

Many All-Stars also have one or more of the following features:

- Low maintenance
- Drought tolerant
- Attracts beneficial wildlife

For a complete list of UC Davis Arboretum All-Star plants and landscape designs, please visit our website at <http://arboretum.ucdavis.edu>

Grow it!

PLANT TYPE	perennial
HEIGHT	6-12 in.
WIDTH	1-2 ft.
BLOOM SEASON	March-April
PLACEMENT	full sun or part shade
WATER NEEDS	water deeply once or twice a month
PRUNING NEEDS	little or none
NATIVE TO	Mexico



Figure 2. Point of Purchase Poster for Retail Display

Introducing **UC DAVIS**
ARBORETUM



All-Stars



For a complete list of UC Davis Arboretum All-Star plants and landscape designs, please visit our website at <http://arboretum.ucdavis.edu>

Make the "Green" Choice for Your Great-Looking Garden

**UC DAVIS ARBORETUM
ALL-STARS**

- Use less water
- Require less maintenance
- Require less fertilizer
- Resist pests
- Make your home garden more sustainable
- Are grown and tested by the UC Davis Arboretum



purple dome Michaelmas daisy
Aster 'Purple Dome'
This striking dwarf daisy blooms profusely in mid- to late summer. It's attractive to butterflies, is happiest in full sun and tolerates wet soils. "Purple Dome" does not have any serious pest or disease problems.
Sunset Zone 1-24



Cape balsam
Thalassia thalassiana
Cape balsam produces compact spikes of succulent leaves and delicate, yellow flower plumes from fall through spring. It is a hardy plant, tolerating drought and poor soils.
Sunset Zone 8, 9, 12-24



Marie Simon ceanothus
Ceanothus 'Marie Simon'
Clusters of pink flowers atop maroon stems appear in spring with butterflies and other pollinators visiting frequently. Water-conscious gardeners should welcome Marie Simon as it thrives with little water.
Sunset Zone 5-9, 14-24



California fuchsia
Eupatorium californicum
A native, California fuchsia comes in many different forms, each displaying beautiful orange-red flowers in summer and fall. Hummingbirds love this plant and it gladly tolerates heat and drought.
Sunset Zone 2-11, 14-24



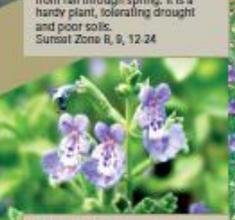
Wayne Roderick seaside daisy
Erigeron 'W. R.'
Low growing and great for flower borders, this California native blooms spring to fall with charming daisies. It is very popular with butterflies and does best with afternoon shade in hotter areas of the state.
Sunset Zone 1-9, 14-24



Goodwin Creek lavender
Lavandula x greggii 'Goodwin Creek Grey'
Add fragrance to your garden with this plant. It looks great in groupings or alone and always attracts butterflies. Gardeners love this lavender because it tolerates heat and requires little water.
Sunset Zone 8, 9, 12-24



Ed Carman's rosemary
Rosmarinus officinalis 'Mozart'
A blue flower and small habit set "Mozart" apart from other rosemary selections. Oils in the leaves add fragrance to the garden and the flowers persist from fall to spring. "Mozart" requires little water.
Sunset Zone 4-24



Palmer's sodum
Sedum palmeri
A low-growing groundcover, Palmer's sodum has attractive rosettes of leaves and flowers prolifically in spring. This versatile plant is drought and shade tolerant.
Sunset Zone 2-9, 14-24



autumn sage
Salvia greggii and *Salvia x amenae*
These plants flower abundantly in spring and fall, constantly visited by hummingbirds and pollinators. Autumn sages are heat and drought tolerant, a wise choice for conserving water.
Sunset Zone 8-24



Santa Margarita foothill penstemon
Penstemon heterophyllus 'Margarita B.O.H.'
Bring California's hills to your home garden with this native, drought-tolerant plant. The golden buds become intense blue blossoms.



hybrid catmint
Nepeta x intermedia

Figure 3. All-Stars Plant Tags Design Format

