Final Report
Saratoga Horticultural Research Endowment
2011-2013

Continued evaluations of the water use and climate zone tolerance of landscape ornamentals for sustainable California gardens

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Executive Summary

This two-year trial evaluated the performance of 20 landscape species from the *UC Davis Arboretum All-Stars* list on four levels of deficit irrigation based on percentages of reference evapotranspiration (ET_0). Twelve plant species were grown in full sun and eight were grown under 50% shade from October, 2011 to October, 2013 (Table 1). After the first year of establishment irrigation at 80-100% of ET_0, the plants were compared for growth, health, and aesthetic qualities across four levels of reduced irrigation at 80%, 60%, 40%, and 20% of ET_0. From these data we have developed the lowest rate or range of irrigation that would still yield a healthy plant with an aesthetically acceptable appearance in the landscape, and where appropriate, uncompromised flowering (Table 4). Thirteen of these plant species (eight for full sun, five for shade) were also planted and evaluated by UC Master Gardeners in up to eleven county-based demonstration gardens (Table 5). Those evaluations help inform the regional recommendations for success with some of the species.

Introduction

Sustainable gardening with low water-use landscape plants has finally shifted from being a regional trend in areas of California with extremely limited water availability to a statewide landscape movement. With the economy pulling out of the recession and land development again on the rise, the demand for landscape materials has once again increased. One side effect of this development upswing is the need for new landscapes that comply with the state of California's updated Model Water Efficient Landscape Ordinance, a response to Assembly Bill 1881 (Laird 2006), which went into effect about the same time the recession hit ("MWELO", 2010 ; "Water Conservation in Landscaping Act", 2006).

As part of the effort to promote sustainable landscaping, the UC Davis Arboretum has been showcasing its low water-use *UC Davis Arboretum All-Stars* plants as examples of attractive options for the new California landscape aesthetic (UC Davis Arboretum, n.d.). In

order for the majority of these or other water-conserving plant species to be grown successfully, they must be irrigated during our dry growing season at a level that is conservative but sufficient to maintain plant health and good looks. (Only a relatively few will thrive in the heat of interior summers on no irrigation.)

New irrigation technologies most often use specific values for plant water need to calculate irrigation amounts and frequency. Landscape architects, designers, and managers must have accurate value ranges for plant water needs if they are to plan and execute successful irrigation management. Currently, the most useful tool available to them is the Water Use Classification of Landscape Species (http://ucanr.edu/sites/WUCOLS/). Past research by these and other researchers has informed WUCOLS, but most of the information is still based on the well-educated opinion of horticultural professionals.

This research aimed to fill in some of the gaps in research-based information on the water needs of commercially available species from the *All-Stars* list. The secondary goal of this work was to evaluate how well these species performed during their first two years in a variety of soils and climate zones found in UC Master Gardener-managed demonstration gardens across the state (Table 5), and to report all these data to our stakeholders.

Research Methods

Irrigation Trials

Twenty-four plants each of twenty species were planted in the ground on the University of California campus in Davis, CA, (USDA Zone 9b and Sunset zone 14). Twelve species were planted in full sun, and eight were planted under 50% shade cloth. The soil in these adjacent fields is characterized as Yolo clay loam, a fairly heavy soil. Four full-sun species and three shade species were planted in the spring of 2012, for one of two reasons: either space was available because the cooperating grower was unable to source field-sized plants for fall, or it was determined that the particular species, going dormant during late autumn, had better survival rates when spring planted. The spring 2012-planted species are indicated in Table 1. The rest of the species were planted in fall 2011.

Plants were placed 2 meters apart in 1-meter wide planting rows, with 1 meter between rows. Beds were covered with 3 inches of chipped wood mulch. Each row was supplied with 4 water lines corresponding to one of the 4 irrigation treatments. Two 2-gallon/hour drip emitters attached to one of the four lines were installed under the mulch in the root zone of each plant. The plants and treatments were randomized throughout the fields in two complete blocks with a total of 6 repetitions of each water treatment for each species. The field was manually weeded between rows and post- and pre-emergent herbicide was applied around the perimeter of the field as needed. Throughout the trial, no pesticide or fertilizer treatments were applied to the plants. The plants were established on irrigation at 80-100% ET_0, as well as rainfall during fall 2011 through spring 2013.

Because of a dry winter, all plants received irrigation on April 1, 2013 to fill the soil water reservoir and begin the deficit irrigation budgets. These treatments continued through October. Irrigation was based on reference evapotranspiration (ET_0) as reported online by the local California Irrigation Management Information System (CIMIS; http://wwwcimis.water.ca.gov/) using the weather station at the Davis campus. ET_0 is defined as the total amount of water loss from a reference plant (in this case, a well-maintained tall fescue) through evaporation and transpiration. There were four treatment levels: 80%, 60%, 40%, and 20% of ET_0, corresponding to high, moderate, moderate-low, and low irrigation levels,

as described in *The Water Use Classification of Landscape Species IV* (WUCOLS IV, 2014). An equal volume of water was applied at each irrigation equivalent to 50% of the soil's water holding capacity in the root zone (about 16.5 gallons) to a depth of 18 inches. The frequency of the irrigation was determined using a water budget for each treatment percentage of ET_0, and modified for the shade treatments using an executable tool provided online by the UC Davis Biometerology Program (Snyder, R.L., 2007).

During the deficit irrigation treatments of 2013, the plants in full sun on 80%, 60%, and 40% of ET_0 were irrigated approximately every 2, 3, and 4 weeks, respectively. The 20% treatment received 2 irrigations, one in early July and another in early September. In the shade, the frequency was far lower: the 80% treatment was irrigated 4 times, the 60% treatment 3 times, the 40% treatment twice (once done early due to technician error), and the 20% treatment not at all. The only significant rain events during this time were almost an inch in early May, and just over half an inch in late September.

Measurements of length (l), width (w), and height (h) were taken monthly. These measurements were used to calculate a plant growth index (PGI = $[(l + w)/2 + h]/2$) (Irmak, S. et al., 2004). A relative plant growth index was also calculated (PGI/ initial PGI) and tracked to account for original plant size differences, and to evaluate the percentage of new growth along with final average plant size for each treatment.

Qualitative ratings were also taken on a monthly basis. The plants were rated on a scale of 1-5 for foliage appearance, flowering, pest tolerance, disease resistance, vigor, and overall appearance, with 5 being highest and 1 lowest. In all categories except flowering, these ratings can be characterized as 5=exceptional, 4=very good, 3=average, 2=below average, 1=very poor. The flowering rating reflects the percentage of the plant in bloom. Descriptions of the guidelines for ratings are in Table 3.

Photographs and complete growth data and quality ratings are found in the Appendix.

Climate Zone Evaluations

Three to five plants of most species were delivered to a total of 10 publicly accessible demonstration gardens in 9 counties with UC Master Gardener programs. Not all gardens could accommodate all the plants. Table 5 shows the distribution of each species and the average overall quality ratings given. It is noted in the table when a species was already successfully growing in a county, and the master gardeners recommend it for their area. Since these demonstration gardens are typically devoted to sustainable landscaping methods, the irrigation systems are designed to deliver water efficiently, and are scheduled for moderate or low water-need plants. In most cases, this means the plants must receive additional hand watering during their establishment year.

Master gardeners collected quarterly growth data and rated the quality of the plants monthly using the same criteria as the irrigation trials. Their data was uploaded through an on-line survey to a UC-hosted website where it can be accessed by the PI for evaluation at the end of each trial period. The location of the trial gardens and a map are included in the Appendix.

Table 1. Plants installed fall 2011 and spring 2012; * indicates CA native/native cultivar

SUN	Botanical name	Common name
	Arctostaphylos densiflora 'Howard McMinn'*	Vine Hill manzanita
	Calamagrostis × *acutiflora* 'Karl Foerster'	Karl Foerster feather reed grass
	Cerastium tomentosum	snow-in-summer
	Ceratostigma plumbaginoides	dwarf blue plumbago
	Delosperma cooperi	Cooper's ice plant
Spring	*Isomeris arborea**	bladderpod
	Kniphofia 'Christmas Cheer'	Christmas Cheer poker plant
Spring	*Phlomis purpurea*	purple phlomis
Spring	*Rosa* 'Pink Grüss an Aachen'	pink grüss an Aachen rose
Spring	*Salvia microphylla* 'Hot Lips'	Hot Lips mint bush sage
	Teucrium chamaedrys 'Prostrata' ('Nanum')	dwarf germander
	Teucrium fruticans 'Azureum'	Azureum bush germander
SHADE		
	Berberis aquifolium 'Compacta'*	compact Oregon grape
Spring	*Ceratostigma plumbaginoides*	dwarf blue plumbago
	Cyrtomium falcatum	Japanese holly fern
	Daphne odora 'Aureomarginata'	variegated winter Daphne
Spring	*Festuca californica**	California fescue
	Neomarica caerulea	walking iris
	*Ribes malvaceum**	chaparral currant
Spring	*Sollya heterophylla*	bluebell creeper

Table 2. 2013 Deficit Irrigation Frequency Details – April to October

Irrigation % of ET_0	# of Irrigations	Dates of Irrigation (rainfall: 4/4, 0.6"; 5/6: 0.8"; 9/21, 0.7")
SUN		
80	10	4/23, 5/14, 6/1, 6/15, 7/2, 7/16, 7/31, 8/16, 9/3, 9/27
60	7	4/30, 5/20, 6/13, 7/2, 7/22, 8/12, 9/4
40	5	5/8, 5/25, 6/27, 7/25, 8/27
20	1	7/3, 9/6
SHADE		
80	4	5/22, 6/22, 7/24, 8/26
60	3	6/6, 7/16, 9/10
40	2	6/6 (in error), 8/25
20	0	

Table 3. Description of quality ratings

RATING	5	4	3	2	1
Foliage	perfect to excellent; plant is in full leaf with no signs of leaf burn, disease or insect damage, and has an appealing appearance	same as 5 except for minor tip burn, edge damage, or minor damage to only a few leaves	acceptable but not its best; minor damage to all leaves that is less evident from a distance or severe damage to no more than 25% of plant	unacceptable; moderate damage to most of the plant or major damage to more than 25%; plant is declining and may not recover	unacceptable; close to dead
Flowering	full, glorious bloom; the height of bloom for the species	51-75% of plant in bloom	30-50% of plant in bloom	11-15% of plant in bloom	1 bloom open to 10% in bloom
Pest Tolerance/ Disease Resistance	no visible damage	only very minor damage to a few leaves	minor damage to many of the leaves or flowers; appearance still acceptable from a distance	major damage ; appearance unacceptable	severely damaged and probably dying
Vigor	pushing out a lot of new growth from every growing point	pushing out new growth from most growing points	Plant is surviving and healthy, but not pushing out much new growth, if any	Plant is very small for the species or unhealthy, and declining	Plant is barely alive; close to death
Overall Appearance	An impressive plant; everything works together: flowers (if present), leaves, the shape and condition of the plant are all very appealing. It has the WOW factor that makes it an attractive garden plant, even if each individual factor isn't perfect.	a very attractive plant; may be a 5 when in bloom, or just a very nice species that lacks the WOW factor or is not at its prime	Acceptable but nothing special; may be past or not quite to its prime; often described as an 'okay' plant.	unacceptable for any of the above reasons	completely unacceptable and probably not going to improve

Results and Discussion

Irrigation Trials

The following table summarizes the quality ratings at each irrigation level for each species. Unless flowering is compromised, the combination of highest acceptable rating and lowest irrigation level is the recommended rate of irrigation for that species. Where there were no significant differences between treatments for the quality ratings, the range of irrigation levels that produced acceptable ratings is shown. Rather than just recommend the lowest rate, this range is included since it is helpful to know if a plant may be grown successfully in more than one hydrozone. Discussion of individual species follows in the order shown in Table 1. Detailed plant growth index (PGI) charts and monthly average quality ratings in each category for each species are included in the appendix. The PGI charts show growth over the entire year, while the relative PGI charts have been excerpted for clarity to show just the months of deficit irrigation.

The only species not included is *Ribes malvaceum*. This plant had extremely high mortality in the irrigation trials; by the end of the second year, only two plants remained. It also failed almost completely in the demonstration gardens, and only the Mariposa County garden, which lies in its natural range, had garden success with this species. *Ceratostigma plumbaginoides* was grown in both sun and shade for comparison of quality and water needs, and the results from both conditions are discussed together.

Table 4. Summary of average overall quality ratings on 4 irrigation treatments for 2013; significantly highest ratings are in bold print. *Denotes a California native species or cultivar.

PLANT NAME	Overall Rating on each ET_0 % (1-5)				Recommended rate
SUN	**80**	**60**	**40**	**20**	
Arctostaphylos densiflora 'Howard McMinn'*	3.6	3.5	**3.8**	3.5	40%
Calamagrostis × acutiflora 'Karl Foerster'	**4.7**	4.4	4.3	4.2	20-80%
Cerastium tomentosum	3.1	3.0	2.8	3.1	20-80%
Ceratostigma plumbaginoides	**3.9**	3.3	3.4	3.5	80%
Delosperma cooperi	3.8	3.6	3.8	**4.0**	20%
*Isomeris arborea**	3.4	2.6	3.4	**3.6**	20%
Kniphofia 'Christmas Cheer'	3.3	3.0	3.3	3.3	40-80%
Phlomis purpurea	3.3	3.7	3.8	3.7	20-60%
Rosa 'Pink Grüss an Aachen'	3.6	3.2	3.6	3.4	40-80%
Salvia microphylla 'Hot Lips'	3.7	4.0	4.0	3.6	40-60%
Teucrium chamaedrys 'Prostrata'	3.9	**4.2**	4.0	3.7	60%
Teucrium fruticans 'Azureum'	3.5	3.7	3.8	3.9	20-40%
SHADE					
Berberis aquifolium 'Compacta'*	3.6	3.8	**4.0**	3.8	40%
Ceratostigma plumbaginoides	3.4	3.3	3.4	3.3	20-80%
Cyrtomium falcatum	2.9	3.5	3.3	**3.7**	20%
Daphne odora 'Aureomarginata'	3.2	**3.5**	3.2	3.3	20-60%
*Festuca californica**	3.5	3.2	3.8	3.7	20-40%
Neomarica caerulea	3.3	3.6	3.6	**3.8**	20%
Sollya heterophylla	3.9	4.0	4.1	3.9	20-80%

Climate Zone Trials

Table 6 below shows a summary of the average annual ratings given each species by the individual counties who evaluated them, along with the Sunset climate zone. Detailed charts of growth and individual quality category ratings by county are in the appendix. Master Gardener comments will be included with the individual species discussions.

Table 5. Summary of average overall quality ratings in 10 MG demonstration gardens; AR = already growing – recommended; x means it did not survive to the end of the trial period.

COUNTY	Alameda	Los Angeles	Mariposa	Nevada/Placer	Orange	SD- inland	SD- coastal	San Joaquin	Shasta	Ventura
Sunset Climate Zone	**14**	**21**	**7**	**7**	**23**	**21/23**	**24**	**14**	**9**	**21**
SUN										
Arctostaphylos densiflora 'Howard McMinn'	4.4	AR	4.6	AR	4.0	4.3	3.4	AR	3.0	4.1
Calamagrostis acutiflora 'Karl Foerster'	3.5			3.7	2.2*		3.7	4.0	3.4	x*
Cerastium tomentosum	3.1			AR	2.2		3.2	3.4	3.4	1.0
Ceratostigma plumbaginoides	3.6			3.1	2.4	3.3	2.9	3.8	2.0	3.5
Delosperma cooperi	3.7			3.5		4.1		2.3	2.8	2.9
Kniphofia 'Christmas Cheer'	3.9			3.4	3.1	3.2	3.1	4.1	2.7	3.1
Teucrium chamaedrys 'Nanum'	4.2			4.0	3.7	3.1	3.7	4.8	2.8	2.7
Teucrium fruticans	3.4			AR		3.9	4.0	4.2		3.8
SHADE										
Berberis aquifolium 'Compacta'		4.0	4.1		3.6	3.0	2.8		2.7	3.6
Neomarica caerulea					4.0				2.2	3.0
Cyrtomium falcatum	x							3.9	2.4	x
Daphne odora 'Aureomarginata'					4.3	4.2	2.8#	5.0	3.9	2.8#
Ribes malvaceum	x	x	3.4			x	x	x	x	x

***Ratings adversely affected by repeated rabbit damage**

 # Ratings adversely affected by failure to adequately irrigate during establishment

DISCUSSION:
SUN SPECIES

Arctostaphylos densiflora 'Howard McMinn'

This exceptionally adaptable manzanita grew and thrived in every site where it was grown and on every irrigation level. Like most woody California native species, it can be slow to establish, flower, and put on size, but in gardens where it has been growing for some time, it is a handsome part of the landscape with consistent good looks and heavy flowering in early spring. Flowering cannot be correlated to irrigation in this study, since it precedes the irrigation treatments. A three-year trial would be needed to see if flowering in subsequent years was affected by the previous year's irrigation. Though there were no statistically significant differences in relative growth between the treatments, the best overall appearance was achieved at 40% ET_0.

The only pest issue was manzanita leaf gall aphids, which distorted the tips and edges of the leaves with reddish galls. Although it was technically pest damage, the overall aesthetics of most plants were not really diminished by minor galling, though in a few cases major galling turned necrotic and affected the appearance negatively. However, some found the reddish galling attractive for the color it added in the non-flowering season.

Calamagrostis × acutiflora 'Karl Foerster'

Karl Foerster feather reed grass proved itself a tough and beautiful ornamental whose only drawback is the downtime after cutting back typical of ornamental grasses. It also proved irresistible to rabbits in two sites, Orange and Ventura Counties. Size, flowering, and overall appearance increased incrementally with increased irrigation, but it must be noted that even at the lowest irrigation level, the average plant quality was still rated consistently above the acceptable or very good rating while receiving water only in July and September. By October, the statistical difference in size between treatments had gradually disappeared with each successive irrigation application. For this reason, this plant could be grown successfully on any of these levels of irrigation.

Cerastium tomentosum

Snow-in-summer did not turn out to be as hardy a plant as we had hoped. The average overall appearance of these plants was barely acceptable at all irrigation levels during the second year. Plants sent out runners under the bark that put up new remote growth, but the main clumps often showed old interior leaves and died out in the center leaving a donut effect. Other plants died off completely on one side for no apparent reason. Growth and overall appearance were not significantly different between irrigation treatments. The only county garden to recommend it was coastal San Diego, and they had to cage it to keep it from rabbit browsing. It just did not prove to be a vigorous spreader or a consistently attractive clumping plant. These results have caused us to question its inclusion on the *All-Stars* list.

Ceratostigma plumbaginoides

Since we grew this species in both the full sun and shade, both treatments' results will be discussed together for comparison. In full sun, the 60% and 80% ET_0 treatments were significantly larger in size than the two lowest treatments, but the foliage, flowering and overall appearance ratings were consistently highest on the highest level of irrigation. In the shade, there were no significant differences between the treatments in size or quality. For these reasons,

the recommended irrigation rate for full sun would be the highest level, 80% ET_0, but we feel confident in recommending any irrigation level for the shade. In both sun and shade, the leaves were never flawless, but seemed to have minor damage from various sources much of the time. When in bloom, the damage was unnoticeable, but when the season was late, and the flower heads were spent, it had periods of looking ragged before it turned red for the fall.

The master gardeners struggled with this species. Most of them were growing it in full sun all day, and their demonstration gardens are typically conservative with water after establishment. Complaints against it included failure to grow vigorously and fill in, and that the spent flowers looked messy. The garden with the highest overall quality rating, San Joaquin, was able to give it consistent water.

Delosperma cooperi

As a flowering groundcover, this iceplant was fairly fast spreading and sturdy in the trials field. It showed some sensitivity to hard frost, turning purple and dying back in some cases. The best overall appearance was achieved at the lowest irrigation rate, though, as the summer wore on, the best flowering was maintained at the highest water. There was still acceptable flowering on the lower levels, however, and the spring flowering was not affected, so the lowest irrigation rate is recommended. Issues with this species in the field besides freezing included occasional damage by turkeys that dug around in a few plants, breaking off stems and creating holes. This caused some inconsistencies in the measurements, but overall there was little difference in growth between treatments and the differences are not clearly attributable to the irrigation.

Features appreciated by the master gardeners were the long bloom time, and the relatively low maintenance. However, all gardens noted the unattractive appearance that follows heavy blooming when a large number of dead flower heads are still on the plant. Some of this is overcome later by new growth and blooming, but overall it was not rated very highly. Where the soil was heavy, as would be expected, it did not perform well at all. In San Joaquin County it was also prone to rabbit browsing. Only the gardens in El Cajon and Livermore recommended it.

Isomeris arborea

This southern California native species was extremely difficult to analyze due to 50% mortality rates on the 80, 60, and 20% treatments, leaving only three plants on each of these irrigation levels. The 40% ET_0 treatment had 30% mortality, leaving four plants for measurements and ratings. There seemed to be no significant difference in growth between the lowest and highest irrigation level, and while the 60% seems to have put on the most relative growth, it is difficult to establish significance with the small sample size.

There was a single but considerable pest issue. Due to our proximity to a bell pepper trial, we became the victims of a flea beetle infestation on the bladderpod. It is worth noting the strong similarity in the scent of the bladderpod leaves and bell peppers. We think this may have been what lured them from the bell pepper trial through the orchard to our field. The leaf damage was considerable on some plants, and even flowers were chewed in some cases. We attempted to rid the plants of dead leaves and the bark immediately around the base to lower the pest numbers the following year, but there were still active populations during the second year.

The highest irrigation treatment had the best flowering, but the best overall appearance was at the lowest level. When only the ratings for the June through October period are averaged, this difference becomes even more pronounced in favor or the 20% of ET_0 treatment.

It seems apparent that this species can be difficult to establish. When it did survive and perform well it was appreciated for its long flowering period, and it was agreed that it would make an interesting addition to a southwestern style garden. The master gardeners did not evaluate this species.

***Kniphofia* 'Christmas Cheer'**

Although this large poker plant's average overall appearance ratings for the year are barely average, it was actually outstanding at the height of its bloom in December, making it true to its name. Irrigation levels seemed to have little effect on the quality ratings or the growth, except that the 20% ET_0 treatment put on relatively less growth than the 40% treatment, though not significantly less than the two highest treatments. Overall, only the three highest treatments put on size between October 2012 and October 2013. For this reason, the lowest level of irrigation is not recommended, as plant decline may ensue in subsequent years in hot inland areas. The 80% and 60% irrigation rates also had early fall flowering before the trials ended, while the two lower rates did not.

In the demonstration gardens where it was evaluated, the winter blooming was an asset for its striking color and form and its provision of off-season nectar for hummingbirds and insects. This is also a plant that improves with age and hard pruning in early spring, and its ratings would likely have improved with an additional year of evaluations. Drawbacks include the need to spend time cleaning up the dead leaves each year, and throughout the year, if a pristine appearance is desired. All counties that grew it recommended it except inland San Diego where it had problems with mealy bug, and Shasta where it took a long time to recover from being cut back after blooming.

Phlomis purpurea

This gray-foliaged Mediterranean plant performed best on the three lowest levels of irrigation. Growth differences did not show consistent variation dependent on irrigation. The lavender flower spikes are attractive, though not a striking contrast to the foliage color. The plant appearance is much improved if these are removed after flowering, and the drop in size on the growth charts reflects post-flowering pruning. This unusual shrubby perennial would make a nice addition to a low-water use design for its foliage color and flexible range of lower irrigation levels. The master gardeners did not evaluate this species.

***Rosa* 'Pink Grüss an Aachen'**

The first thing to note is that these plants, which are not commercially available, were sourced from the UC Davis Arboretum nursery in the spring of 2012, and much of the material was in poor condition. Some disease symptoms were apparent immediately, so rather than treat, we did our best to clean up the infected foliage and allow the plants to put on newer healthier growth. Throughout the irrigated growing season of 2013, there were no significant differences between irrigation treatments in relative growth. Only flowering was somewhat compromised on the lowest level of irrigation.

Overall these old-fashioned landscape roses are somewhat attractive when at their height of bloom, but their overall appearance only occasionally and sporadically rose to the "very good" level. The shrubs were never completely disease-free except for a brief period when the spring growth first appeared. It is unclear whether this was an artifact of poor propagation methods, or whether this rose is just prone to some level of fungal disease. It is our opinion that this species

does not rise to the level of an *All-Star*, and that there are landscape roses available that are hardier and as attractive in bloom. The master gardeners did not evaluate this species.

***Salvia microphylla* 'Hot Lips'**

S. microphylla is truly a plant worthy of the *All-Stars* name. It bloomed from March to December with really heavy bloom for the four months June through September. The best flowering and foliage appearance were in the 40 to 60% of ET_0 range, with only marginally higher relative growth on the 60% treatment.

Hot Lips was mostly unaffected by disease symptoms and was insect pest free. There was a strong and unpredictable tendency for the red "lips" appearance of flowers to revert to either all red or all white, often on the same shrub. This seems to be a common phenomenon where this plant has been seen growing in other areas as well.

***Teucrium chamaedrys* 'Nanum' (also called 'Prostrata')**

By August, the two lowest irrigation treatments, 20 and 40% ET_0, were yielding significantly lower relative growth than the highest irrigation treatment, though not the 60% treatment. The highest irrigation at 80% ET_0 did not yield the highest quality ratings however, which were achieved at the 60% level. The spreading habit of this plant is to send out roots under the mulch and pop up at some distance from the original plant, leading to a scattered, disconnected look for a groundcover. It may have filled in given additional time in the ground.

Master gardeners varied in their response to this species. Inland San Diego did not recommend it for its lack of vigor in their garden, and Ventura County found it unimpressive and easy to miss where they had it planted. Other gardens found it attractive, useful, and were fond of the floral display in the spring. Its need for deadheading to stay attractive after blooming was considered a detriment, as it is difficult to shear off flowers from a low-growing plant. However, it hardiness and generally tidy appearance when not blooming were its strong features.

***Teucrium fruticans* 'Azureum'**

This is another species useful for landscapes in need of a gray-leaved accent, hedge, or focal point. It performed best on the lowest two irrigation treatments, with the highest foliage and overall appearance ratings at just 20% of ET_0 and the best flowering and most growth at 40% of ET_0.

All the master gardener counties who grew it recommended it, including the county that already had it growing. It was appreciated for its care-free nature, gray foliage color, and in some cases the ability to hedge it or shape it into formal landscape "balls".

SHADE SPECIES

***Berberis aquifolium* 'Compacta'**

The 40% ET_0 treatment yielded consistently the highest quality ratings, though there were no differences between treatments in relative growth. Since flowering occurred before treatments were applied, it cannot be correlated to irrigation in a 2-year trial.

Shasta and both San Diego County locations gave this species low overall appearance ratings for the year and did not recommend it. As mentioned before, native species can be slow to establish, and given better growing conditions and time, they may have changed their final recommendations.

Cyrtomium falcatum

We were pleasantly surprised to see this fern produce the best average quality ratings on the lowest irrigation treatment with absolutely no supplemental summer water. (This is not apparent from the photos called Figure 15a and 15b in the appendix, which were of the same designated plants throughout the year; other specimens not photographed had better appearance at the end of the season.) However, in these first two years, none of the treatments were really good looking during the summer months. Significant differences in relative growth were absent. Four demonstration gardens took this species, but only two had survivors, and only one, San Joaquin County, recommended it. Issues associated with mortality were frost damage (Shasta County), failure to site the plant in the shade or protect it from trampling. Where it did survive (San Joaquin County) and is still growing, it has continued to improve in appearance in its third year and would definitely be recommended for the shade. It should be noted that San Joaquin County is in the same Sunset zone as Davis.

***Daphne odora* 'Aureomarginata'**

The batch of plants we received for planting were not as strongly marked with the yellow margins typically characteristic of this cultivar. They struggled during their first establishment year both in the irrigation field and in some of the demonstration gardens. They took off more in the second year, and were rated highest overall on the 60% ET_0 treatment. This is definitely a species that improves in form with age.

WUCOLS currently has this plant listed as a Low category water user. In our trials, there was a significant difference in growth between the treatments: the lowest and highest were both smaller than the 40 and 60% treatments by the last measurement in October, although quality ratings were only marginally better for the 60% treatment. For this reason, we can safely recommend a range of irrigation from 20-60%.

Ventura and coastal San Diego gardens both had trouble providing sufficient establishment water; all other gardens recommended the plant and gave it good ratings.

Festuca californica

When visiting our trials field, Ellen Zagory, public horticulture director for the UCD Arboretum, remarked that our specimens were the best looking she had ever seen. Its first year in the ground it was the victim of some rabbit damage during the winter, but once the holes in the fence were patched up, most plants recovered well. This California native grass really performed beautifully in 50% shade, producing well-formed plants with good flowering and an attractive overall appearance even on the lowest irrigation treatment of 20% (no summer water). The 60 and 80% irrigation treatments unsurprisingly yielded the largest plants, with the 60% rate being favored somewhat throughout the season. However, if the overall appearance ratings are averaged for just the months of irrigation (rather than the entire year), the highest ratings are the 20 and 40% treatments! So, at least for this species, bigger is not necessarily better.

The master gardeners did not evaluate this species.

Neomarica caerulea

The walking iris is a little grown plant, but with potential for dry shade gardens since its foliage is tall and striking throughout the year. The only notable difference in size between

treatments was a slight advantage of the 80% over the 20% during the last two months of summer. The significance of the difference faded , however, with the first fall rain. As with the *Festuca*, the highest overall appearance ratings did not go to the largest plants but to the smallest on the 20% treatment. This is understandable when you take into consideration that taller more succulent leaves are prone to bending over in the breeze and creasing. The 80% treatment did have the highest flowering rating, but the flowers, though beautiful, are small, very fleeting, and not the main feature of this plant.

Shasta County plants suffered irreparably from frost damage and never fully recovered. Both Ventura and Orange County recommended the iris for their area as a tall striking plant for dry shade.

Sollya heterophylla

The Australian bluebell creeper turned out to be one of the favorites in our irrigation trials with its year-round fresh green foliage and dainty blue flowers in summer. There were no differenced in growth attributable to irrigation levels, and the quality ratings were very close. The quality ratings chart in the appendix show that for the irrigated season in 2013, all treatments were consistently in the very good range and ended the season at 5.0. If the overall appearance ratings for just this season are averaged, they are all at 4.3 or 4.4.

The master gardeners did not grow this species.

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Appendix

Photos – SUN SPECIES

Figure 1a. *Arctostaphylos densiflora* 'Howard McMinn' in March 2013

Figure 1b. Extensive galling on *Arctostaphylos densiflora* 'Howard McMinn' in August 2013

Figure 2a. *Calamagrostis* × *acutiflora* 'Karl Foerster' in August 2013

Figure 2b. Calamagrostis × *acutiflora* 'Karl Foerster' in the breeze October 2013

Figure 3a. *Cerastium tomentosum* in May 2013

Figure 3b. *Cerastium tomentosum* in August 2013 on 60% ET_0 showing the donut effect

Figure 4a. *Ceratostigma plumbaginoides* in full sun in June on 60% ET_0

Figure 4b. *Ceratostigma plumbaginoides* in full sun in Sept 2013 on 60% ET_0

Figure 5a. *Delosperma cooperi* in May 2013 on 20% ET_0

Figure 5b. Delosperma cooperi in September 2013 on 20% ET_0

Figure 6a. *Isomeris arborea* in May 2013 on 20%ET_0

Fig. 6b *Isomeris arborea* in October 2013 on 20% ET_0

Figure 6c. Close-up of flea beetles and their leaf damage on *Isomeris arborea*

Fig. 7a *Kniphofia* 'Christmas Cheer' in August 2013 on 60% ET_0

Fig. 7b *Kniphofia* 'Christmas Cheer' in December 2012

Figure 8a. *Phlomis purpurea* in May 2013 on 20% ET_0

Figure 8b. *Phlomis purpurea* in September 2013 on 20% ET_0

Figure 9a. *Rosa* 'Pink Grüss an Aachen' in May on 40% ET_0

Figure 9b. *Rosa* 'Pink Grüss an Aachen' in August on 40% ET_0

Figure 10a. *Salvia microphylla* 'Hot Lips' in bloom in June 2013 on 40% ET_0

Figure 10b. *Salvia microphylla* 'Hot Lips' in bloom in August 2013 on 40% ET_0

Figure 10c. *Salvia microphylla* 'Hot Lips' in bloom in October 2013 on 40% ET_0

Figure 10d. *Salvia microphylla* 'Hot Lips' on 20% ET_0 in May 2013

Figure 10e. *Salvia microphylla* 'Hot Lips' on 20% ET_0 in September 2013

Figure 11a. *Teucrium chamaedrys* 'Prostrata' ('Nanum') in May 2013 on 60% ET_0

Figure 11b. *Teucrium chamaedrys* 'Prostrata' in October 2013 on 60% ET_0

Figure 12a. *Teucrium fruticans* 'Azureum' in February 2013 on 40% ET_0

Figure 12b. *Teucrium fruticans* 'Azureum' in October 2013 on 40% ET_0

Photos – SHADE

Figure 13a. Berberis aquifolium 'Compacta' in March 2013

Figure 13b. *Berberis aquifolium* 'Compacta' in August 2013 on 20% ET_0 (no water)

Figure 14a. *Ceratostigma plumbaginoides* in June on 40% ET_0 in 50% shade

Figure 14b. *Ceratostigma plumbaginoides* in October on 40% ET_0 in 50% shade

Figure 15a. *Cyrtomium falcatum* on 20% ET_0 in March 2013

Figure 15b. *Cyrtomium falcatum* on 20% ET_0 in October 2013

Figure 16a. *Daphne odora* 'Aureomarginata' on 40% ET_0 showing little variegation

Figure 16b. *Daphne odora* 'Aureomarginata' in October on 40% ET_0

Figure 17a. *Festuca californica* in late March 2013 on 20% ET_0

Figure 17b. *Festuca californica* in October 2013 on 20% ET_0 (no summer water)

Figure 18a. *Neomarica caerulea* on 20% ET_0 in June 2013

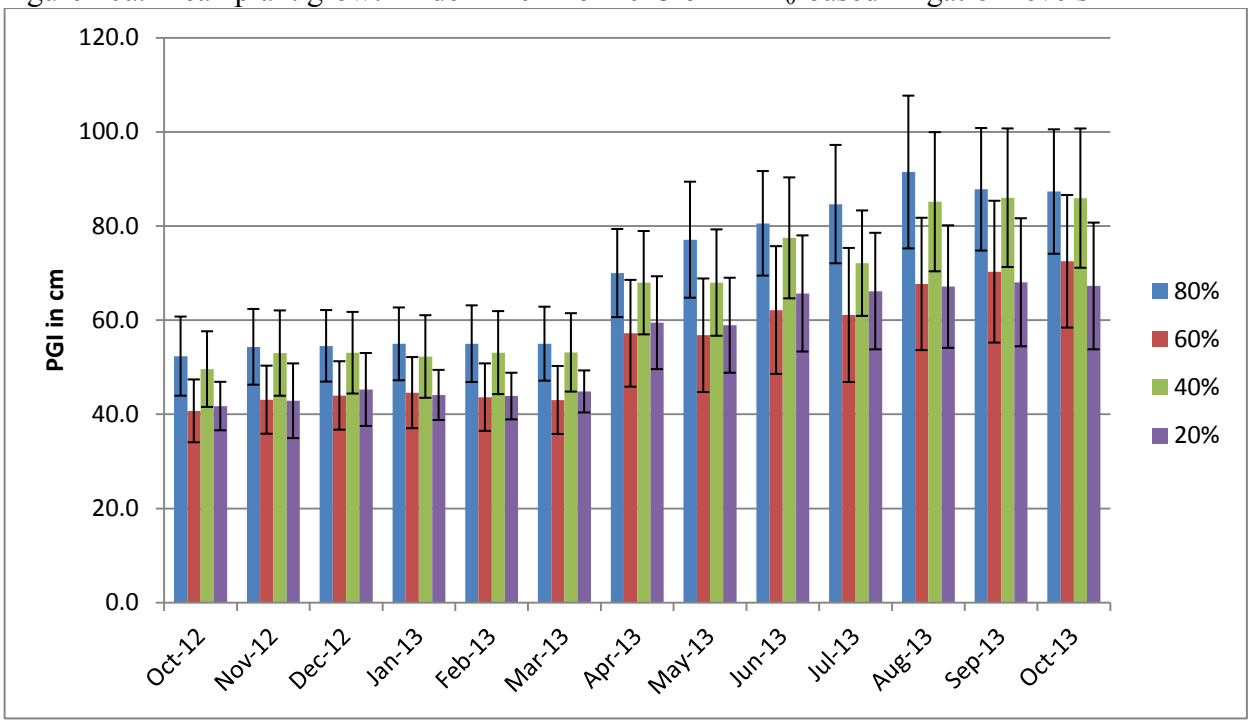
Figure 18 b. *Neomarica caerulea* on 20%ET_0 in October 2013 (no summer water)

Figure 19a. *Sollya heterophylla* on 20% ET_0 in April 2013

Figure 19b. *Sollya heterophylla* on 20% ET_0 in October 2013 (no summer water)

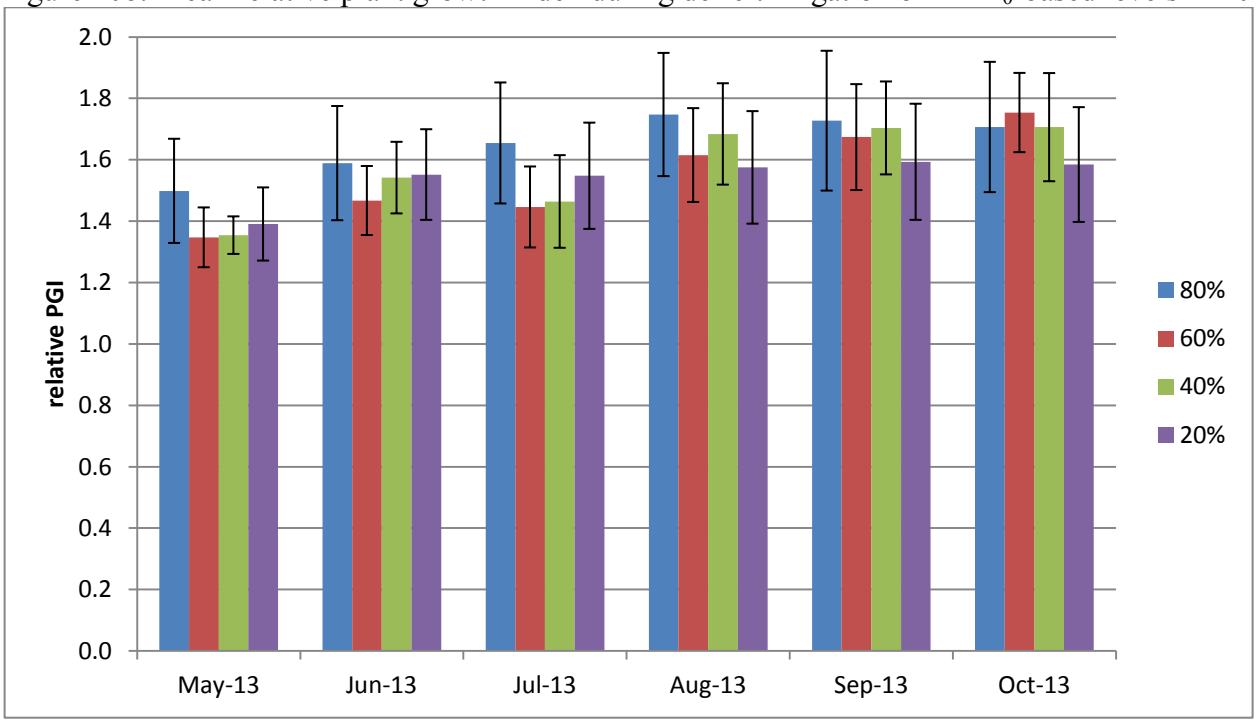
Arctostaphylos densiflora 'Howard McMinn'

Figure 20a. Mean plant growth index in cm for 2013 on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Figure 20b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels in 2013



Error bars represent ± 1 SE

Table 6. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

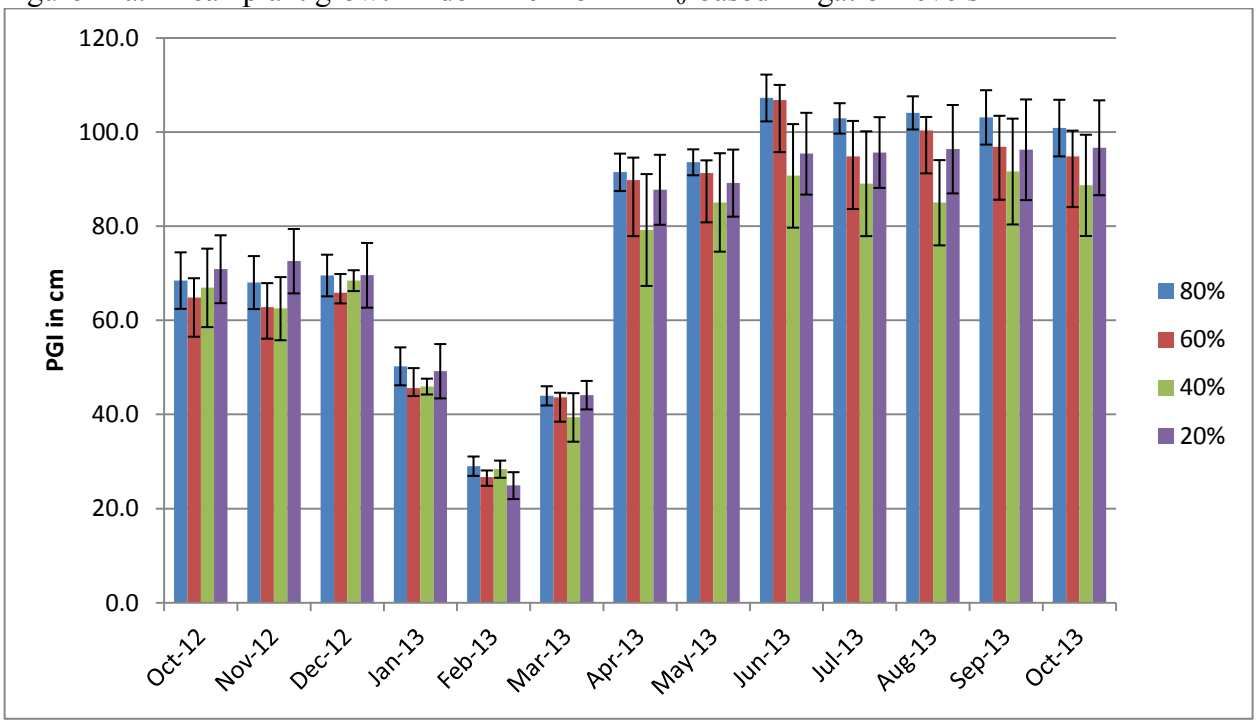
***Arctostaphylos densiflora* 'Howard McMinn' average quality ratings 2012-2013**														
foliage		**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	4.2	4.2	3.7	4.3	4.3	4.5	3.7	3.7	3.5	3.2	3.0	3.3	**3.8**
	60%	4.8	4.3	4.4	4.3	5.0	4.7	4.3	4.2	3.8	3.5	4.0	4.2	**4.3**
	40%	5.0	4.4	4.2	4.8	4.8	4.4	4.0	3.8	4.0	3.4	3.4	3.6	**4.2**
	20%	4.7	4.0	4.2	4.0	4.8	4.7	4.2	4.2	4.2	4.1	4.0	4.1	**4.3**
flowering														
	80%		1.0		1.5	2.2					3.0			**1.9**
	60%		5.0	1.0	1.5	2.8								**2.6**
	40%		1.0		1.5	2.6								**1.7**
	20%				2.0	3.2								**2.6**
pest tolerance														
	80%	4.5	4.5	4.7	4.7	4.8	4.8	3.7	3.8	3.5	3.3	3.5	3.7	**4.1**
	60%	5.0	4.7	4.7	4.7	5.0	5.0	4.3	4.3	3.8	3.5	3.8	4.2	**4.4**
	40%	4.8	4.3	4.8	4.8	5.0	4.8	4.0	3.8	4.0	3.0	3.0	3.5	**4.1**
	20%	5.0	4.5	4.8	4.5	5.0	4.8	4.3	4.5	4.3	4.0	4.0	4.2	**4.5**
disease resistance														
	80%	4.7	4.7	4.5	5.0	5.0	5.0	5.0	5.0	4.8	4.8	4.4	5.0	**4.8**
	60%	5.0	4.7	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	20%	4.7	4.5	4.3	4.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.8**
vigor														
	80%	4.0	4.2	3.7	4.0	4.2	4.5	4.3	4.2	4.3	4.2	4.3	4.2	**4.2**
	60%	3.3	3.5	3.0	3.5	3.5	3.5	3.5	3.2	3.5	3.7	3.5	3.7	**3.4**
	40%	3.8	3.6	3.4	3.6	4.4	4.2	4.2	4.2	4.4	4.4	4.4	4.2	**4.1**
	20%	3.5	3.8	3.0	3.5	3.3	3.8	3.3	3.8	4.0	3.7	3.8	3.7	**3.6**
overall appearance														
	80%	3.5	3.8	3.4	3.5	3.9	3.7	3.7	3.8	3.5	3.3	3.2	3.4	**3.6**
	60%	3.5	3.7	3.3	3.7	4.0	3.3	3.7	3.5	3.5	3.3	3.3	3.4	**3.5**
	40%	3.7	3.8	3.7	4.0	4.5	3.4	3.9	3.6	3.8	3.7	3.4	3.8	**3.8**
	20%	3.2	3.6	3.2	3.9	4.2	3.3	3.3	3.3	3.8	3.7	3.5	3.5	**3.5**

Table 7. Master Gardener average annual quality ratings and 2-year growth for *Arctostaphylos densiflora* 'Howard McMinn'

COUNTY	Alameda	Mariposa	Orange	San Joaquin	SD inland	SD coastal	Shasta	Ventura
Sunset Zone	**9**	**7**	**23**	**14**	**21/23**	**24**	**9**	**21**
foliage	4.8	4.6	3.9	4.1	4.4	3.8	3.2	4.5
flowering	3.3	2.8	2.4	1.3	2.5	2.0	2.4	1.2
bloom period	Feb-Mar	May	Jan-Apr, Oct	Jan-Apr	Jan-Feb	Jan-Feb	Jan-Apr	Feb-Mar all year
pest tolerance	4.9	4.8	4.7	5.0	4.6	4.4	5.0	5.0
disease resistance	5.0	4.8	4.8	5.0	4.8	4.4	4.9	5.0
vigor	3.9	4.7	3.9	4.2	4.3	3.5	3.1	4.0
overall appearance	**4.4**	**4.6**	**4.0**	**4.2**	**4.3**	**3.4**	**3.0**	**4.1**
MSMTS								
relative PGI	3.3	1.6	2.5	5.3	1.9	1.4	2.2	2.9
avg ht (cm)	84	45	47	149	40	30	50	54
avg wd (cm)	90	64	57	140	68	58	45	88
AVG HT (in)	33	18	19	59	16	12	19	21
AVG WD (in)	36	25	23	55	27	23	18	35

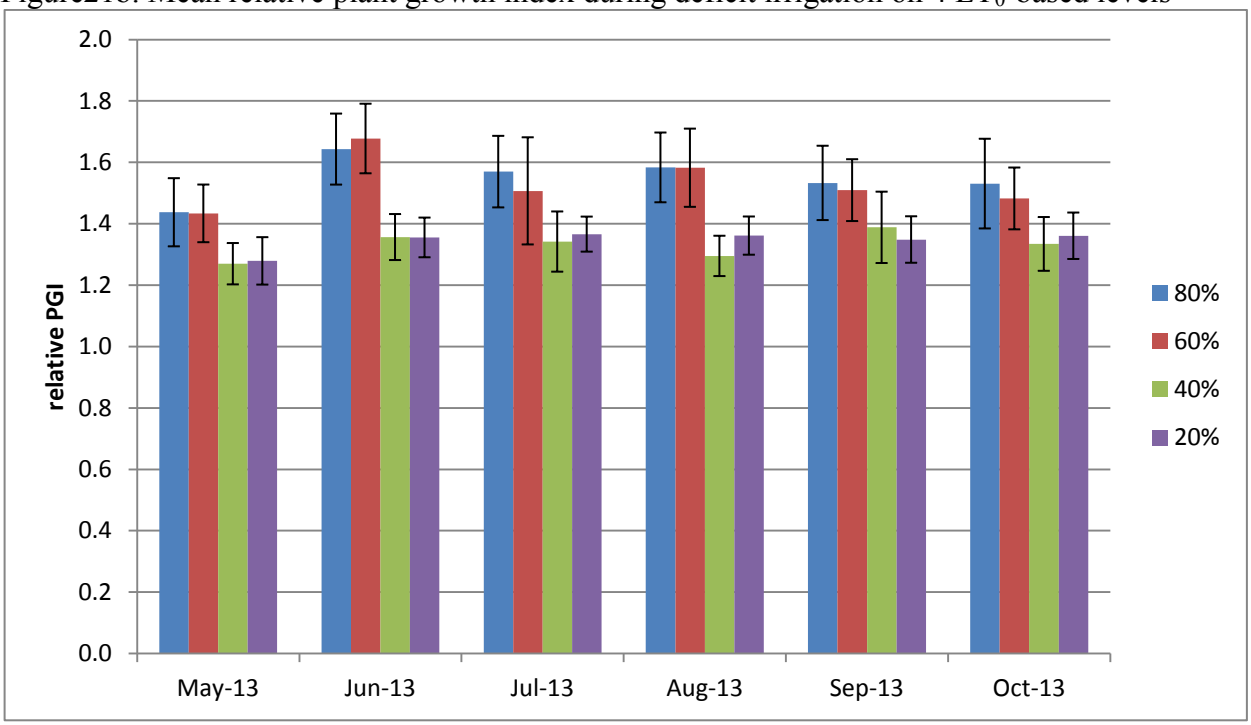
Calamagrostis × acutiflora 'Karl Foerster'

Figure 21a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Figure21b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 8. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Calamagrostis × *acutiflora* 'Karl Foerster'												
foliage		**NOV**	**DEC**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	4.8	4.0	5.0	5.0	5.0	4.3	4.3	3.8	3.2	3.7	**4.3**
	60%	4.5	4.0	5.0	5.0	4.8	4.0	4.0	3.8	3.2	3.2	**4.2**
	40%	4.2	4.1	4.7	4.8	4.8	4.0	3.5	3.5	3.3	3.5	**4.0**
	20%	4.3	3.8	5.0	5.0	5.0	4.3	4.0	4.0	3.2	3.3	**4.2**
flowering												
	80%					5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	60%	2.0	1.0			5.0	5.0	5.0	5.0	5.0	5.0	**4.1**
	40%	2.0		1.0		4.3	5.0	4.8	4.5	4.5	4.3	**3.8**
	20%	1.0	2.0			4.8	4.8	4.5	4.5	4.7	4.7	**3.9**
pest tolerance												
	80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	40%	5.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	5.0	**5.0**
	20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance												
	80%	4.8	4.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**4.9**
	60%	4.8	4.5	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**4.9**
	40%	4.8	3.8	5.0	5.0	5.0	4.8	4.5	4.5	4.7	5.0	**4.7**
	20%	4.5	3.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.8**
vigor												
	80%	4.0	4.5	4.8	4.7	4.8	4.7	4.8	4.7	4.8	4.7	**4.7**
	60%	4.0	4.3	4.3	4.7	4.8	4.8	4.7	4.3	4.2	4.2	**4.4**
	40%	3.7	4.6	3.7	3.8	4.7	4.7	4.7	4.7	4.3	4.7	**4.3**
	20%	4.0	4.2	4.2	4.2	4.3	4.3	4.5	4.5	3.8	3.8	**4.2**
overall appearance												
	80%	3.8	3.9	3.8	4.2	5.0	5.0	5.0	5.0	5.0	5.0	**4.6**
	60%	3.8	3.8	3.5	4.2	5.0	5.0	5.0	4.8	5.0	4.8	**4.5**
	40%	3.7	3.9	3.5	3.7	4.8	5.0	4.8	4.7	4.8	4.7	**4.4**
	20%	3.7	3.7	3.2	3.8	4.8	4.8	4.8	4.7	4.7	4.7	**4.3**

Plants were cut back in late January and not rated again until March.

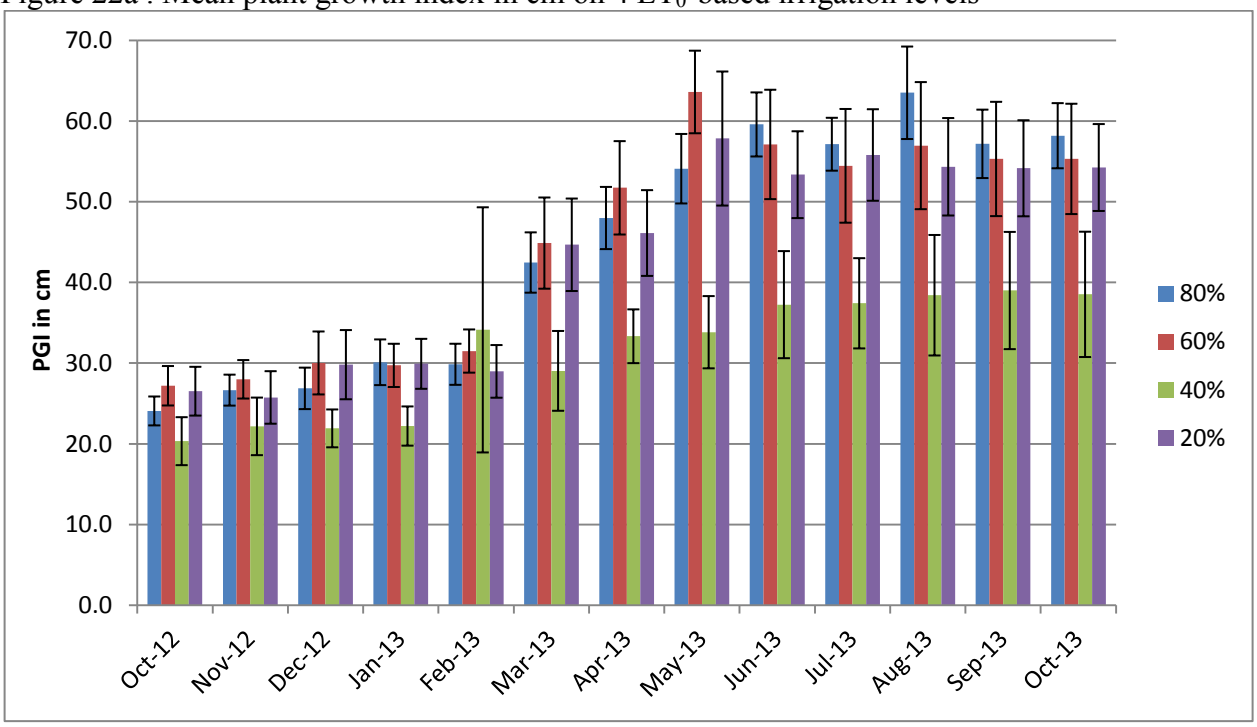
Table 9. Master Gardener average annual quality ratings and 2-year growth for *Calamagrostis* × *acutiflora* 'Karl Foerster'

COUNTY	Alameda	Nevada	Orange	San Joaquin	SD coastal	Shasta
Sunset Zone	**9**	**7**	**23**	**14**	**24**	**9**
foliage	3.5	3.9	2.2	3.8	3.8	3.4
flowering	5.0	4.5	1.0	3.7	*	4.1
bloom period	Jun-Oct	Jun-Nov	Sept	May-Nov		Jun-Nov
pest tolerance	5.0	5.0	5.0	5.0	5.0	5.0
disease resistance	4.9	5.0	5.0	5.0	5.0	5.0
vigor	3.5	4.0	2.4	4.0	4.1	3.5
overall appearance	**3.5**	**3.7**	**2.2**	**4.0**	**3.7**	**3.4**
MSMTS						
relative PGI	2.5	1.9	1.6	1.2	2.7	2.5
avg ht (cm)	79	94	26	33	101	150
avg wd (cm)	105	101	45	39	147	77
AVG HT (in)	31	37	10	13	40	59
AVG WD (in)	41	40	18	15	58	30

*Plants were pruned just before bloom period by a gardener unfamiliar with the project.

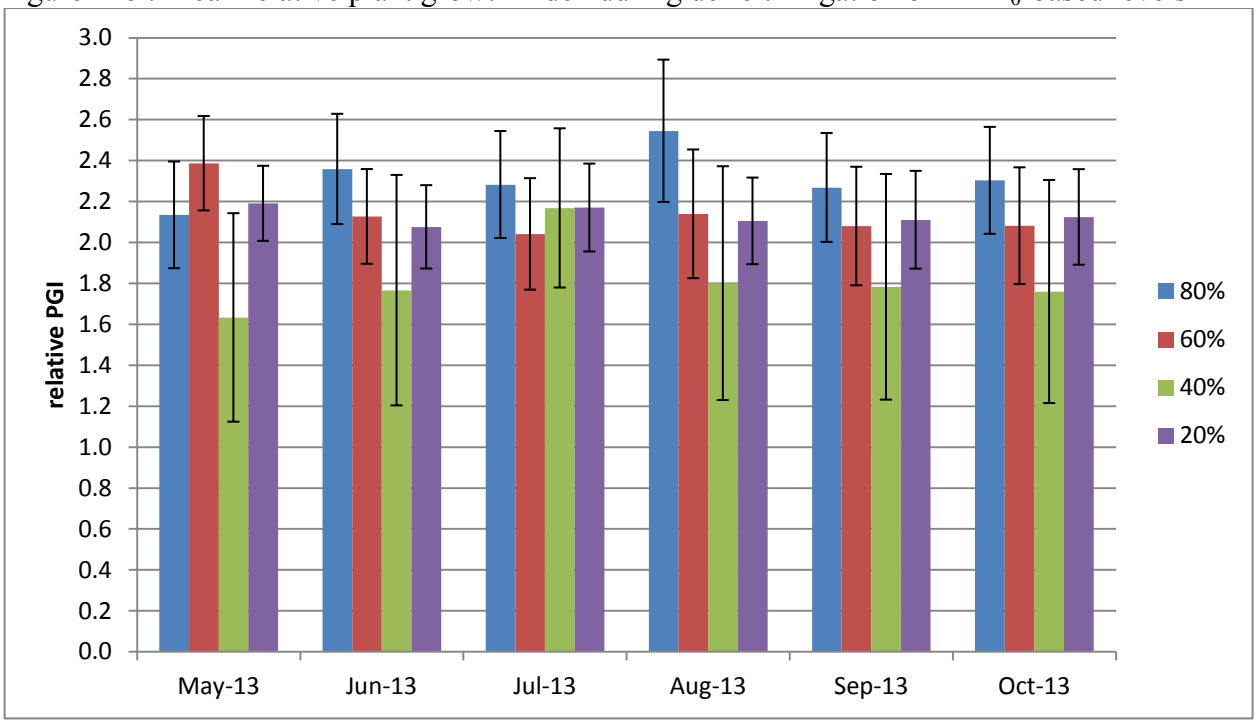
Cerastium tomentosum

Figure 22a . Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Figure 22b . Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 10. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

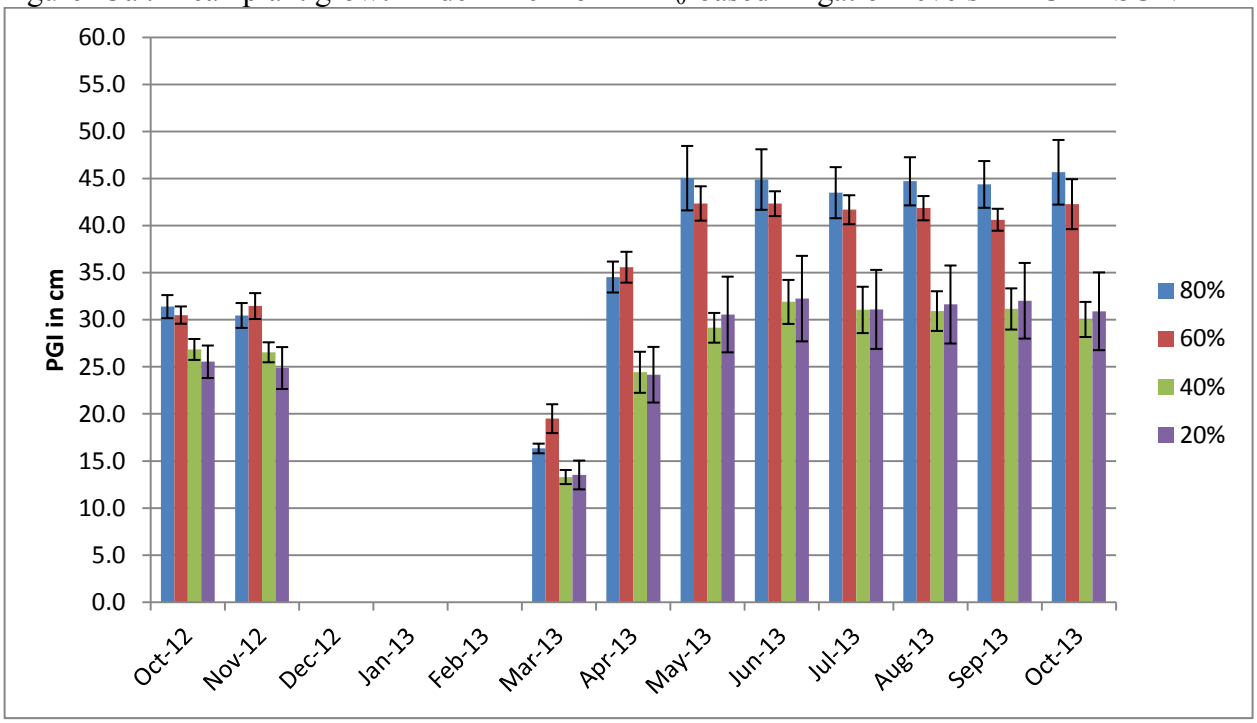
Cerastium tomentosum													
foliage		**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	3.5	3.6	2.9	3.4	4.6	4.8	4.6	4.4	2.9	3.1	2.8	3.3	**3.6**
	60%	3.8	3.8	2.8	2.8	4.0	4.8	4.4	4.0	3.0	2.6	2.6	3.2	**3.5**
	40%	3.8	3.0	2.5	3.3	4.2	4.3	4.5	3.3	2.3	2.8	3.0	3.3	**3.3**
	20%	3.7	4.0	3.0	3.2	4.8	4.3	4.3	4.3	3.0	2.7	3.0	3.8	**3.7**
flowering														
	80%					5.0	1.6	1.0						**2.5**
	60%	2.0					1.3	1.0						**1.4**
	40%	3.0	3.0			5.0	1.0	1.0						**2.6**
	20%						1.2	1.0						**1.1**
pest tolerance														
	80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	40%	4.8	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	20%	5.0	5.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance														
	80%	3.5	4.0	4.8	5.0	5.0	5.0	5.0	4.8	4.4	3.5	4.4	4.3	**4.5**
	60%	4.0	4.2	4.8	5.0	5.0	5.0	5.0	5.0	4.0	3.0	4.2	3.6	**4.4**
	40%	4.4	3.6	5.0	5.0	5.0	5.0	5.0	4.8	5.0	2.8	3.8	4.3	**4.5**
	20%	4.0	4.3	4.7	5.0	5.0	4.7	5.0	5.0	4.3	2.8	3.7	4.5	**4.4**
vigor														
	80%	3.6	4.3	3.9	4.1	4.5	4.5	4.4	4.6	4.4	4.3	4.1	4.1	**4.2**
	60%	4.2	4.2	4.0	3.6	3.8	4.2	4.2	4.2	4.3	3.4	3.4	3.8	**3.9**
	40%	3.2	3.8	3.3	3.3	3.8	3.5	4.0	3.5	3.8	3.8	3.3	3.3	**3.5**
	20%	3.5	4.0	3.5	3.5	4.2	4.5	3.8	4.3	4.2	4.3	4.0	3.7	**4.0**
overall appearance														
	80%	3.1	3.4	2.8	3.1	4.0	4.1	3.6	3.6	2.5	2.5	2.3	2.3	**3.1**
	60%	3.6	3.6	2.6	2.8	3.4	3.6	3.5	3.4	2.3	2.4	2.4	2.4	**3.0**
	40%	3.0	3.3	2.3	3.0	3.8	3.3	3.5	2.8	1.8	2.5	2.3	2.3	**2.8**
	20%	3.2	3.7	2.7	2.9	4.0	3.8	3.2	3.3	2.3	2.4	2.4	2.8	**3.1**

Table 11. Master Gardener average annual quality ratings and 2-year growth for *Cerastium tomentosum*

COUNTY	Alameda	Orange	San Joaquin	SD coastal	Shasta	Ventura
Sunset Zone	**9**	**23**	**14**	**24**	**9**	**21**
foliage	3.6	2.4	3.4	3.7	3.6	1.3
flowering	2.0	1.0	2.5		4.5	1.0
bloom period	Apr-May	Aug	Mar/Jul		Mar-Apr	Jan-Apr
pest tolerance	5.0	4.3	5.0	4.8	4.9	5.0
disease resistance	5.0	4.9	5.0	5.0	5.0	5.0
vigor	3.3	2.3	3.4	3.5	3.5	1.5
overall appearance	**3.1**	**2.2**	**3.4**	**3.2**	**3.4**	**1.0**
MSMTS						
relative PGI	0.9	0.5	0.8	2.1	2.4	0.8
avg ht (cm)	4	5	6	25	17	7
avg wd (cm)	31	13	27	72	52	25
AVG HT (in)	1	2	2	10	7	3
AVG WD (in)	12	5	10	28	21	10

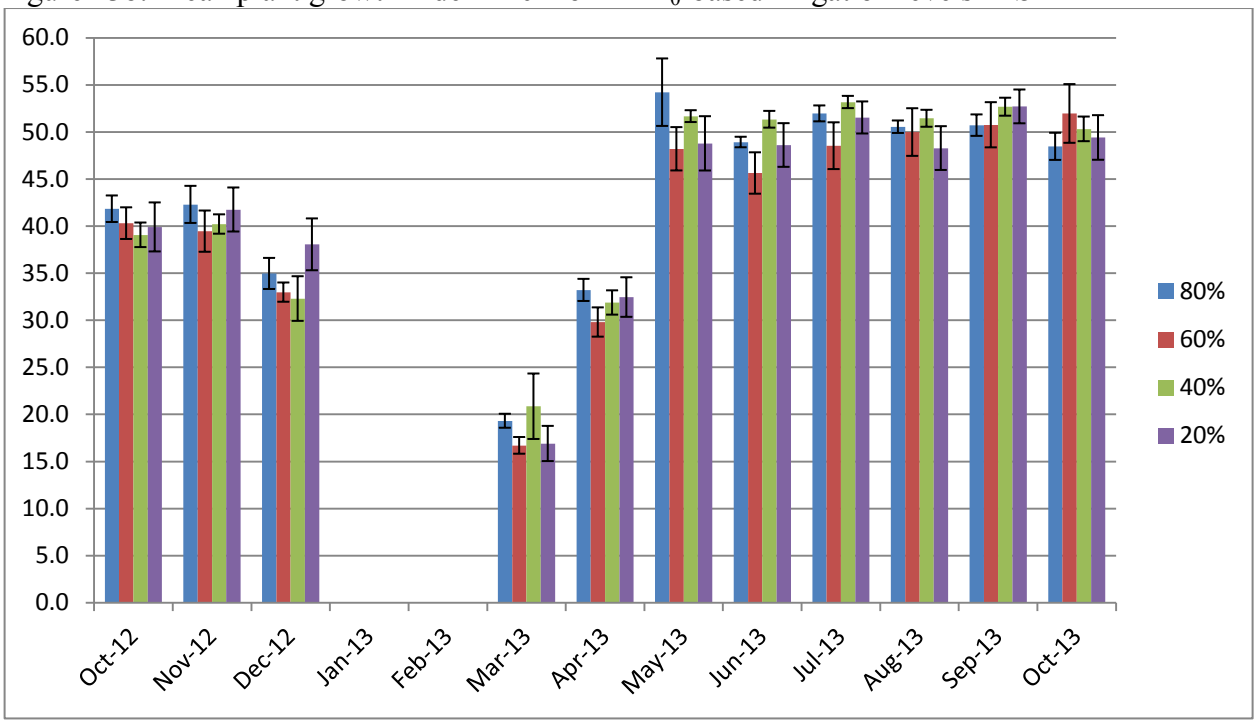
Ceratostigma plumbaginoides- SUN & SHADE

Figure 23a . Mean plant growth index in cm on 4 ET_0-based irrigation levels in **FULL SUN**



Error bars represent ± 1 SE

Figure 23b. Mean plant growth index in cm on 4 ET_0-based irrigation levels in **SHADE**



Error bars represent ± 1 SE

Ceratostigma plumbaginoides- SUN & SHADE

Figure 23c. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels in **FULL SUN**

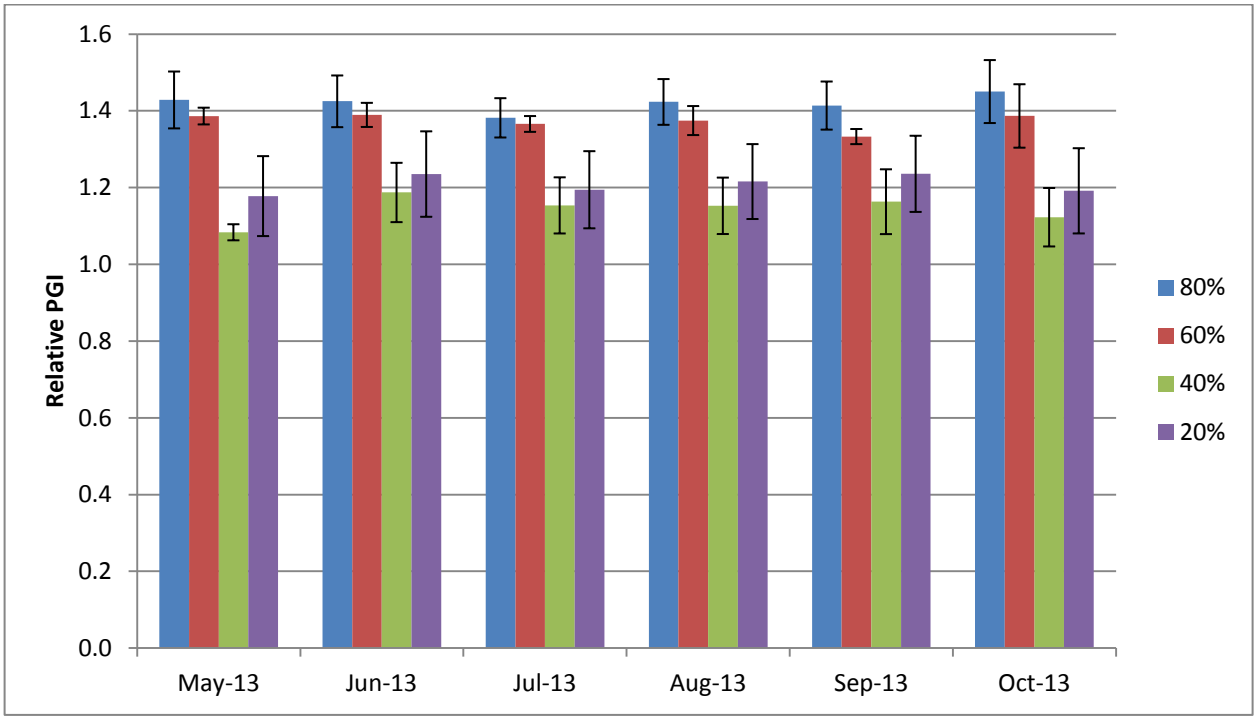


Figure 23d. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels in **SHADE**

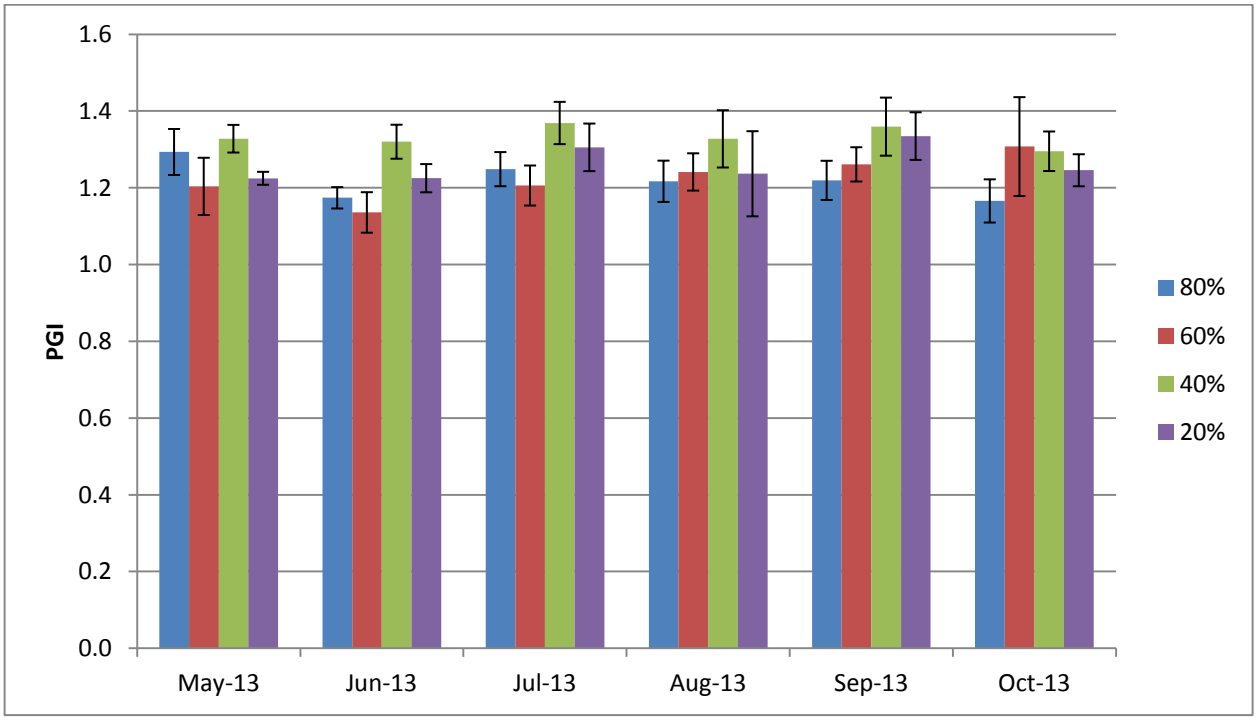


Table 12. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels in FULL SUN

***Ceratostigma plumbaginoides*- SUN**														
foliage		**NOV**	**DEC**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG SUN**	**AVG SHD**
	80%	4.0			5.0	3.7	4.5	4.0	3.7	3.3	3.0	3.2	**3.8**	**3.6**
	60%	4.0			5.0	3.7	5.0	3.7	3.7	2.8	2.3	2.5	**3.4**	**3.5**
	40%	3.8			4.8	3.7	4.2	3.4	3.4	3.2	3.0	2.8	**3.6**	**3.5**
	20%	4.0	3.5		4.8	4.0	4.0	3.3	3.8	3.3	3.0	2.8	**3.7**	**3.6**
flowering														
	80%	1.8					2.8	4.8	4.2	2.5	1.8	1.2	**2.7**	**2.0**
	60%	1.3					3.5	4.8	3.2	1.8	1.3	1.0	**2.4**	**2.1**
	40%	1.7					2.5	4.6	3.2	1.4	1.8	1.0	**2.3**	**2.1**
	20%	2.0					3.0	3.6	2.7	2.7	2.3	1.8	**2.6**	**1.9**
pest tolerance														
	80%	4.8			5.0	4.5	5.0	4.8	5.0	5.0	5.0	5.0	**4.9**	**5.0**
	60%	4.5		5.0	5.0	4.3	5.0	4.8	5.0	5.0	5.0	5.0	**4.9**	**5.0**
	40%	4.6			5.0	4.6	4.8	5.0	4.8	5.0	4.6	4.2	**4.7**	**5.0**
	20%	4.8	5.0		5.0	4.8	4.8	5.0	5.0	5.0	5.0	4.3	**4.9**	**5.0**
disease resistance														
	80%	4.2			5.0	5.0	4.8	4.2	3.7	3.5	3.0	4.0	**4.1**	**5.0**
	60%	4.3		5.0	5.0	4.8	5.0	4.0	3.7	2.8	3.0	3.5	**4.1**	**5.0**
	40%	4.0			5.0	4.6	4.6	4.4	3.6	3.2	3.2	3.8	**4.0**	**5.0**
	20%	4.5	4.0		5.0	5.0	4.8	4.3	4.3	4.7	3.8	4.2	**4.5**	**5.0**
vigor														
	80%	4.3			4.3	5.0	5.0	4.8	5.0	4.8	4.8	4.8	**4.8**	**3.7**
	60%	4.2		1.0	3.7	5.0	5.0	5.0	5.0	4.8	4.3	3.7	**4.2**	**3.5**
	40%	4.2			2.8	4.2	3.8	3.8	4.2	4.0	4.4	3.8	**3.9**	**3.7**
	20%	3.2	3.0		3.2	3.8	3.5	3.7	4.0	3.8	3.7	3.3	**3.5**	**3.5**
overall appearance														
	80%	3.8			3.7	3.3	4.8	4.7	4.2	3.4	3.7	3.3	**3.9**	**3.4**
	60%	3.7		1.0	3.5	3.4	4.8	4.8	3.6	3.0	3.0	2.3	**3.3**	**3.3**
	40%	3.6			3.0	3.4	3.8	4.4	3.6	3.2	3.0	2.9	**3.4**	**3.4**
	20%	3.5	3.5		3.3	3.2	3.7	3.8	3.8	3.5	3.5	3.2	**3.5**	**3.3**

Table 13. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels in SHADE

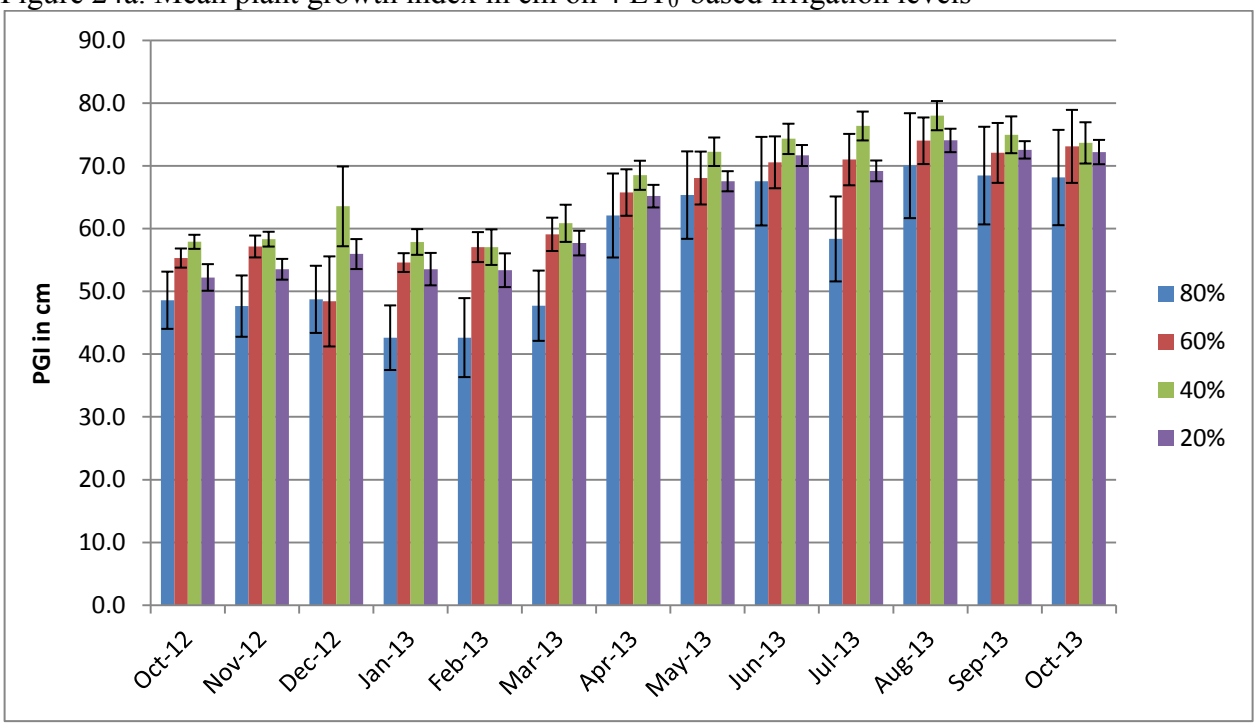
***Ceratostigma plumbaginoides*- SHADE**												
foliage		**NOV**	**DEC**	**JAN**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	3.1	3.0	2.2	4.7	2.8	3.0	5.0	4.9	4.0	3.2	**3.6**
	60%	3.1	3.0	2.4	4.6	2.6	3.0	4.8	5.0	3.6	3.2	**3.5**
	40%	3.0	3.0	2.0	5.0	2.3	2.7	4.8	4.7	3.7	3.5	**3.5**
	20%	3.1	3.3	2.4	4.6	3.0	3.2	5.0	4.9	3.4	3.1	**3.6**
flowering												
	80%							2.8	1.8	2.4	1.0	**2.0**
	60%							2.7	1.5	3.0	1.0	**2.1**
	40%							2.6	1.8	2.7	1.2	**2.1**
	20%							2.3	1.7	2.7	0.9	**1.9**
pest tolerance												
	80%	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance												
	80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
	20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor												
	80%	3.3	3.3	3.5	3.2	3.5	3.2	4.3	4.7	4.5	4.1	**3.7**
	60%	3.1	3.3	3.2	3.1	3.2	3.2	4.2	4.4	3.8	3.9	**3.5**
	40%	3.2	3.1	3.2	3.4	3.7	3.7	4.0	4.3	4.5	4.2	**3.7**
	20%	2.9	3.0	3.4	3.2	3.6	3.4	3.9	4.2	3.9	4.0	**3.5**
overall appearance												
	80%	3.1	3.1	2.0	2.8	3.0	3.1	4.4	4.4	4.3	3.8	**3.4**
	60%	3.1	3.2	2.0	2.8	2.8	3.1	4.1	4.2	3.6	4.0	**3.3**
	40%	3.1	3.3	2.0	2.8	3.0	3.2	4.3	4.3	4.3	3.9	**3.4**
	20%	3.0	3.0	2.0	2.9	3.2	3.3	3.8	4.3	3.7	4.0	**3.3**

Table 14. Master Gardener average annual quality ratings and 2-year growth for *Ceratostigma plumbaginoides*

COUNTY	Alameda	Nevada	Orange	San Joaquin	SD inland	SD coastal	Shasta	Ventura
Sunset Zone	**9**	**7**	**23**	**14**	**21/23**	**24**	**9**	**21**
foliage	3.7	4.0	2.6	3.6	3.4	3.1	2.2	3.3
flower	4.1	3.8	2.7	2.3	2.7	2.9	3.3	2.0
bloom period	Jun-Oct	Jul-Oct	Jul-Sep	Mar-Dec	May-Oct	Jul-Sep	Jul-Nov	all year
pest tolerance	5.0	4.5	5.0	5.0	4.1	3.7	4.9	5.0
disease resistance	5.0	4.8	5.0	5.0	4.9	5.0	5.0	5.0
vigor	3.6	3.1	2.4	3.8	3.3	2.9	2.1	3.5
overall appearance	**3.6**	**3.1**	**2.4**	**3.8**	**3.3**	**2.9**	**2.0**	**3.5**
MSMTS								
relative PGI	1.9	1.8	5.5	1.4	2.8	0.4	1.8	4.3
avg ht (cm)	19	23	16	29	18	13	28	27
avg wd (cm)	90	38	53	61	55	16	48	113
AVG HT (in)	7	9	6	11	7	5	11	11
AVG WD (in)	35	15	21	24	22	6	19	45

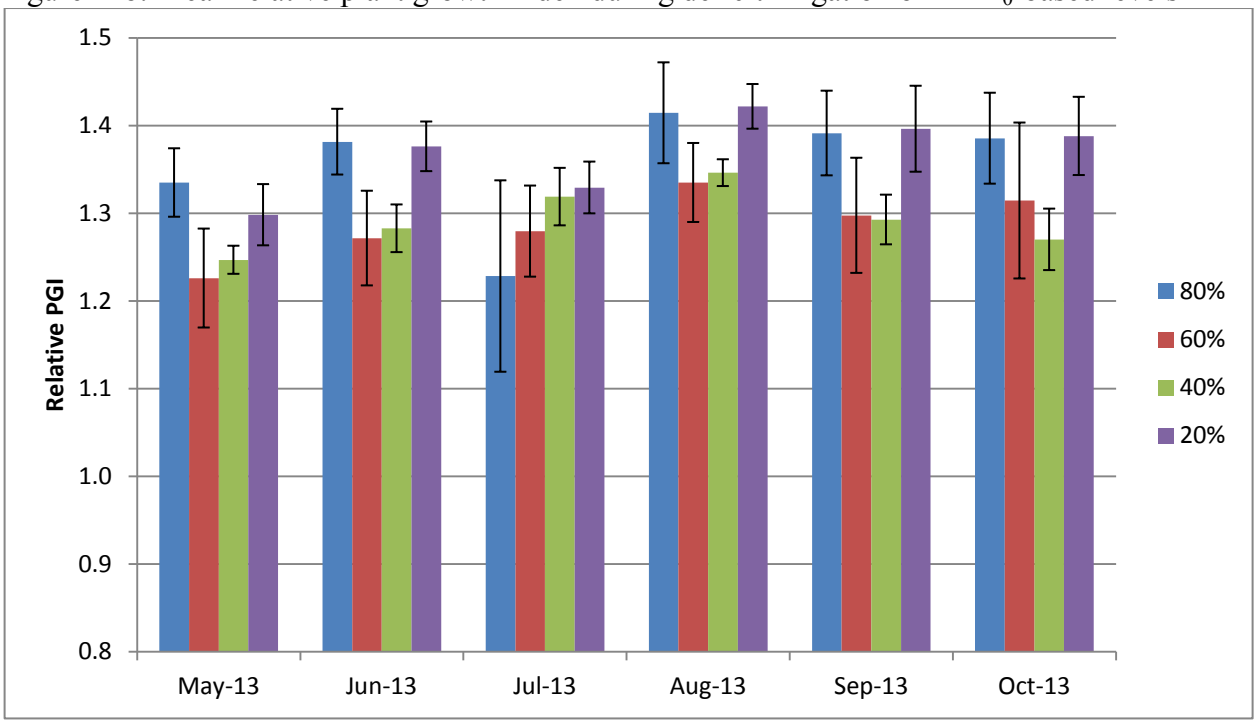
Delosperma cooperi

Figure 24a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Figure 24b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 15. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Delosperma cooperi													
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	5.0	4.4	3.1	4.3	4.8	5.0	4.8	4.9	4.8	4.8	4.4	4.1	4.5
60%	5.0	4.6	2.6	2.6	3.6	4.4	4.4	4.4	4.6	4.6	3.8	4.4	4.1
40%	5.0	4.5	3.3	3.3	4.8	5.0	5.0	4.7	4.3	4.2	4.0	4.0	4.3
20%	4.6	4.8	2.8	4.0	4.6	5.0	5.0	5.0	5.0	5.0	4.6	4.4	4.6
flowering													
80%	2.6	1.4			1.0	4.6	4.9	4.8	3.1	2.0	2.4	2.5	2.9
60%	3.0	1.6			1.0	3.7	4.4	4.4	2.6	2.0	1.8	1.5	2.6
40%	3.2	1.3			1.0	5.0	5.0	4.7	2.2	1.8	3.0	1.2	2.8
20%	2.4	1.0			1.0	5.0	5.0	5.0	2.6	1.8	1.2	1.4	2.6
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
disease resistance													
80%	5.0	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
60%	5.0	4.8	5.0	5.0	4.2	5.0	4.6	4.4	4.4	5.0	4.2	5.0	4.7
40%	5.0	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
20%	4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
vigor													
80%	4.1	3.9	3.4	4.0	4.0	4.3	4.3	4.3	4.3	4.3	4.3	4.0	4.1
60%	4.8	5.0	4.2	4.0	3.8	4.0	4.2	4.4	4.0	4.2	4.2	3.8	4.2
40%	4.8	4.8	4.3	4.8	5.0	5.0	5.0	4.7	4.5	4.3	4.2	3.8	4.6
20%	4.2	4.8	4.8	4.2	4.6	5.0	5.0	5.0	4.8	5.0	5.0	5.0	4.8
overall appearance													
80%	4.1	3.3	2.1	2.6	3.6	5.0	4.8	4.6	4.1	4.1	4.0	3.5	**3.8**
60%	4.8	4.2	2.2	2.5	3.0	4.0	4.2	4.4	3.9	3.8	3.4	3.2	**3.6**
40%	4.5	3.7	2.6	2.5	3.8	5.0	5.0	4.7	3.8	3.3	3.7	2.6	**3.8**
20%	4.2	3.8	2.4	2.6	3.7	5.0	5.0	5.0	4.2	4.4	4.0	3.2	**4.0**

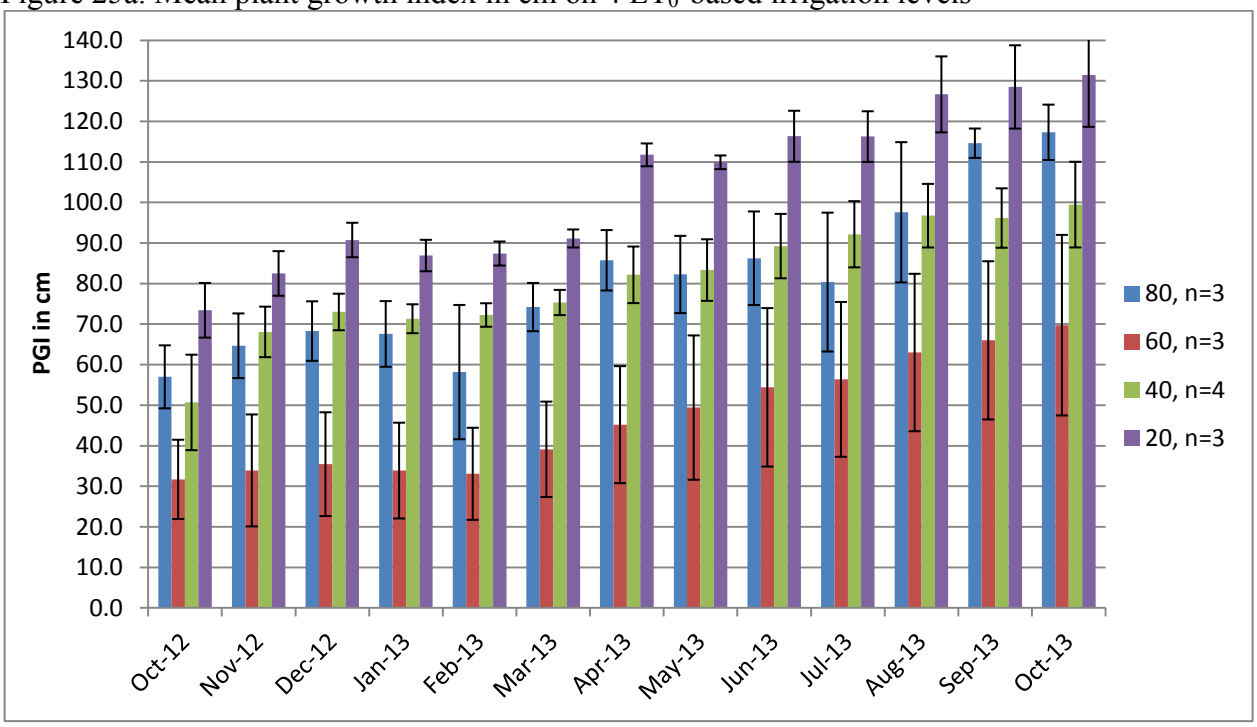
Table 16. Master Gardener average annual quality ratings and 2-year growth for *Delosperma cooperi*

COUNTY	Alameda	Nevada	SD- inland	San Joaquin	Shasta	Ventura
Sunset Zone	**9**	**7**	**21/23**	**14**	**9**	**21**
foliage	4.3	3.7	4.2	2.4	2.8	3.6
flower	2.9	3.4	2.6	1.5	3.0	1.6
bloom period	Mar-Dec	Jun-Aug	Mar-Dec	Jan-Nov	May-Jun*	all year
pest tolerance	5.0	5.0	5.0	4.4	5.0	5.0
disease resistance	5.0	5.0	5.0	4.8	5.0	5.0
vigor	3.9	3.8	4.5	2.2	2.7	3.5
overall appearance	**3.7**	**3.5**	**4.1**	**2.3**	**2.8**	**2.9**
MSMTS						
relative PGI	2.6	1.9	4.9	1.1	1.8	3.1
avg ht (cm)	10	13	14	8	8	10
avg wd (cm)	73	47	134	20	34	80
AVG HT (in)	4	5	5	3	3	4
AVG WD (in)	29	18	53	8	14	31

*flowered the first year only; damaged by frost and did not recover fully

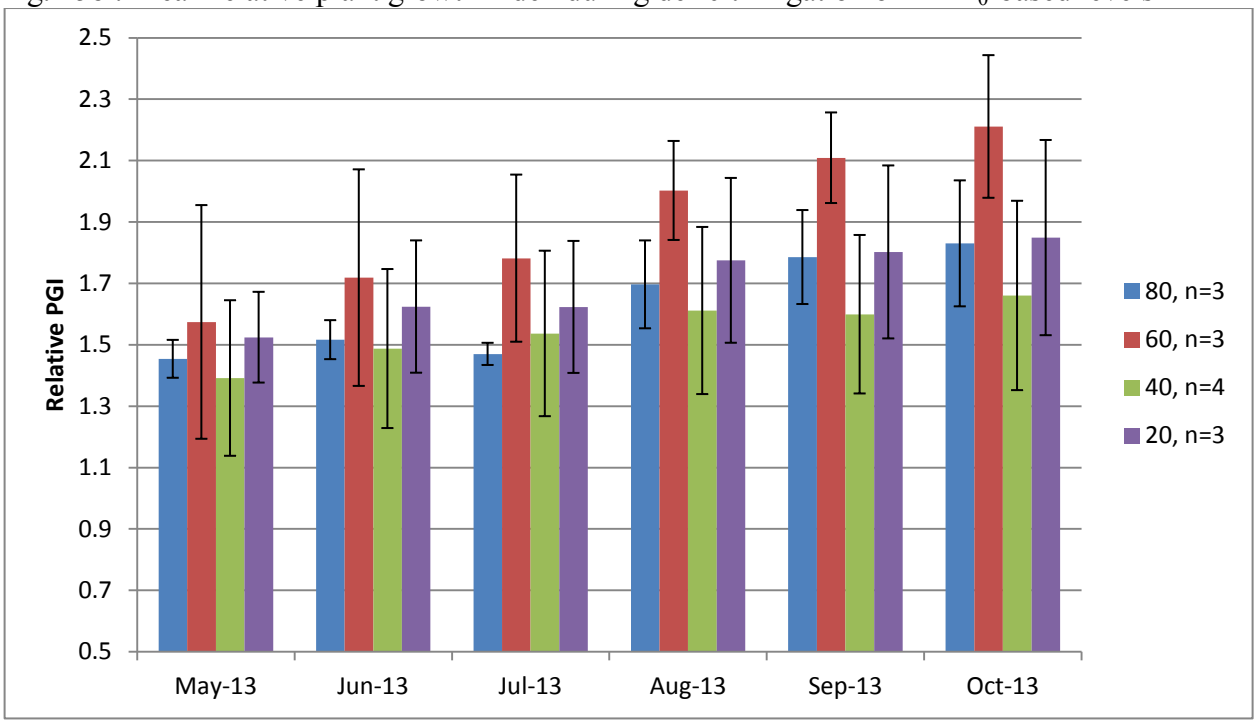
Isomeris arborea

Figure 25a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 25b . Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



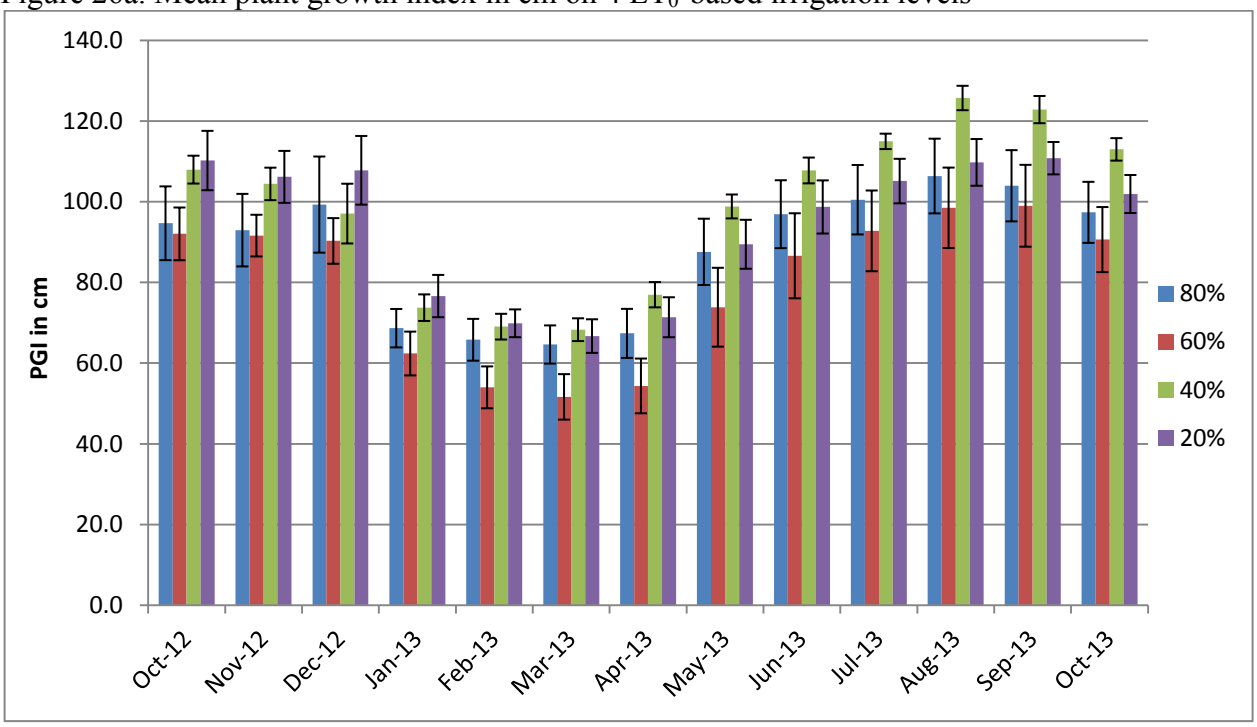
Error bars represent ± 1 SE

Table 17. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Isomeris arborea													
foliage		**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	2.8	3.5	2.0	3.0	4.7	4.0	3.0	3.3	2.7	2.3	3.0	4.0	**3.2**
	60%	3.3	2.7	1.3	2.0	3.7	3.0	3.0	2.7	2.3	3.0	3.0	3.0	**2.7**
	40%	4.0	3.7	2.0	2.3	3.0	3.7	3.7	3.0	3.0	3.0	3.0	3.0	**3.1**
	20%	3.6	3.6	1.5	3.3	3.8	4.0	3.7	4.0	3.0	2.7	3.7	3.3	**3.3**
flowering														
	80%	2.0	2.7		2.0	2.7	1.7	3.0	3.5	3.0	3.5	3.5	5.0	**3.0**
	60%	2.0	1.0			2.0	1.0	3.0	3.0	1.0	1.0	2.0	3.0	**1.9**
	40%	3.0	3.7		1.0	3.0	2.7	3.0	4.7	1.3	1.7	3.7	4.0	**2.9**
	20%	2.0	2.2	1.0	1.5	1.5	1.7	2.3	4.0	1.0	1.0	1.7	2.7	**1.9**
pest tolerance														
	80%	3.5	3.0	5.0	5.0	5.0	5.0	5.0	4.0	4.0	2.3	3.0	4.0	**4.1**
	60%	4.8	4.0	5.0	5.0	5.0	4.7	4.7	4.3	4.0	4.0	3.7	4.3	**4.5**
	40%	3.7	3.3	5.0	5.0	5.0	5.0	4.3	3.7	3.7	2.7	3.0	3.0	**3.9**
	20%	4.0	3.6	5.0	5.0	5.0	4.7	4.3	4.3	3.0	2.7	3.7	3.3	**4.1**
disease resistance														
	80%	5.0	5.0	5.0	4.3	4.7	5.0	4.3	5.0	4.7	5.0	4.0	5.0	**4.8**
	60%	4.3	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.3	4.3	5.0	**4.7**
	40%	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.5	5.0	4.0	5.0	**4.8**
	20%	4.8	4.8	5.0	4.0	5.0	4.3	5.0	5.0	3.7	5.0	5.0	5.0	**4.7**
vigor														
	80%	3.8	5.0	3.7	4.3	5.0	5.0	4.3	4.0	4.3	4.0	5.0	5.0	**4.5**
	60%	3.3	3.0	1.7	1.7	3.3	3.0	3.0	3.0	2.7	3.3	3.0	3.3	**2.9**
	40%	3.3	3.0	1.7	1.7	3.3	3.0	3.0	3.0	2.7	3.3	3.0	3.3	**2.9**
	20%	4.0	4.4	1.3	4.0	4.5	5.0	5.0	5.0	3.7	5.0	4.7	4.7	**4.3**
overall appearance														
	80%	3.5	4.0	1.7	2.7	4.3	3.7	3.3	2.7	2.7	3.0	4.0	4.8	**3.4**
	60%	3.3	3.0	1.3	2.0	3.3	2.7	2.8	2.7	2.0	3.0	2.7	3.0	**2.6**
	40%	4.7	3.7	1.7	2.2	3.3	3.5	3.5	4.0	3.7	3.7	3.7	3.5	**3.4**
	20%	3.8	3.6	1.5	2.7	3.5	4.0	4.2	4.5	3.3	4.0	4.2	4.0	**3.6**

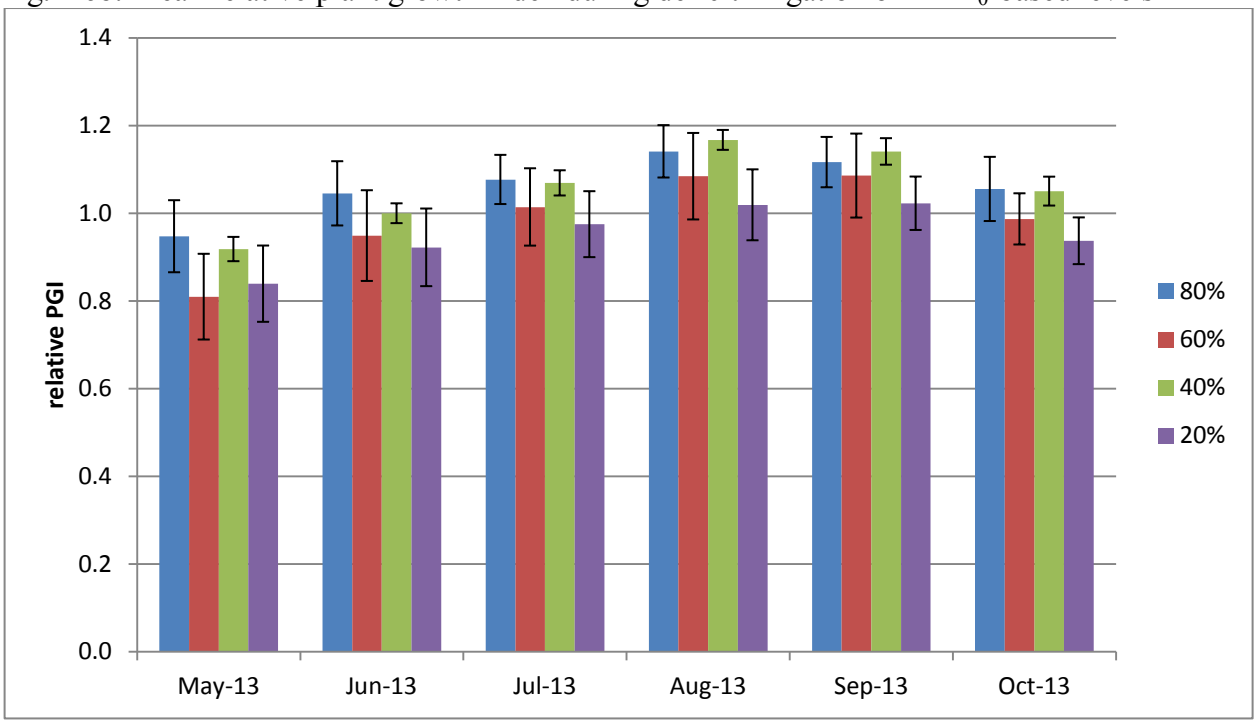
Kniphofia 'Christmas Cheer'

Figure 26a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 26b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 18. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

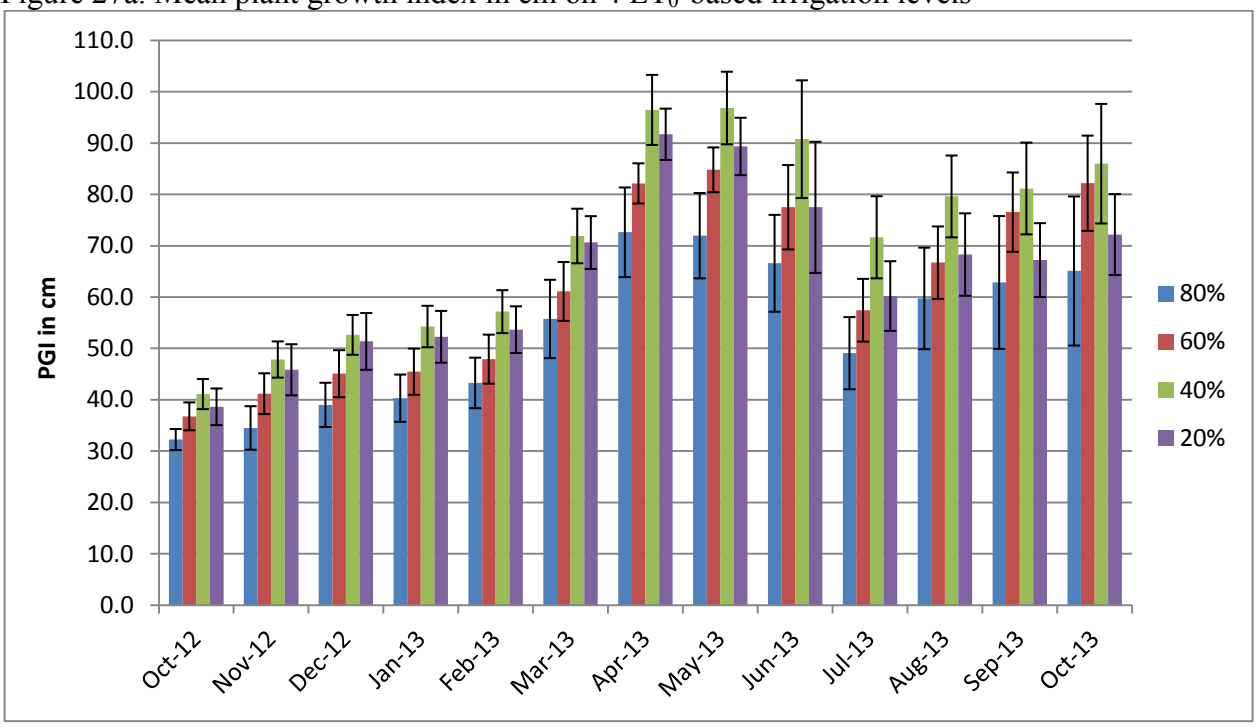
Kniphofia 'Christmas Cheer'													
foliage		**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
	80%	3.7	3.0	2.0	2.0	2.8	3.7	4.0	3.8	3.5	3.7	3.5	3.3	**3.3**
	60%	3.3	2.9	2.1	2.0	2.7	4.0	4.0	3.9	3.4	3.0	2.9	3.3	**3.1**
	40%	3.3	2.9	2.0	2.0	3.2	4.0	3.8	3.8	3.8	3.7	3.3	3.5	**3.3**
	20%	3.3	3.3	2.0	2.0	2.8	4.2	4.0	4.0	3.2	3.6	3.4	3.0	**3.2**
flowering														
	80%	3.3	5.0	1.5									4.0	**3.5**
	60%	2.7	4.3	1.0		3.0							1.0	**2.4**
	40%	2.3	5.0	1.0		2.0								**2.6**
	20%	1.0	4.2			1.0								**2.1**
pest tolerance														
	80%	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	3.8	5.0	5.0	**4.9**
	60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.8	4.7	4.7	**4.8**
	40%	4.7	5.0		5.0	5.0	5.0	5.0	5.0	5.0	3.7	5.0	5.0	**4.8**
	20%	4.8	4.7		5.0	5.0	5.0	5.0	5.0	5.0	3.6	5.0	5.0	**4.8**
disease resistance														
	80%	4.0	3.0		5.0	4.5	4.5	5.0	4.5	4.3	4.7	4.7	5.0	**4.5**
	60%	3.7	2.9	5.0	5.0	5.0	4.7	5.0	4.6	4.1	4.7	4.7	4.4	**4.5**
	40%	4.3	2.8		5.0	5.0	4.8	5.0	4.7	4.5	5.0	5.0	5.0	**4.7**
	20%	3.5	3.7		5.0	5.0	5.0	5.0	5.0	4.4	5.0	4.8	5.0	**4.7**
vigor														
	80%	4.2	4.3	4.3	4.0	3.3	3.5	3.5	4.2	4.3	4.5	4.3	4.3	**4.1**
	60%	3.6	3.9	3.1	3.0	3.0	3.3	3.3	3.7	3.6	3.7	3.6	3.3	**3.4**
	40%	4.2	4.3	4.0	3.7	4.0	4.0	4.3	4.3	4.2	4.5	4.3	4.5	**4.2**
	20%	3.8	3.5	3.2	3.4	3.4	4.2	4.2	4.8	4.2	4.4	4.6	4.6	**4.0**
overall appearance														
	80%	4.3	4.9	1.8	2.0	2.7	3.0	3.3	3.3	3.7	3.7	3.7	3.5	**3.3**
	60%	3.6	4.5	2.1	2.0	2.7	3.0	3.4	3.2	3.1	2.9	2.9	3.1	**3.0**
	40%	3.8	4.7	2.0	2.0	2.8	3.0	3.5	3.5	3.8	3.7	3.3	3.5	**3.3**
	20%	3.8	4.3	2.0	2.0	2.8	3.4	4.0	3.7	3.2	3.7	3.6	3.0	**3.3**

Table 19. Master Gardener average annual quality ratings and 2-year growth for *Kniphofia* 'Christmas Cheer'

COUNTY	Alameda	Nevada	Orange	SD inland	SD coastal	San Joaquin	Shasta	Ventura
Sunset Zone	9	7	23	21/23	24	14	9	21
foliage	3.8	3.5	3.2	3.5	3.4	4.0	2.7	3.4
flower	2.9	3.4	2.8	3.3	3.7	3.2	2.7	1.8
bloom period	Sep-Jan	Nov-Dec	Jul-Sep Jan	Jul-Aug, Nov-Dec	Nov-Dec	Sep-Mar	Nov-Jan	year round
pest tolerance	4.9	5.0	4.9	4.0	3.9	4.8	5.0	5.0
disease resistance	4.9	5.0	5.0	4.1	4.9	6.0	5.0	5.0
vigor	4.3	3.8	3.2	3.7	3.5	4.0	2.9	3.4
overall appearance	**3.9**	**3.4**	**3.1**	**3.2**	**3.1**	**4.1**	**2.7**	**3.1**
MSMTS								
relative PGI	2.7	2.1	7.4	0.7	1.0	1.2	2.5	1.5
avg ht (cm)	91	91	43	36	51	86	67	80
avg wd (cm)	161	158	88	81	89	133	118	152
AVG HT (in)	36	36	17	14	20	34	27	31
AVG WD (in)	63	62	35	32	35	52	46	60

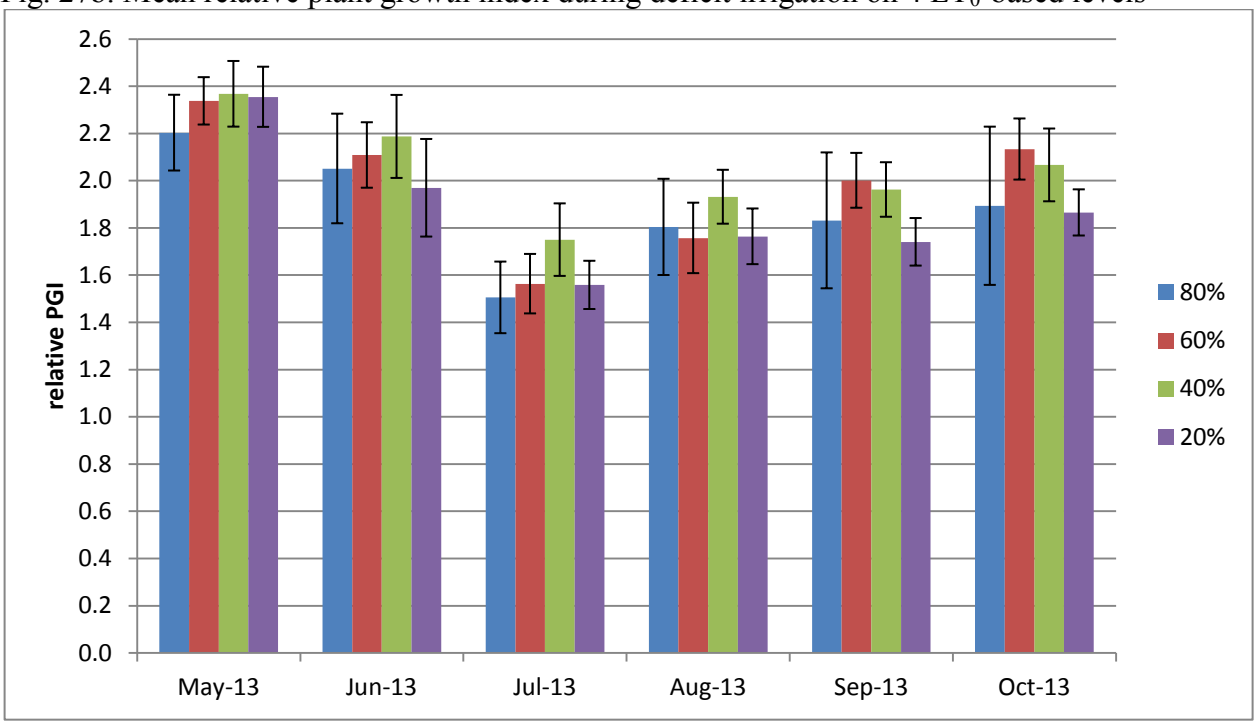
Phlomis purpurea

Figure 27a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 27b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



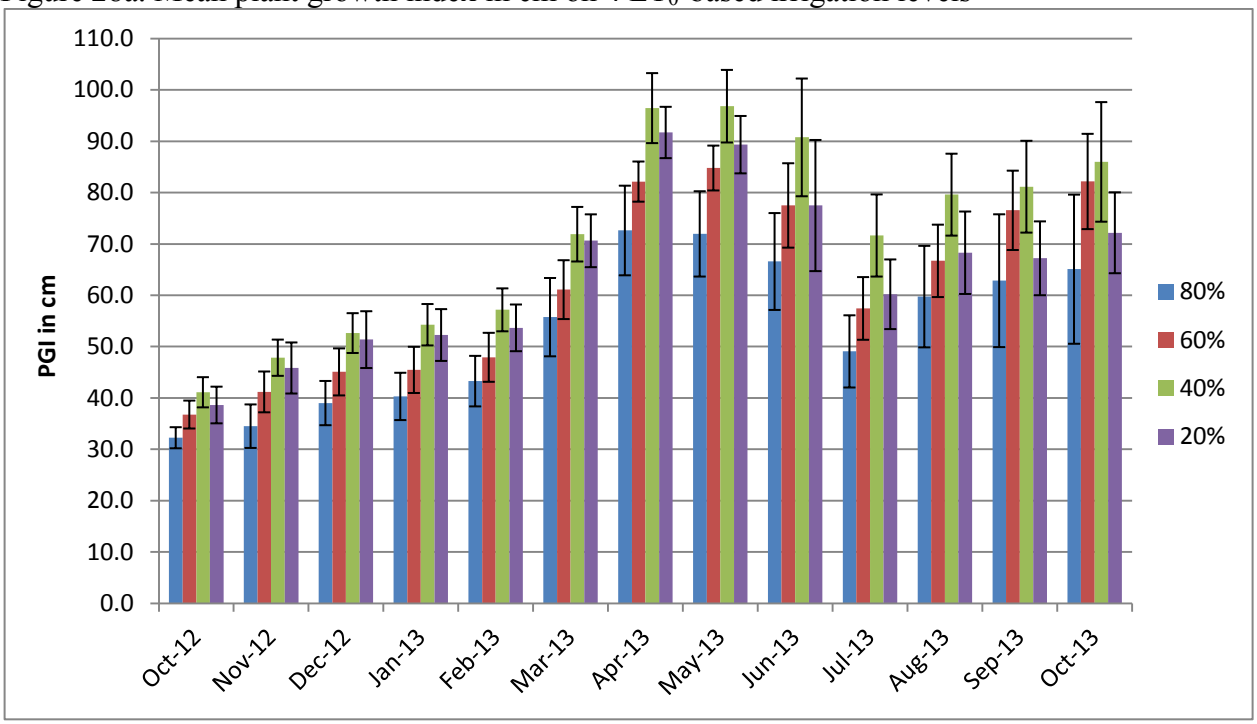
Error bars represent ± 1 SE

Table 20. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Phlomis purpurea													
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	3.8	4.8	4.3	4.2	4.7	4.8	4.7	3.5	3.7	3.3	3.6	3.6	**4.1**
60%	4.0	5.0	4.3	4.5	5.0	5.0	4.3	3.2	4.0	4.8	4.0	4.8	**4.4**
40%	4.4	5.0	4.6	4.8	5.0	5.0	5.0	4.2	4.2	4.2	4.4	4.8	**4.6**
20%	4.8	4.8	4.3	4.9	5.0	5.0	4.8	4.2	4.2	4.2	4.0	4.7	**4.6**
flowering													
80%					1.0	4.8	1.0	1.3	1.0	2.0	1.0		**1.7**
60%					1.0	5.0	1.0	1.4	1.0	1.0	1.3	1.0	**1.6**
40%		1.0			2.0	5.0	1.0	1.2	1.0	1.0	1.0		**1.7**
20%	1.0				1.0	5.0	1.0	1.3	1.3	1.3	1.0	1.0	**1.6**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.3	5.0	5.0	**4.9**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	4.2	4.8	5.0	5.0	5.0	5.0	5.0	4.7	4.8	3.8	5.0	4.6	**4.7**
60%	5.0	5.0	5.0	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.8	4.6	4.8	5.0	**4.9**
20%	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.8	4.5	4.5	4.8	**4.9**
vigor													
80%	3.2	3.8	3.0	3.5	3.8	3.5	3.2	3.2	3.3	3.2	3.4	3.2	**3.4**
60%	3.9	4.4	3.4	4.0	4.3	4.7	4.0	3.6	3.4	4.4	4.0	4.2	**4.0**
40%	4.0	5.0	4.6	4.5	4.8	4.8	4.8	4.4	4.6	3.6	3.8	4.0	**4.4**
20%	4.4	4.8	4.2	4.8	4.6	4.2	4.2	4.0	4.6	4.2	3.8	4.4	**4.3**
overall appearance													
80%	3.3	3.8	3.6	3.8	3.5	4.3	3.5	2.8	2.8	2.5	3.0	2.8	**3.3**
60%	3.7	4.0	3.6	3.9	4.0	4.6	3.3	2.7	3.3	3.6	3.9	3.8	**3.7**
40%	3.6	4.1	4.0	4.0	4.2	5.0	4.0	3.6	3.2	3.2	3.5	3.6	**3.8**
20%	3.7	4.1	3.6	4.0	3.8	4.5	3.5	3.1	3.3	3.2	3.6	3.8	**3.7**

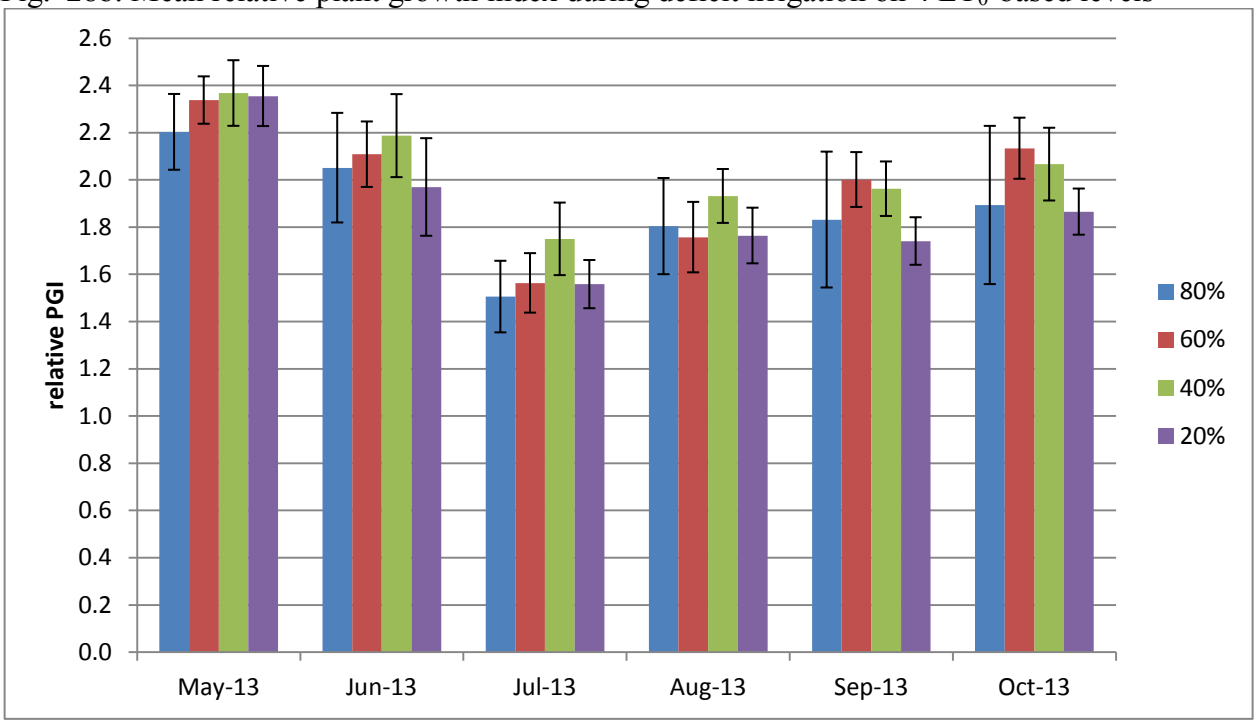
Rosa 'Pink Grüss an Aachen'

Figure 28a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 28b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



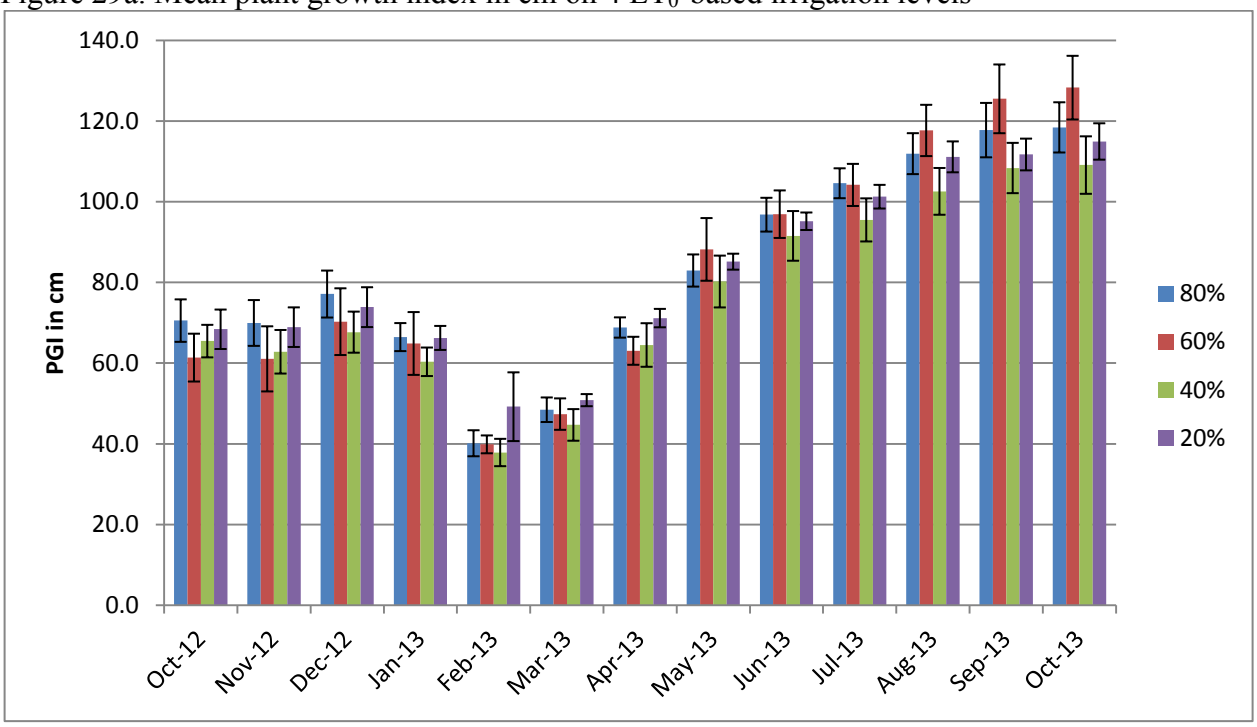
Error bars represent ± 1 SE

Table 21. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Rosa 'Grüss an Aachen'												
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**
80%	4.2	3.8		3.6	4.8	3.2	3.8	4.1	4.2	3.8	4.4	**4.0**
60%	4.7	3.8		4.2	4.8	3.2	4.2	3.5	3.3	3.3	3.4	**3.2**
40%	4.3	3.7		4.0	5.0	3.3	3.5	3.8	4.0	3.8	4.2	**3.8**
20%	4.0	3.7		4.0	4.9	3.6	3.6	3.3	3.6	3.0	3.7	**3.9**
flowering												
80%	3.0	1.0				3.3	2.0	3.8	2.3	2.4	1.5	**2.0**
60%	1.5	1.5				3.6	1.0	2.6	1.0	2.8	2.0	**3.0**
40%	1.5	1.0				2.3	2.0	2.5	1.7	3.0	3.0	**2.0**
20%	1.7	2.0				2.6	1.3	2.3	2.3	1.8	1.0	**2.0**
pest tolerance												
80%	5.0	5.0		5.0	4.8	4.0	4.8	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	4.8		5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**5.0**
20%	4.9	5.0		5.0	4.9	4.6	4.9	5.0	5.0	5.0	5.0	**5.0**
disease resistance												
80%	4.4	3.8		4.8	5.0	3.2	3.8	4.0	4.2	3.8	4.6	**4.0**
60%	4.8	3.8		5.0	5.0	3.2	4.0	3.7	3.3	3.3	3.6	**3.2**
40%	4.3	3.8		4.8	5.0	3.3	3.4	3.8	4.0	3.8	4.2	**3.8**
20%	4.0	3.7		5.0	5.0	3.7	3.6	3.3	3.4	3.0	3.7	**4.0**
vigor												
80%	3.0	3.6		3.6	3.8	3.8	4.0	3.8	4.2	4.0	4.0	**4.0**
60%	3.3	4.0		3.8	3.8	3.7	4.2	3.2	3.5	3.3	3.2	**3.2**
40%	3.3	4.0		4.2	4.2	4.2	4.3	3.7	4.3	4.0	4.3	**4.0**
20%	3.3	3.7		3.6	4.0	4.0	4.0	3.0	3.9	3.4	4.1	**4.1**
overall appearance												
80%	3.3	3.4		3.0	3.6	4.0	3.8	4.0	3.7	4.0	3.6	**3.4**
60%	3.3	3.6		3.0	3.5	3.4	3.8	3.1	2.8	3.0	2.8	**2.9**
40%	3.5	3.6		3.0	3.7	3.3	3.6	3.8	4.0	3.7	3.8	**3.7**
20%	3.3	3.3		3.0	3.8	3.7	3.4	3.1	3.6	3.0	3.6	**3.6**

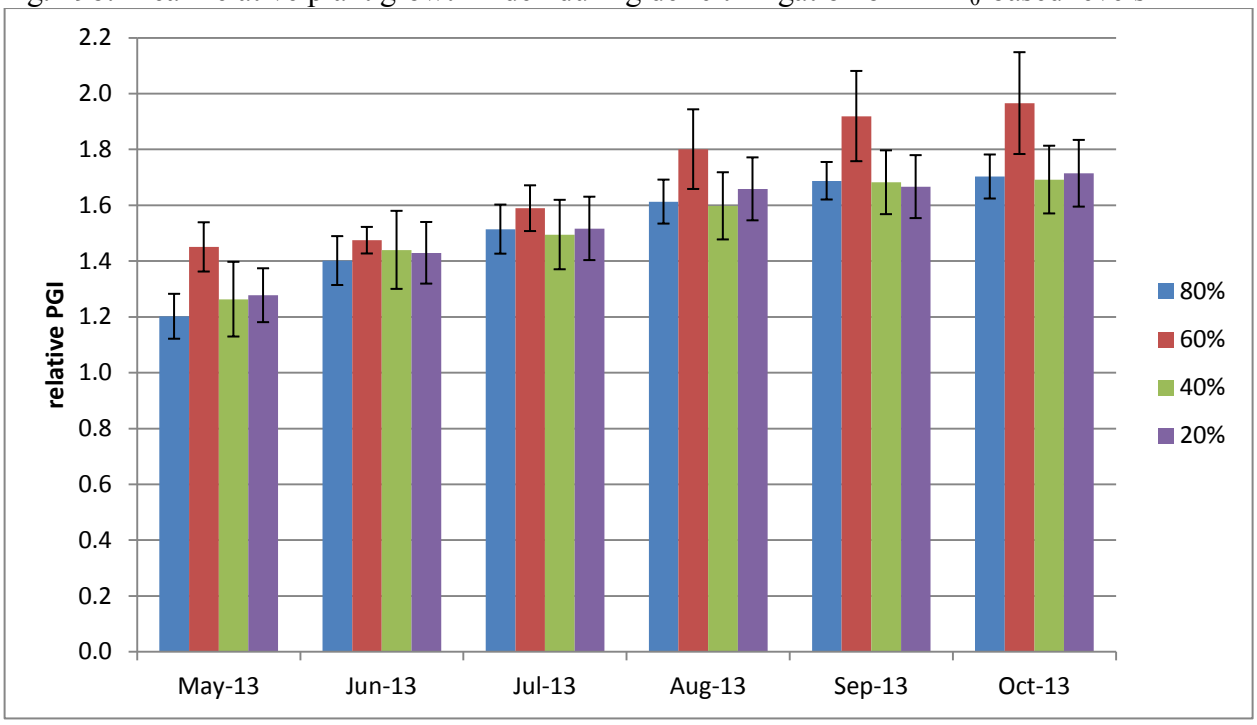
Salvia microphylla 'Hot Lips'

Figure 29a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 29b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



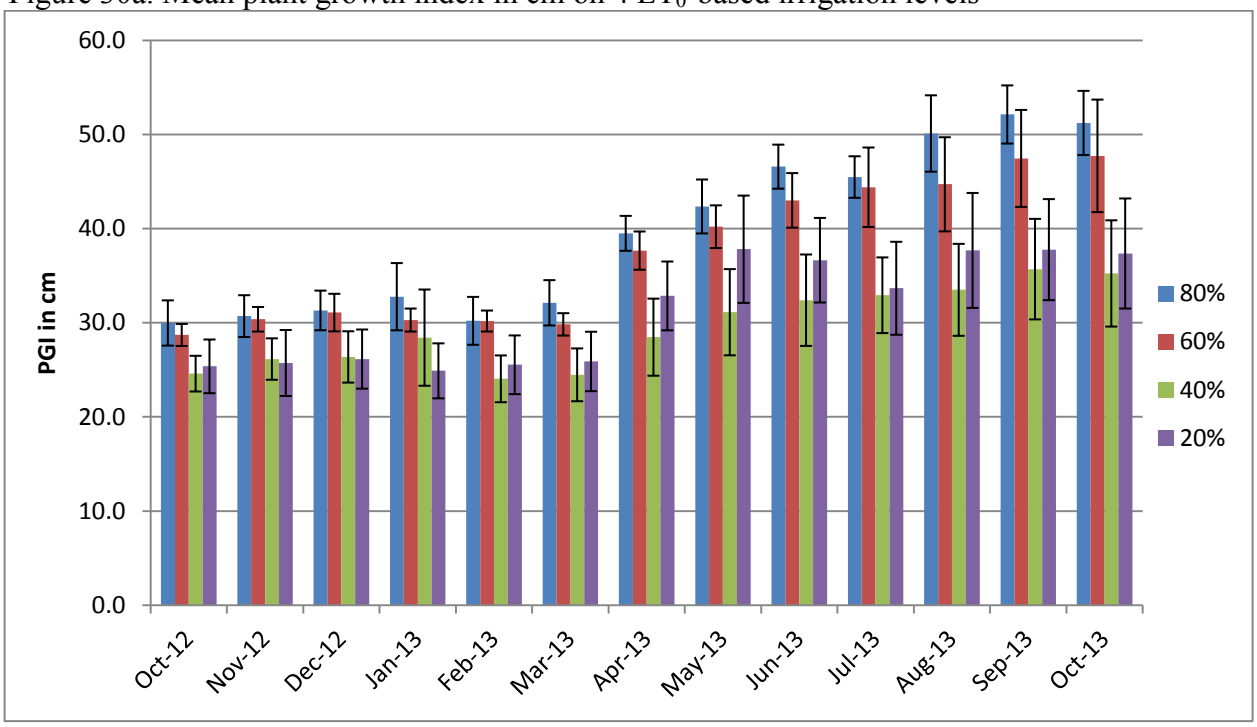
Error bars represent ± 1 SE

Table 22. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Salvia microphylla 'Hot Lips'													
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	3.8	4.5	2.8	3.8	4.2	4.3	4.7	4.5	4.2	3.8	2.8	3.2	**3.9**
60%	4.4	4.4	2.6	3.6	5.0	4.2	4.8	4.8	4.5	4.5	4.3	4.5	**4.3**
40%	4.3	4.7	2.7	4.0	4.8	4.5	4.7	4.7	4.7	4.3	4.2	3.8	**4.3**
20%	4.2	4.2	2.7	4.0	4.3	4.5	4.7	4.2	3.8	4.0	3.5	3.2	**3.9**
flowering													
80%	4.5	1.3			2.8	1.8	2.3	5.0	4.8	5.0	4.0	1.8	**3.4**
60%	4.4	1.5			2.8	1.0	2.2	5.0	5.0	5.0	4.5	2.5	**3.5**
40%	4.2	1.5			3.0	1.5	2.7	4.8	4.8	4.6	4.8	2.3	**3.6**
20%	4.0	1.2			2.0	1.5	3.0	4.5	4.2	4.5	3.8	2.0	**3.2**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	3.5	4.2	4.2	2.7	4.0	4.3	4.5	4.7	4.2	3.8	4.0	3.5	**4.0**
disease resistance													
80%	4.2	4.5	5.0	5.0	5.0	4.5	5.0	5.0	5.0	5.0	4.7	4.5	**4.8**
60%	4.6	4.6	5.0	5.0	5.0	4.8	5.0	5.0	4.5	5.0	4.8	5.0	**4.9**
40%	4.2	4.7	5.0	5.0	5.0	4.8	5.0	5.0	5.0	4.5	5.0	4.8	**4.8**
20%	4.5	4.3	5.0	5.0	4.8	4.7	5.0	5.0	5.0	4.3	4.8	5.0	**4.8**
vigor													
80%	4.3	4.3	3.7	3.2	4.0	4.8	4.7	4.8	4.7	4.0	3.5	3.7	**4.1**
60%	4.2	4.6	2.8	2.8	4.0	4.4	4.4	5.0	5.0	5.0	4.8	4.8	**4.3**
40%	4.8	4.7	3.7	3.7	4.7	5.0	5.0	4.8	4.8	4.5	4.8	4.7	**4.6**
20%	4.0	4.0	2.8	2.8	3.3	4.0	4.3	3.8	4.0	4.0	4.0	3.5	**3.7**
overall appearance													
80%	4.3	3.8	2.2	3.1	4.0	3.8	3.8	4.8	4.5	4.3	3.2	2.8	**3.7**
60%	4.4	3.7	1.7	2.8	4.4	4.0	4.0	5.0	4.8	4.8	4.4	3.9	**4.0**
40%	4.5	3.8	2.2	3.0	4.6	4.0	4.4	4.8	4.6	4.4	4.4	3.4	**4.0**
20%	4.3	3.7	1.8	2.8	3.7	3.6	3.9	4.0	4.2	4.2	3.8	3.0	**3.6**

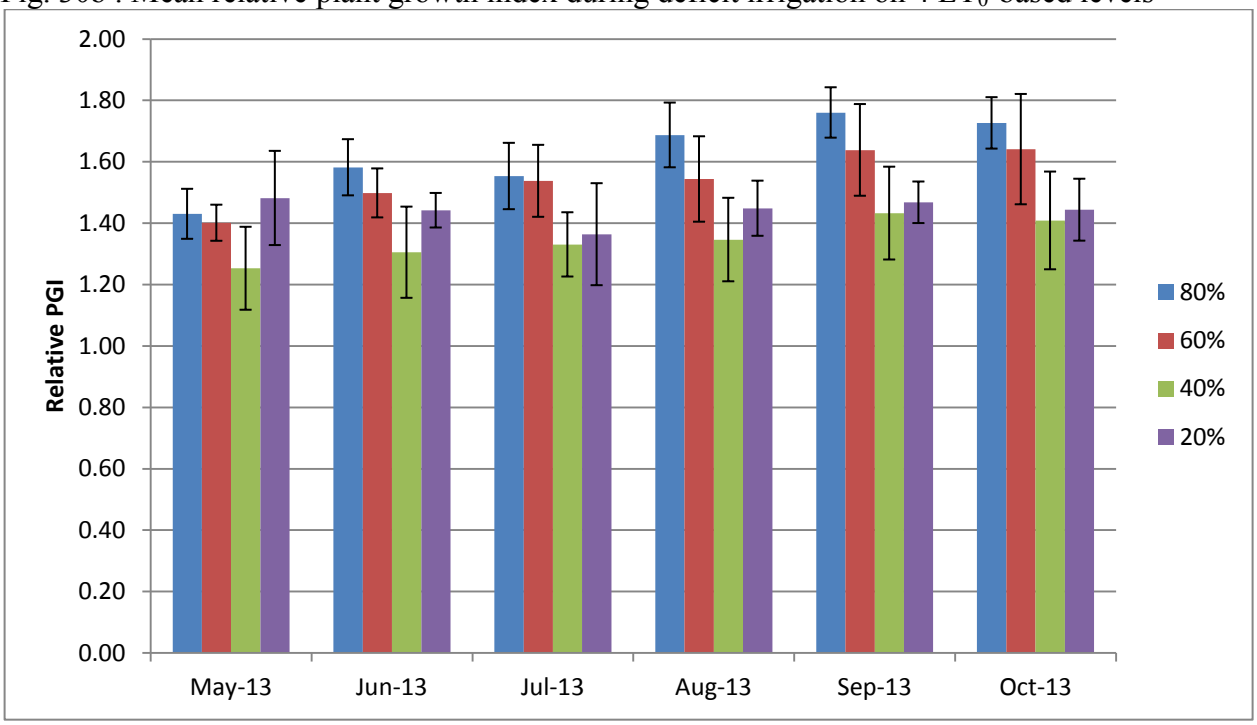
Teucrium chamaedrys 'Prostrata'

Figure 30a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 30b . Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 23. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Teucrium chamaedrys 'Prostrata'													
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	4.8	4.0	3.7	4.3	4.5	4.8	4.7	4.8	5.0	4.7	4.8	4.7	**4.6**
60%	4.8	4.0	4.0	4.3	4.3	5.0	5.0	5.0	5.0	5.0	5.0	4.8	**4.7**
40%	5.0	4.0	3.8	4.0	4.7	5.0	5.0	4.8	4.5	5.0	4.5	4.2	**4.5**
20%	4.8	4.2	3.8	3.3	4.0	4.4	4.5	4.2	4.8	4.8	4.4	4.5	**4.3**
flowering													
80%	2.5				1.0		4.8	3.0	2.0	1.7	1.7	1.3	**2.3**
60%	2.0				4.0		5.0	4.0	2.5	2.2	2.0	2.0	**3.0**
40%	1.5						5.0	3.7	2.6	2.6	2.2	3.0	**2.9**
20%	1.3				5.0		4.6	2.4	1.5	2.0	1.5	1.7	**2.5**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	5.0	4.8	5.0	5.0	4.8	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	4.8	5.0	5.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.7	5.0	5.0	4.6	5.0	**4.9**
vigor													
80%	3.8	4.3	3.7	4.3	4.0	4.2	4.2	4.3	4.3	4.3	4.2	4.0	**4.1**
60%	5.0	4.8	4.7	4.8	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
40%	4.7	4.7	4.3	4.7	4.5	4.8	5.0	5.0	4.5	4.5	4.3	4.3	**4.6**
20%	4.0	3.8	3.8	3.7	4.2	4.0	4.0	3.5	3.8	4.2	4.2	3.5	**3.9**
overall appearance													
80%	4.2	3.8	3.5	3.8	3.8	3.8	4.8	4.2	4.0	3.8	3.8	3.7	**3.9**
60%	4.2	4.0	3.9	4.0	4.2	4.2	5.0	4.7	4.2	4.3	4.0	3.9	**4.2**
40%	4.0	4.0	3.8	4.0	3.9	4.0	5.0	4.7	3.7	3.8	3.8	3.8	**4.0**
20%	4.0	4.0	3.5	3.3	3.8	3.6	4.2	3.6	3.7	3.8	3.5	3.0	**3.7**

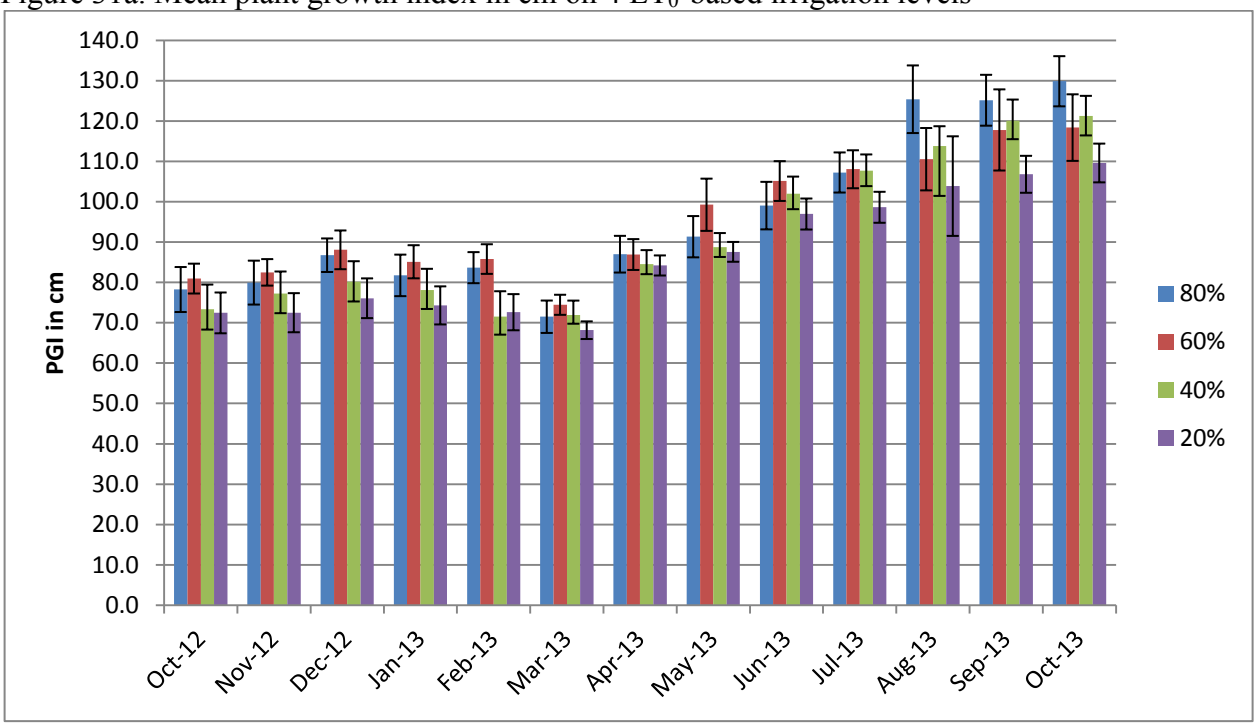
Table 24. Master Gardener average annual quality ratings and 2-year growth for *Teucrium chamaedrys* 'Prostrata'

COUNTY	Alameda	Nevada	Orange	SD coast	SD inland	San Joaquin	Shasta	Ventura
Sunset Zone	**9**	**7**	**23**	**24**	**21/23**	**14**	**9**	**21**
foliage	4.8	4.2	3.7	4.4	4.4	4.9	2.8	3.7
flower	3.0	3.2	1.8	2.5	2.4	5.0	3.5	1.4
bloom period	Jun-Dec	Jun-Oct	all year (**Jun**)	Jun-Aug	May-Aug	May-Jun	May-Jun	all year (**Jul**)
pest tolerance	5.0	5.0	5.0	4.9	4.9	5.0	5.0	5.0
disease resistance	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
vigor	3.5	4.3	3.6	3.7	3.4	4.9	2.8	3.6
overall appearance	**4.2**	**4.0**	**3.7**	**3.7**	**3.1**	**4.8**	**2.8**	**2.7**
MSMTS								
relative PGI	3.0	2.9	0.9	2.6	0.4	3.2	1.7	1.7
avg ht (cm)	15	21	12	15	11	15	14	10
avg wd (cm)	74	72	63	69	27	79	38	48
AVG HT (in)	6	8	5	6	4	6	6	4
AVG WD (in)	29	28	25	27	11	31	15	19

For all year bloom, the month of greatest flush is in bold print.

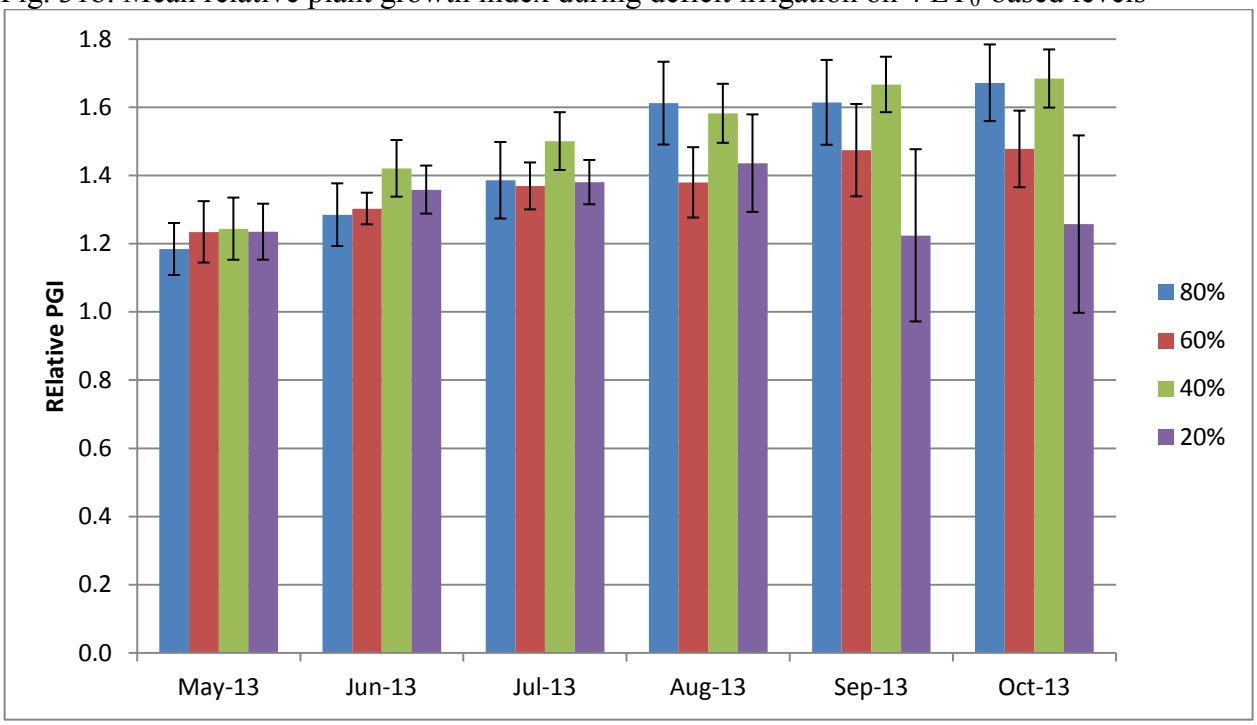
Teucrium fruticans 'Azureum'

Figure 31a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 31b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

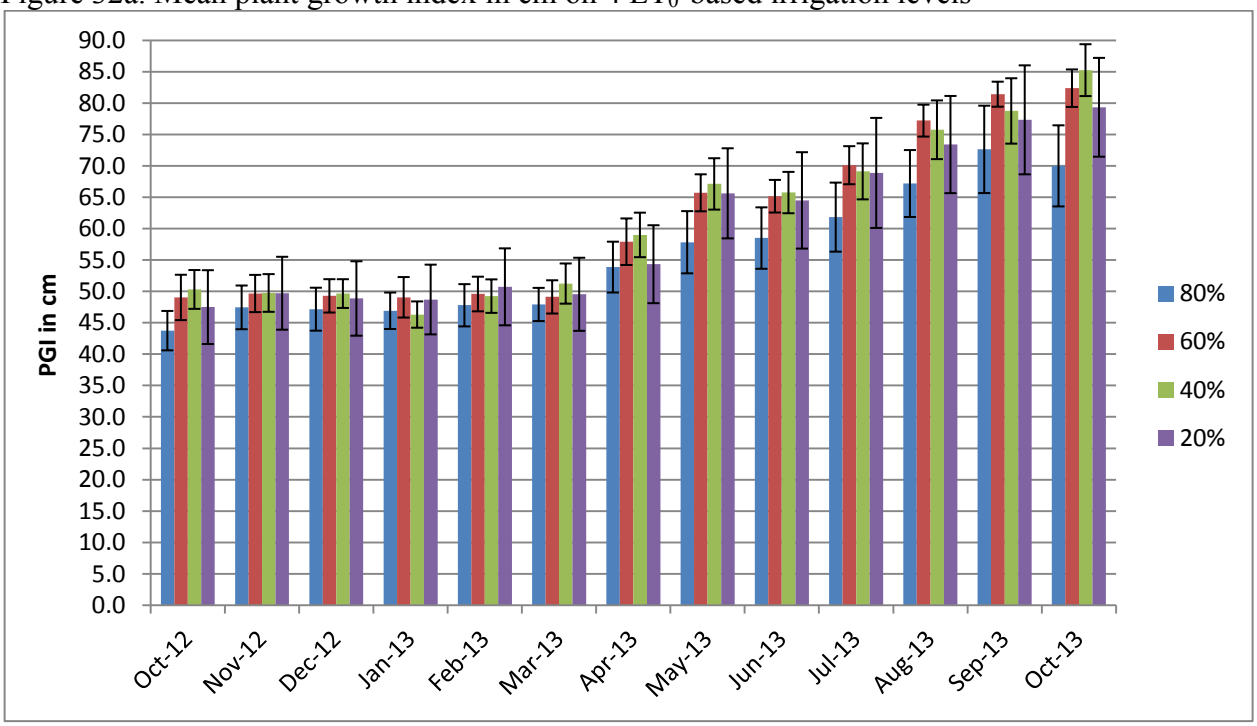
Table 25. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Teucrium fruticans 'Azureum'													
foliage	**OCT**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	4.7	4.2	3.8	4.7	4.7	4.8	4.0	3.5	2.8	2.5	2.8	2.3	**3.7**
60%	4.8	4.5	3.4	4.2	4.5	4.3	3.7	3.5	3.8	3.4	3.4	3.2	**3.9**
40%	4.5	4.8	3.9	4.3	4.2	4.8	3.5	3.2	2.9	3.2	3.6	3.3	**3.9**
20%	4.6	4.9	4.0	4.0	4.3	4.4	3.7	3.6	3.6	3.4	3.6	3.6	**4.0**
flowering													
80%	1.3	2.7	1.0	4.0	4.5	1.2	1.0				1.0	2.0	**1.3**
60%	1.3	3.2	1.3	4.0	4.5	1.2	1.0				1.8	4.8	**2.2**
40%	1.5	3.3	1.7	5.0	3.8	1.3					2.7	3.8	**2.6**
20%	1.5	3.5	1.0	5.0	5.0	1.2					1.3	2.2	**1.6**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.3	5.0	5.0	**4.9**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	4.8	4.2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.7	5.0	5.0	**4.8**
60%	5.0	4.8	4.7	5.0	5.0	4.7	5.0	4.7	5.0	3.4	4.6	5.0	**4.7**
40%	5.0	4.8	5.0	5.0	5.0	5.0	5.0	4.3	3.5	3.2	4.8	5.0	**4.6**
20%	4.8	4.8	5.0	5.0	4.6	5.0	5.0	4.8	4.5	3.8	4.8	5.0	**4.8**
vigor													
80%	3.7	3.7	3.7	3.8	4.7	4.8	4.2	4.2	4.5	3.3	3.4	3.8	**4.0**
60%	4.0	4.0	3.8	3.7	4.3	4.5	4.0	3.8	4.6	4.4	4.2	4.4	**4.1**
40%	3.8	4.5	4.0	4.3	4.5	4.8	4.5	4.8	4.7	3.8	4.4	4.4	**4.4**
20%	4.2	4.3	4.0	4.3	4.0	5.0	4.2	4.7	4.8	4.5	4.3	4.2	**4.4**
overall appearance													
80%	4.0	4.0	3.8	4.7	4.8	4.0	3.3	2.8	2.8	2.3	2.8	2.4	**3.5**
60%	4.2	4.3	3.1	4.5	4.7	3.8	3.3	3.2	3.6	3.2	3.5	3.5	**3.7**
40%	4.3	4.4	3.5	5.0	4.3	4.0	3.4	3.0	2.8	3.2	3.8	3.5	**3.8**
20%	4.2	4.6	3.8	5.0	4.4	3.7	3.5	3.0	3.5	3.7	3.7	3.5	**3.9**

Table 26. Master Gardener average annual quality ratings and 2-year growth for *Teucrium fruticans* 'Azureum'

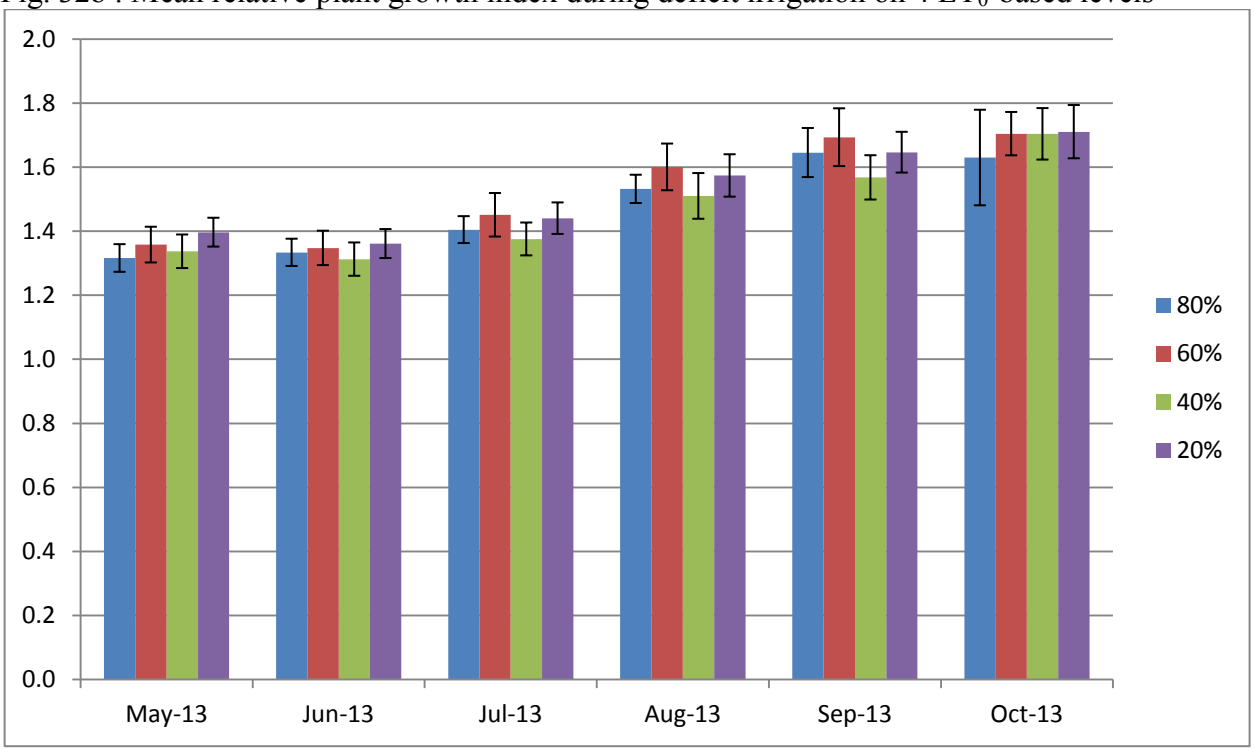
COUNTY	Alameda	SD coastal	SD Inland	San Joaquin	Ventura
Sunset Zone	**9**	**24**	**21/23**	**14**	**21**
foliage	3.8	4.3	3.7	4.9	4.0
flower	3.3	2.8	3.0	3.6	3.1
bloom period	Oct-Apr	Oct-April	Dec-Apr	Dec-April	Oct-Apr
pest tolerance	5.0	4.7	4.9	5.0	5.0
disease resistance	4.9	5.0	4.9	5.0	5.0
vigor	3.5	4.2	4.1	4.3	4.0
overall appearance	**3.4**	**4.0**	**3.9**	**4.2**	**3.8**
MSMTS					
relative PGI	2.4	3.0	2.2	2.4	2.4
avg ht (cm)	81	118	88	82	69
avg wd (cm)	93	150	118	117	105
AVG HT (in)	32	47	35	32	27
AVG WD (in)	37	59	46	46	41

Figure 32a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 32b . Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 27. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

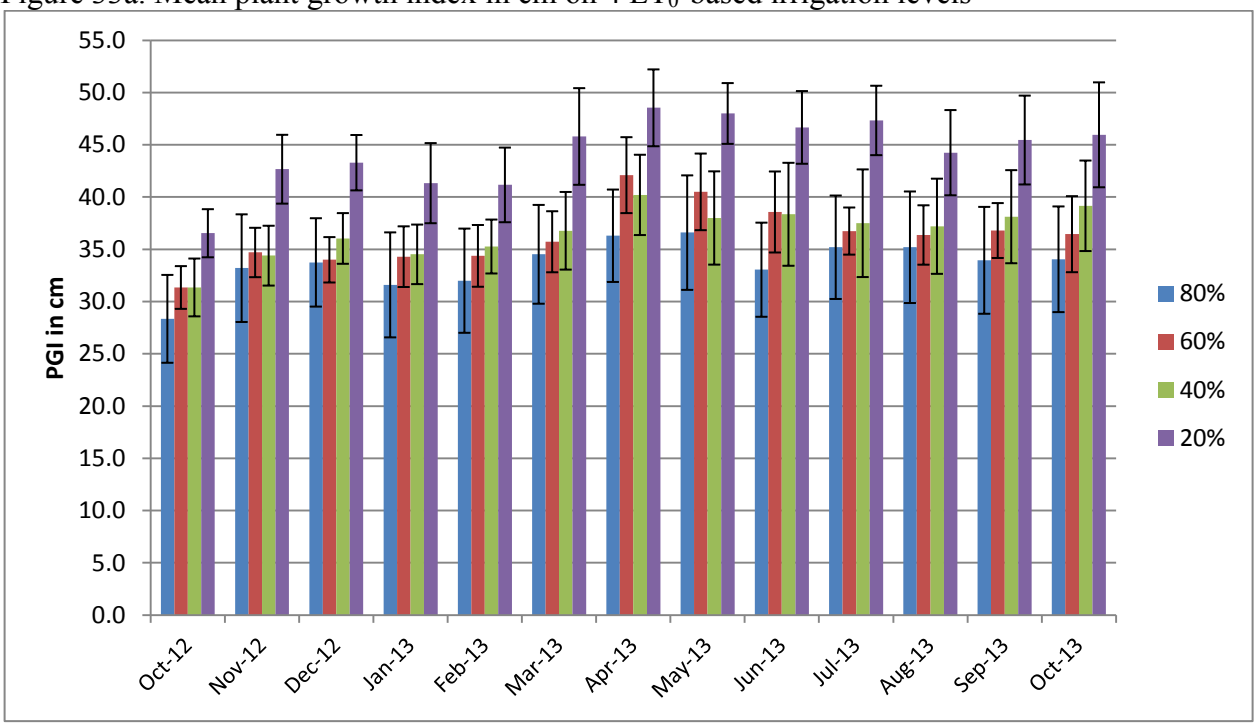
***Berberis aquifolium* 'Compacta'**													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	4.0	4.5	4.3	4.9	4.7	4.7	2.5	2.9	3.8	4.8	4.8	4.6	**4.2**
60%	4.4	5.0	4.3	4.5	4.7	4.7	2.6	3.1	4.3	4.3	5.0	4.5	**4.3**
40%	4.0	4.8	4.8	4.8	5.0	5.0	2.9	3.7	4.1	5.0	5.0	4.6	**4.5**
20%	4.4	4.8	4.7	4.2	4.8	5.0	2.8	3.0	4.5	5.0	5.0	4.8	**4.4**
flowering													
80%						2.4							**2.4**
60%						1.3		1.0					**1.3**
40%						1.0							**1.0**
20%					2.0	2.3							**2.3**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.7	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	4.5	5.0	5.0	5.0	5.0	4.8	**4.9**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	5.0	5.0	4.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.8	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor													
80%	3.2	3.6	3.3	3.3	3.5	3.7	3.6	3.4	3.8	4.3	3.9	3.9	**3.6**
60%	3.6	3.4	3.3	3.7	3.6	3.8	3.8	3.8	4.2	3.7	4.5	4.2	**3.8**
40%	4.0	3.6	3.8	3.4	3.3	4.0	3.5	3.8	4.8	4.6	4.8	4.6	**4.0**
20%	3.8	3.8	3.7	3.9	3.8	3.7	4.1	3.7	4.3	4.5	4.4	4.6	**4.0**
overall appearance													
80%	3.3	3.4	3.2	3.6	3.5	4.0	3.1	3.1	3.6	4.3	4.2	4.2	**3.6**
60%	3.6	3.5	3.3	4.1	3.8	3.9	3.1	3.6	4.2	4.0	4.7	4.3	**3.8**
40%	4.0	3.4	3.4	3.9	3.8	4.0	3.3	3.8	4.4	4.9	4.6	4.4	**4.0**
20%	3.7	3.8	3.1	3.8	3.9	3.8	3.1	3.2	4.3	4.5	4.6	4.3	**3.8**

Table 28. Master Gardener average annual quality ratings and 2-year growth for *Berberis aquifolium* 'Compacta'

COUNTY	LA	Mariposa	Orange	SD Inland	SD Coastal	Shasta	Ventura
Sunset Zone	21	7	23	21/23	24	9	21
foliage	4.3	4.1	3.6	3.3	3.3	2.8	3.9
flower	3.0	3.0	0.9	1.3	1.2	3.0	1.0
bloom period	Feb	Apr	Apr	Mar	Mar-Apr	Apr	Feb-Mar
pest tolerance	4.3	4.2	4.4	3.2	4.4	4.5	5.0
disease resistance	4.8	4.4	4.5	3.7	4.7	4.4	5.0
vigor	3.9	4.3	3.5	3.4	3.2	2.3	3.9
overall appearance	**4.0**	**4.1**	**3.6**	**3.0**	**2.8**	**2.7**	**3.6**
MSMTS							
relative PGI	1.2	1.6	2.1	1.5	1.0	1.5	1.7
avg ht (cm)	34	45	42	40	30	37	45
avg wd (cm)	23	24	13	22	25	22	26
AVG HT (in)	13	18	16	16	12	15	18
AVG WD (in)	9	9	5	9	10	9	10

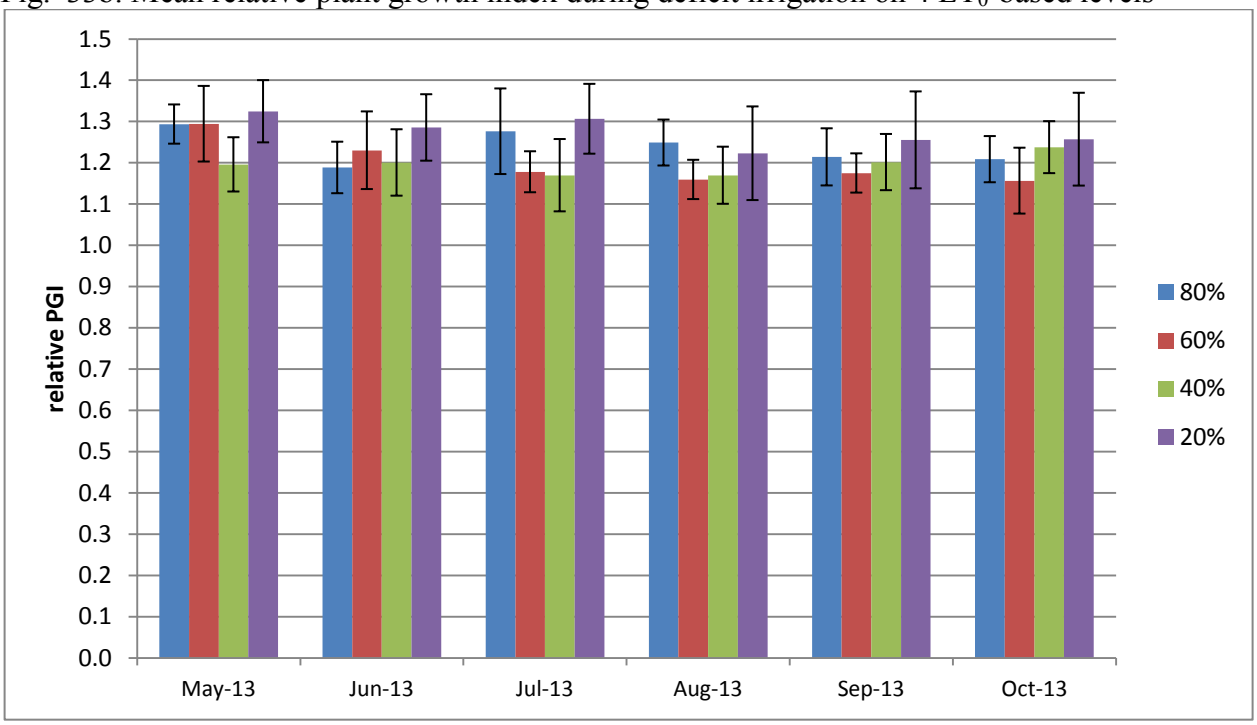
Cyrtomium falcatum

Figure 33a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 33b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 29. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

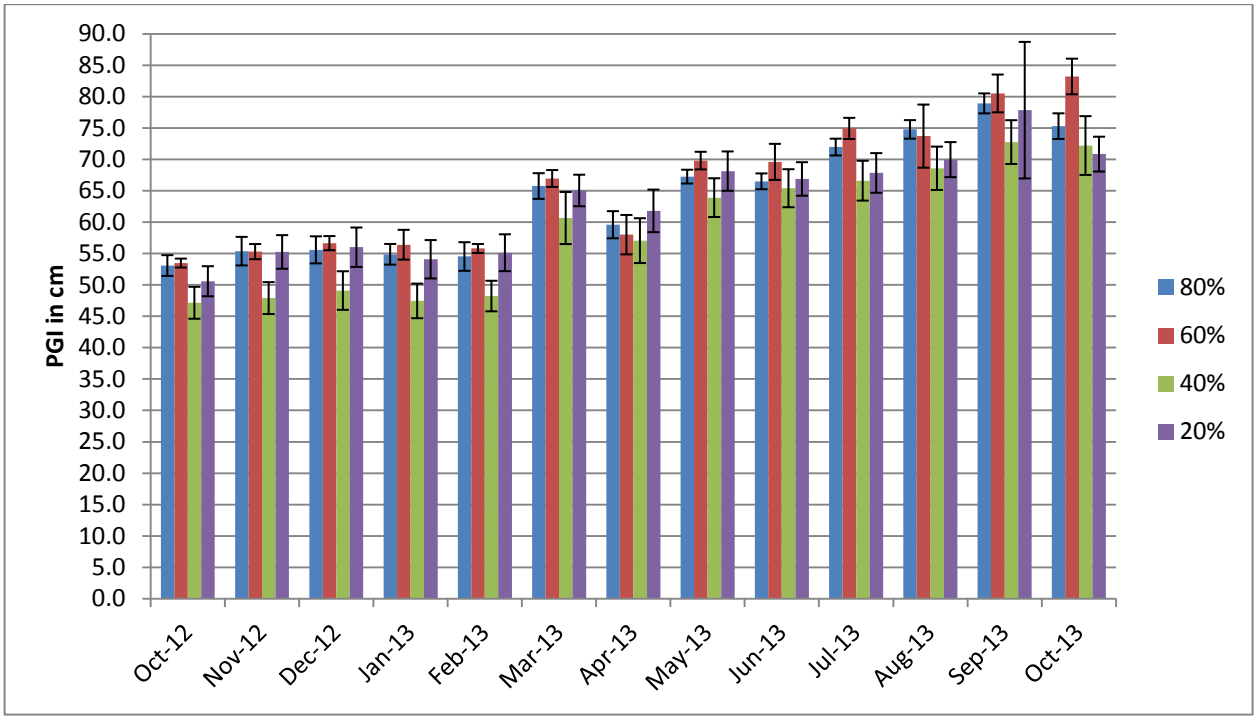
Cyrtomium falcatum													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	2.7	3.4	3.7	3.1	3.0	3.1	3.0	2.9	2.8	2.4	2.3	2.7	**2.9**
60%	2.8	2.8	3.7	3.3	3.4	3.3	2.8	2.8	2.8	2.8	3.3	3.3	**3.1**
40%	3.3	3.3	3.9	3.0	3.0	3.1	2.9	2.8	3.0	2.8	2.6	3.1	**3.1**
20%	3.3	3.4	4.2	3.8	3.7	3.8	3.8	3.8	3.3	3.0	2.7	2.7	**3.4**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor													
80%	3.0	3.2	2.5	3.2	3.0	3.2	3.0	3.0	2.7	2.8	2.9	3.6	
60%	3.5	3.4	2.5	2.8	3.3	3.3	3.0	3.2	3.4	3.2	3.6	3.6	**3.2**
40%	3.8	3.8	3.2	3.3	3.4	4.0	3.2	3.3	3.7	3.3	2.6	3.5	**3.4**
20%	4.2	3.6	3.5	3.5	3.9	4.3	4.0	3.8	3.9	4.1	2.8	3.3	**3.7**
overall appearance													
80%	2.9	2.9	2.8	2.9	2.6	3.1	2.9	3.5	2.7	2.4	2.6	3.0	**2.9**
60%	3.5	3.8	3.4	3.4	3.5	3.2	3.3	3.6	3.5	3.7	3.3	3.2	**3.5**
40%	3.7	3.3	3.2	3.4	3.3	3.6	3.0	3.2	3.5	2.9	2.9	3.3	**3.3**
20%	4.0	3.5	3.4	4.0	4.0	4.3	4.0	3.8	3.9	3.8	3.0	3.1	**3.7**

Table 30. Master Gardener average annual quality ratings and 2-year growth for *Cyrtomium falcatum*

COUNTY	**San Joaquin**	**Shasta**
Sunset Zone	**14**	**9**
foliage	3.8	2.5
pest tolerance	4.4	3.9
disease resistance	4.5	4.5
vigor	4.1	2.4
O/A	3.9	2.4
MSMTS		
relative PGI	3.6	1.2
avg ht (cm)	42	24
avg wd (cm)	63	46
AVG HT (in)	17	9
AVG WD (in)	25	18

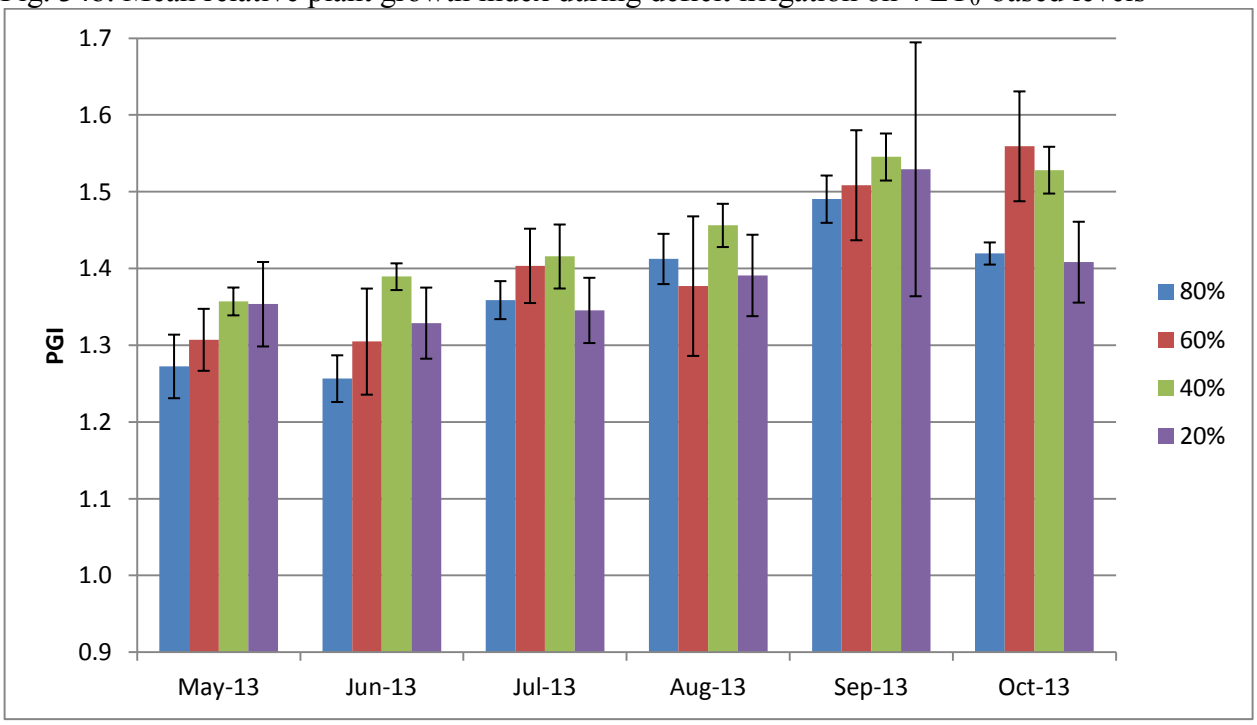
Daphne odora 'Aureomarginata'

Figure 34a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 34b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 31. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

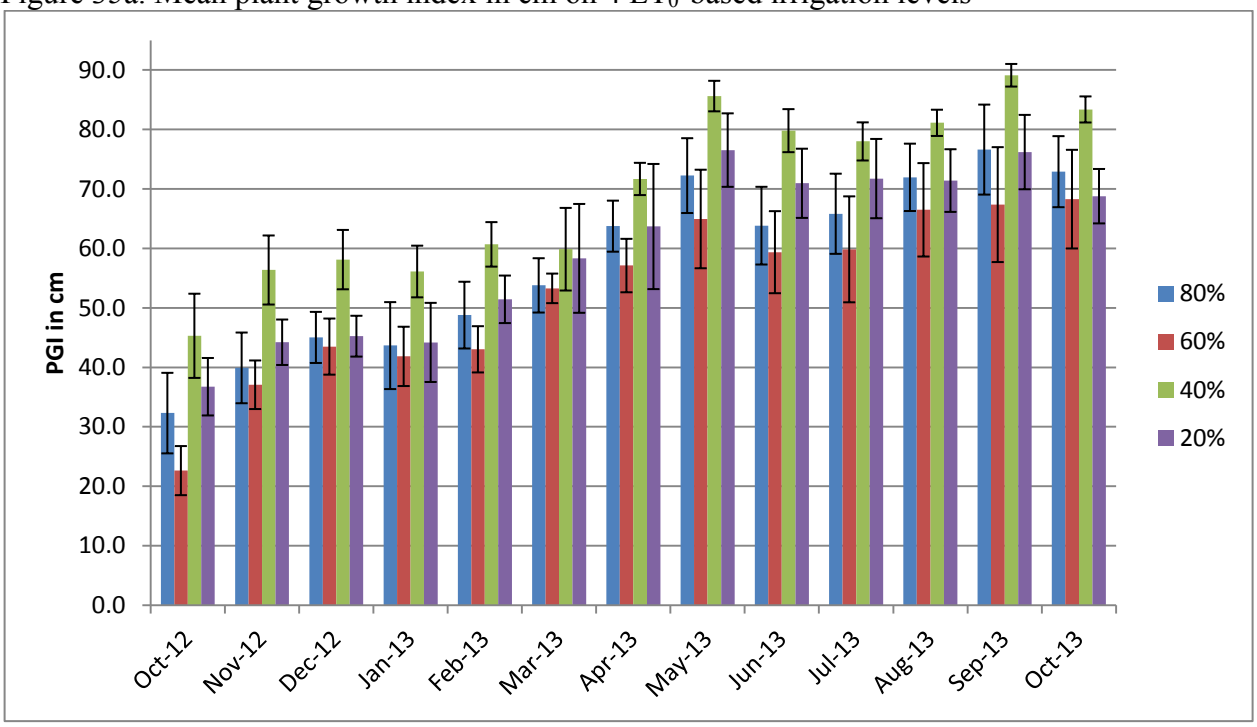
Daphne odora 'Aureomarginata'													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	2.9	3.5	3.9	3.0	3.0	3.3	2.8	3.0	3.0	3.0	3.3	3.2	**3.2**
60%	3.2	3.4	4.0	3.4	3.0	3.0	3.2	3.2	3.4	3.6	3.1	3.2	**3.3**
40%	2.9	3.2	3.9	3.1	3.5	2.9	2.6	2.6	2.9	3.3	3.0	3.0	**3.1**
20%	3.4	3.7	3.8	3.2	3.0	3.0	3.3	3.1	3.6	3.3	3.3	3.1	**3.3**
flowering													
80%					1.7								**1.7**
60%					2.4								**2.4**
40%					2.0								**2.0**
20%					1.7	1.0							**1.3**
pest tolerance													
80%	5.0	3.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
60%	5.0	3.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
40%	5.0	3.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
20%	5.0	3.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
disease resistance													
80%	5.0	5.0	5.0	5.0	5.0	3.4	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
60%	5.0	5.0	5.0	5.0	5.0	3.5	4.6	4.8	5.0	4.8	5.0	5.0	**4.8**
40%	5.0	5.0	5.0	4.8	5.0	3.6	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
20%	5.0	5.0	4.5	5.0	5.0	3.3	5.0	5.0	5.0	5.0	5.0	5.0	**4.8**
vigor													
80%	3.3	3.8	3.2	3.2	3.7	3.7	3.5	3.4	3.6	3.7	3.4	3.5	**3.5**
60%	4.0	3.7	3.8	3.6	4.3	4.2	3.8	3.8	3.8	4.6	3.5	3.9	**3.9**
40%	3.1	3.1	3.2	3.0	3.4	3.2	3.3	3.3	3.6	3.5	3.2	3.5	**3.3**
20%	3.3	3.4	3.3	3.3	3.4	3.5	3.5	3.4	3.9	3.8	3.5	3.6	**3.5**
overall appearance													
80%	3.3	3.5	3.0	3.3	3.3	3.3	3.0	3.1	3.0	3.3	3.3	3.3	**3.2**
60%	3.5	3.8	3.4	3.4	3.5	3.2	3.3	3.6	3.5	3.7	3.3	3.2	**3.5**
40%	3.2	3.4	3.2	3.2	3.6	3.3	2.8	3.0	3.1	3.3	2.8	3.3	**3.2**
20%	3.4	3.4	3.0	3.4	3.1	3.3	3.3	3.3	3.5	3.5	2.9	3.5	**3.3**

Table 32. Master Gardener average annual quality ratings and 2-year growth for *Daphne odora* 'Aureomarginata'

COUNTY	Orange	San Joaquin	SD inland	SD coastal	Shasta	Ventura
Sunset Zone	**23**	**14**	**21/23**	**24**	**9**	**21**
foliage	4.4	5.0	4.4	3.0	3.9	3.2
flower	2.8	5.0	3.2	2.7	3.7	1.4
bloom period	Jan-Apr	Dec-Mar	Jan-Mar	Jan-Feb	Jan-Mar	Jan-Feb
pest tolerance	4.8	5.0	4.7	3.9	4.9	4.8
disease resistance	5.0	5.0	4.8	5.0	4.9	4.7
vigor	4.3	5.0	4.5	3.2	3.5	3.0
overall appearance	**4.3**	**5.0**	**4.2**	**2.8**	**3.9**	**2.8**
MSMTS						
relative PGI	3.3	2.3	0.8	0.8	2.0	1.6
avg ht (cm)	55	47	39	19	46	36
avg wd (cm)	71	68	51	18	46	34
AVG HT (in)	22	18	15	7	18	14
AVG WD (in)	28	27	20	7	18	13

Festuca californica

Figure 35a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 35b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels

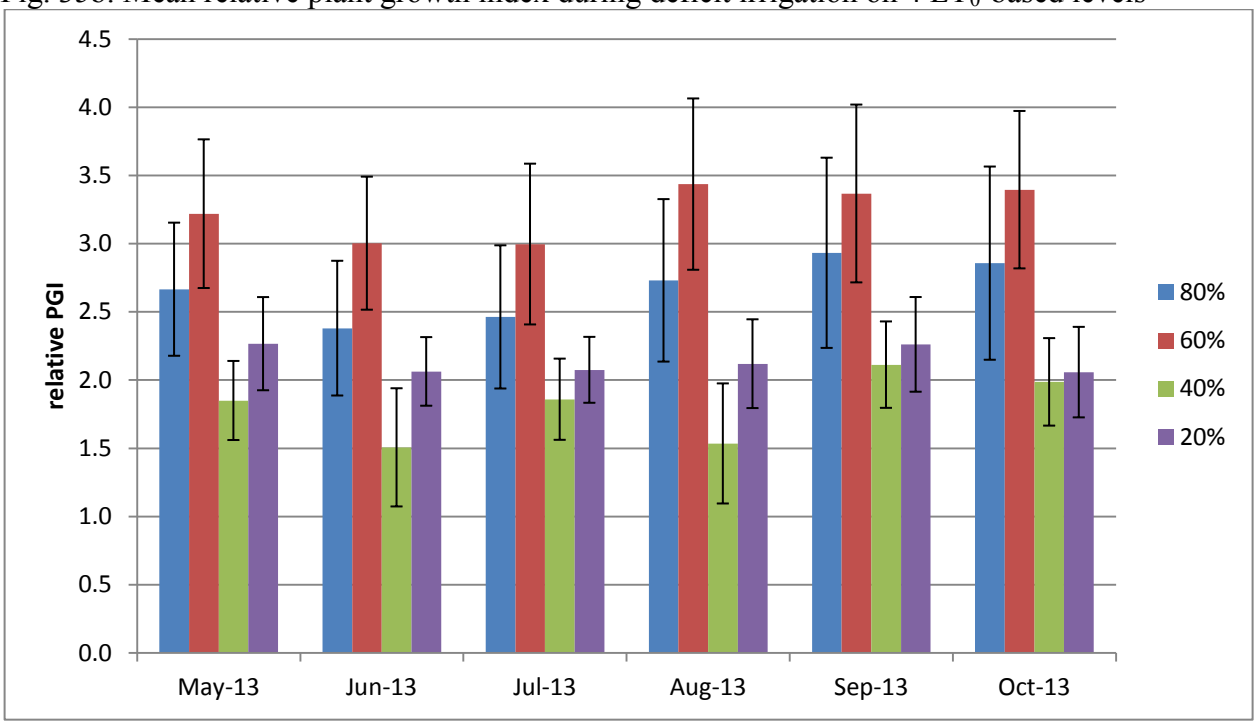
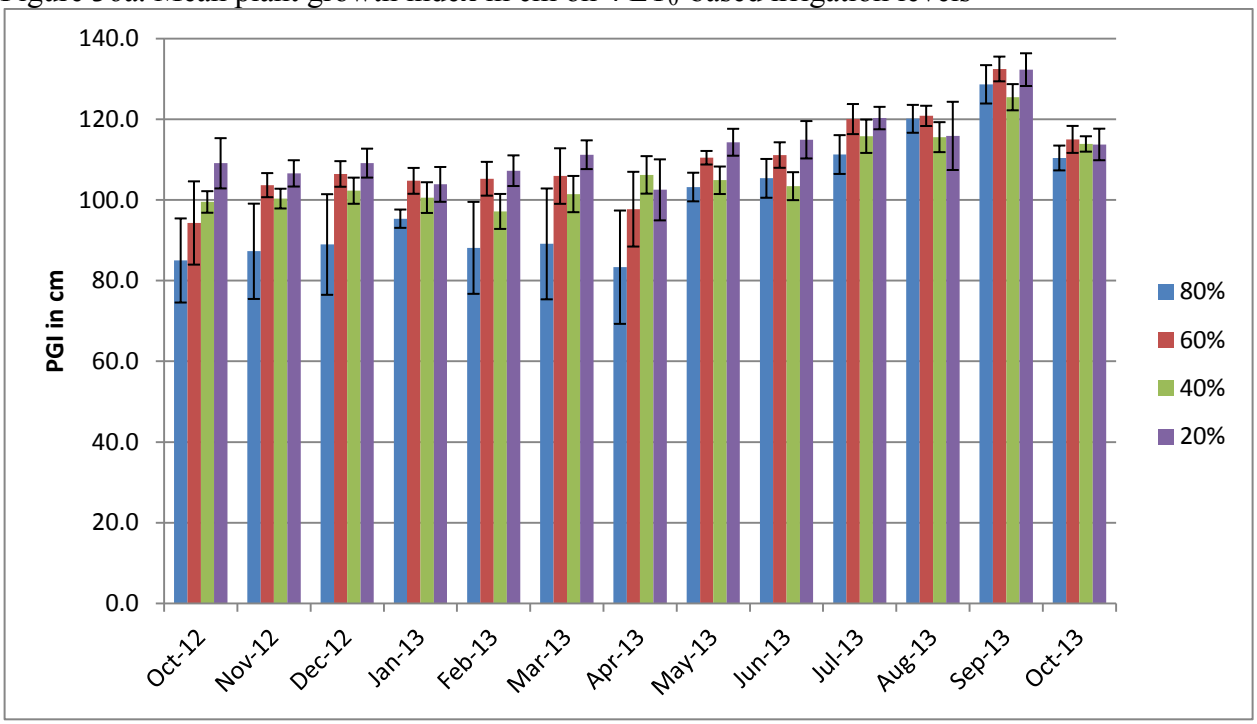


Table 33. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Festuca californica													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	2.9	3.4	4.5	3.3	3.3	4.3	5.0	5.0	3.8	4.3	4.3	4.4	**4.1**
60%	2.5	3.3	4.8	3.3	3.4	4.6	4.7	4.7	3.4	4.5	4.3	4.5	**4.0**
40%	3.1	3.7	5.0	3.8	3.9	4.1	3.7	3.7	4.0	5.0	4.9	4.4	**4.1**
20%	3.3	3.4	4.7	3.6	4.4	5.0	4.7	4.8	3.9	4.8	4.3	4.3	**4.3**
flowering													
80%					1.0	2.7	1.7	2.0					**1.8**
60%					4.0	1.0	2.0	1.0					**2.0**
40%					4.0	3.3	2.8	2.0					**3.0**
20%					2.5	2.1	1.8	1.7	3.0	2.0	2.0	1.0	**2.0**
pest tolerance													
80%	3.0	4.1	5.0	4.3	4.5	5.0	5.0	5.0	5.0	4.3	4.7	4.5	**4.5**
60%	2.7	3.3	5.0	4.1	4.3	5.0	5.0	5.0	4.7	4.7	4.2	5.0	**4.4**
40%	3.2	4.0	5.0	4.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.4	**4.7**
20%	3.7	3.8	5.0	4.7	4.6	5.0	5.0	5.0	5.0	5.0	4.8	5.0	**4.7**
disease resistance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor													
80%	3.0	3.4	3.0	3.1	3.5	3.0	3.8	3.8	3.6	4.0	4.1	3.8	**3.5**
60%	3.0	3.0	2.3	3.0	3.4	3.6	3.4	3.4	3.3	3.6	3.6	3.8	**3.3**
40%	3.3	3.6	3.8	3.4	3.6	3.8	3.6	3.5	3.9	4.5	4.4	3.7	**3.8**
20%	3.0	3.4	3.2	3.0	4.0	3.6	4.0	3.9	3.8	4.4	4.1	4.5	**3.7**
overall appearance													
80%	2.9	3.3	2.8	3.3	3.0	3.4	3.5	3.7	3.5	3.9	4.2	4.3	**3.8**
60%	2.8	2.9	2.3	3.0	2.9	3.1	3.3	3.1	2.8	3.7	3.9	4.2	**3.2**
40%	3.1	3.5	3.4	3.6	3.8	4.0	3.8	3.6	3.9	4.8	4.6	4.2	**3.8**
20%	2.9	3.4	2.8	3.5	3.8	3.5	3.8	3.8	3.5	4.5	4.4	4.6	**3.7**

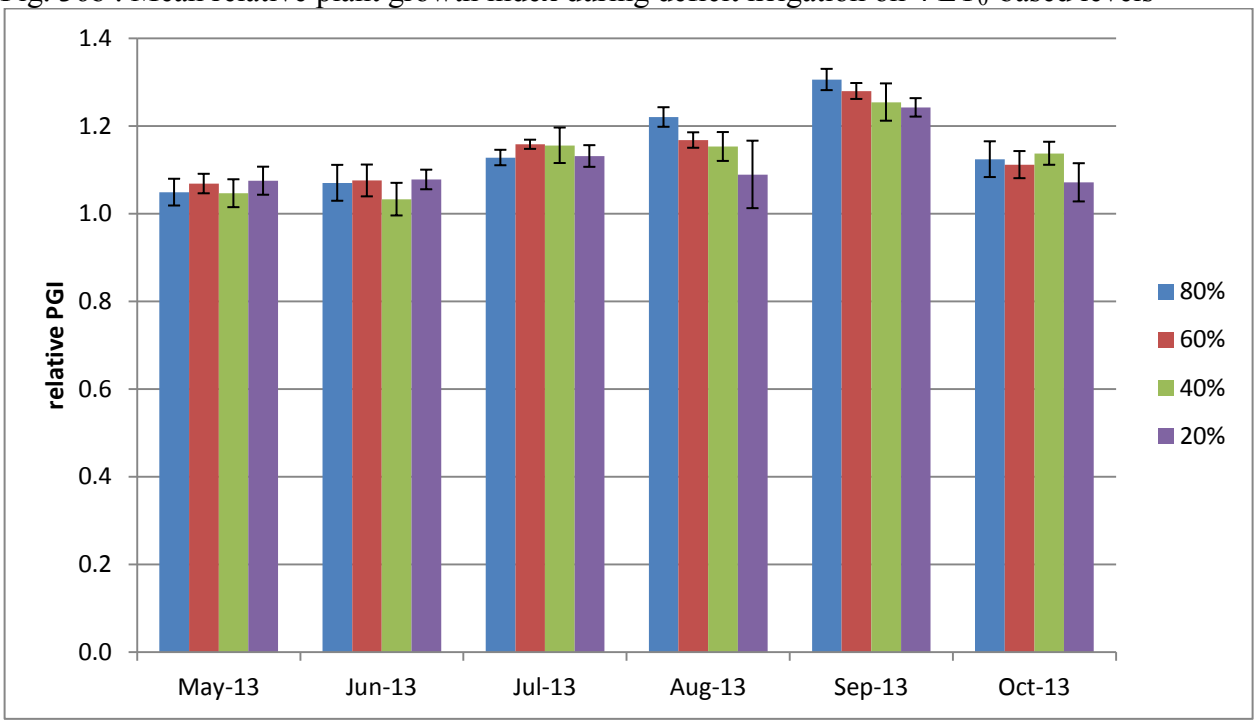
Neomarica caerulea

Figure 36a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 36b . Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 34. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

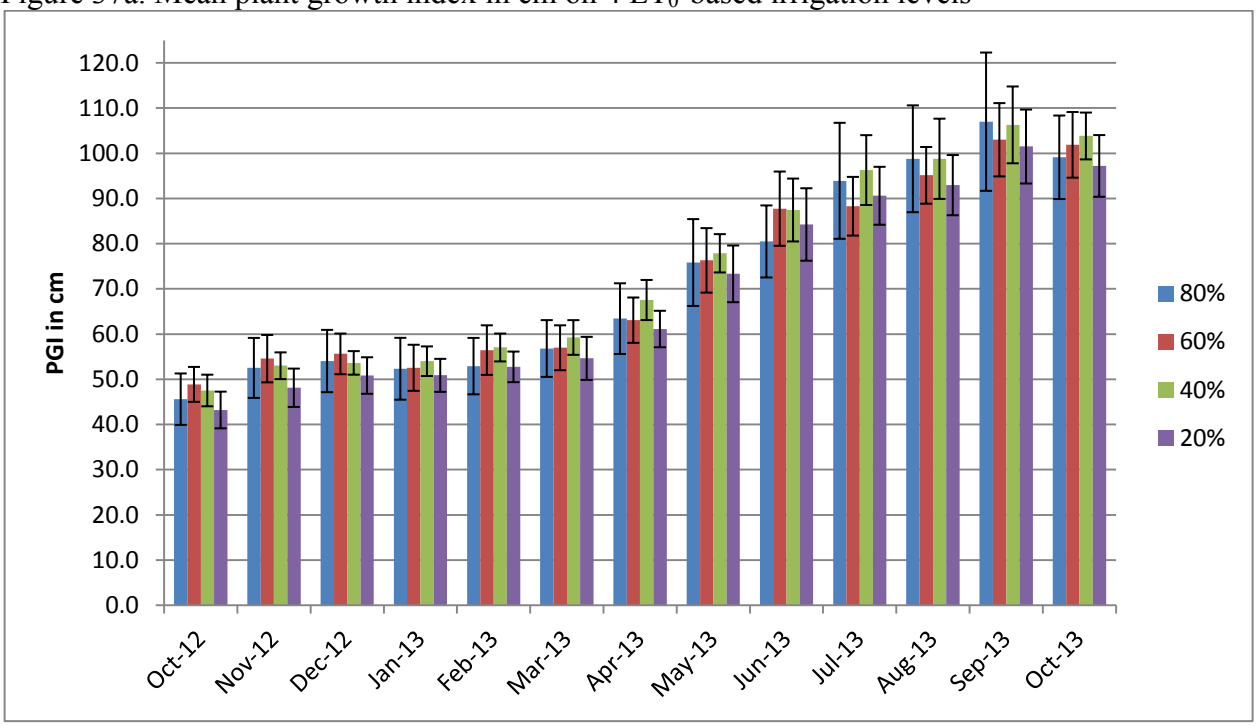
Neomarica caerulea													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	3.0	2.8	3.8	3.0	2.9	3.0	3.3	3.2	3.7	3.0	3.1	3.0	**3.2**
60%	3.1	3.0	3.8	3.0	3.0	3.0	3.0	3.1	3.0	3.1	3.1	3.3	**3.1**
40%	3.0	3.0	3.7	3.0	3.0	3.0	3.0	3.0	3.2	3.1	3.0	3.0	**3.1**
20%	3.2	3.0	4.0	3.0	3.4	3.3	3.0	3.0	3.1	3.1	3.1	3.1	**3.2**
flowering													
80%									2.5	1.7			**2.1**
60%									2.8	1.5			**2.1**
40%									2.8	1.3			**2.1**
20%									2.6	1.3			**2.0**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	4.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	4.5	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor													
80%	3.3	3.1	2.7	2.9	3.3	3.2	3.1	3.2	4.2	4.4	3.7	3.8	**3.4**
60%	3.4	3.9	3.0	3.3	3.4	3.6	3.3	3.2	4.1	4.7	3.9	4.3	**3.7**
40%	3.4	3.8	2.7	3.1	3.3	3.2	3.3	3.2	4.2	4.5	3.8	4.4	**3.6**
20%	3.8	3.8	3.5	3.3	3.5	3.5	3.8	3.8	4.3	4.6	3.8	4.2	**3.8**
overall appearance													
80%	3.1	3.1	2.8	2.7	2.8	3.2	2.8	3.2	4.3	4.6	3.7	4.0	**3.3**
60%	3.4	3.9	3.1	3.3	3.2	3.6	3.0	3.1	4.4	4.8	3.8	4.1	**3.6**
40%	3.6	3.8	3.1	3.0	3.0	3.2	3.2	3.3	4.4	4.5	3.7	4.2	**3.6**
20%	3.7	3.8	3.6	3.5	3.2	3.4	3.2	3.5	4.7	4.7	4.0	4.5	**3.8**

Table 35. Master Gardener average annual quality ratings and 2-year growth for *Neomarica caerulea*

COUNTY	Orange	Shasta	Ventura
Sunset Zone	23	9	21
foliage	3.8	2.4	3.2
flower	2.8		1.2
bloom period	May-Sep		May
pest tolerance	5.0	4.8	5.0
disease resistance	5.0	4.8	5.0
vigor	3.9	2.4	2.9
overall appearance	4.0	2.2	3.0
MSMTS			
relative PGI	2.4	2.1	0.8
avg ht (cm)	75	70	95
avg wd (cm)	56	71	131
AVG HT (in)	29	28	37
AVG WD (in)	22	28	3

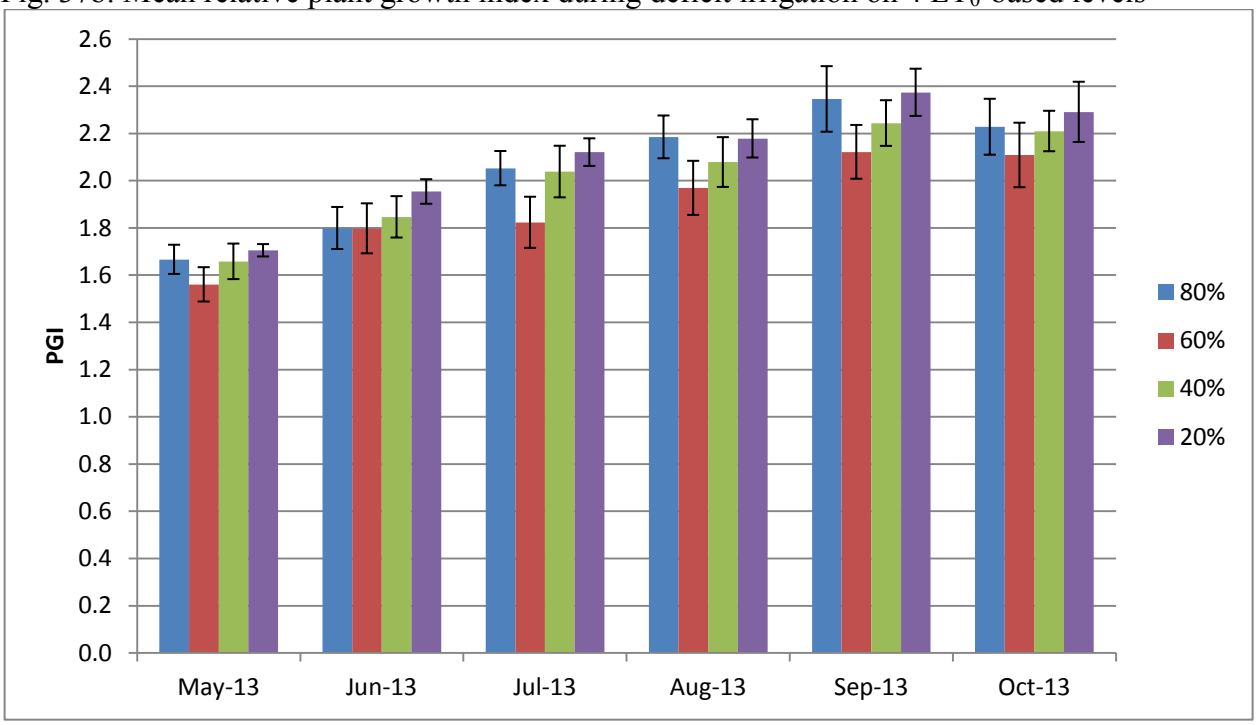
Sollya heterophylla

Figure 37a. Mean plant growth index in cm on 4 ET_0-based irrigation levels



Error bars represent ± 1 SE

Fig. 37b. Mean relative plant growth index during deficit irrigation on 4 ET_0-based levels



Error bars represent ± 1 SE

Table 36. Mean quality ratings in 6 categories on 4 ET_0-based irrigation levels

Sollya heterophylla													
foliage	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**AVG**
80%	5.0	4.8	5.0	5.0	4.7	5.0	5.0	5.0	5.0	4.8	5.0	5.0	**4.9**
60%	5.0	4.7	5.0	5.0	4.7	5.0	5.0	4.8	4.8	4.7	5.0	5.0	**4.9**
40%	5.0	4.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	4.8	5.0	5.0	4.7	4.8	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
flowering													
80%							1.0	1.1	1.6				**1.2**
60%							1.2	1.3	1.5				**1.3**
40%							1.4	1.5	1.8				**1.6**
20%							1.5	1.9	1.9				**1.8**
pest tolerance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
disease resistance													
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
vigor													
80%	3.1	3.8	3.7	3.5	4.1	3.8	4.0	4.0	4.0	4.0	4.0	4.2	**3.8**
60%	3.7	4.1	4.5	3.8	3.8	4.0	4.3	3.9	4.1	4.0	4.2	4.5	**4.1**
40%	3.3	3.6	4.3	3.7	4.0	4.3	4.3	4.2	3.8	4.5	3.8	4.5	**4.0**
20%	2.9	3.5	3.7	3.7	4.2	3.7	4.0	4.1	4.0	4.3	3.3	4.1	**3.8**
overall appearance													
80%	3.3	3.6	3.7	3.5	3.8	3.8	3.9	4.0	4.0	4.3	4.6	5.0	**3.9**
60%	3.6	3.9	3.9	3.5	3.8	3.9	4.3	4.2	3.8	4.1	4.7	5.0	**4.0**
40%	3.2	3.8	4.2	4.0	3.8	4.3	4.3	4.1	3.9	4.5	4.4	5.0	**4.1**
20%	3.0	3.4	3.8	3.8	3.7	3.7	4.3	4.1	3.8	4.2	4.6	5.0	**3.9**