Final Report
Saratoga Horticultural Research Endowment
2012-2014

Ornamental plant trials for the new California garden: Evaluating new landscape plants for sustainable characteristics on reduced water

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Executive Summary

In these trials 12 new perennial landscape plant introductions and three UC Davis Arboretum All-Stars California native species were evaluated for overall performance on a range of reduced irrigation levels in clay loam soil in the hot interior Central Valley of California. All plants were grown in-ground in full sun for two years. Planting in October 2012 was followed by an establishment year of regular irrigation at 80%-100% of reference evapotranspiration (ET_0) through April 2014. Plants were then subjected to one of four different levels of reduced irrigation at 20%, 40%, 60%, or 80% of ET_0 during the dry season through the first week of October 2014. During the deficit irrigation season they were evaluated across treatments for growth, health and vigor, overall appearance, flowering, pest tolerance, and disease resistance. From these assessments, irrigation recommendations are made for their use in the landscape.

Introduction

Plant performance trials are a critical step in the introduction and promotion of new or unfamiliar ornamental plants. With California now in its fourth year of drought, and chemical pollutants in urban landscape runoff an ongoing issue, breeders, growers and retailers are clamoring to fill the growing demand for an expanding palette of appealing landscape plants that are pest-tolerant and disease- resistant low-water users adapted to a wide range of soils without the need for chemical fertilizers or pest control products. Research by these investigators and others have shown that plants in landscapes will survive and even thrive on much less than expected irrigation levels, but finding the optimal range of irrigation may make the difference between acceptable appearance and plant failure (Reid, et al, 2012, 2013; Shaw and Pittenger, 2004). Most ornamental plant trials provide a high-maintenance environment (fertilizers, pest control, and ample water) to remove all outside obstacles to plant performance (Plant Trials Database, 2014). Only in the west have plant trials focused on more rigorous growing conditions such as reduced water and no chemical inputs (Hilaire, et al. 2008).

Since California has enacted the Model Water Efficient Landscape Ordinance and subsequent executive orders related to the drought, it has become incumbent upon landscape managers and homeowners to be more aware of how much water plants really need in order to preserve the aesthetic and ecosystem services of urban landscapes in the most conservatively irrigated manner possible. Currently, the most effective tool widely available for estimating the water needs of landscape plants, and to which MWELO refers, is the UCANR-hosted website WUCOLS IV, the Water Use Classification of Landscape Species (WUCOLS IV, 2014). In order to make our research compatible with the WUCOLS-style of plant water use classification, we have geared our trials to water usage levels corresponding to reference evapotranspiration, or ET_0, the total amount of water lost from a reference plant and the surrounding soil (tall fescue turfgrass). This is the same reference used by WUCOLS in its classifications of water-use ranges corresponding to low, moderate or high water use. The results then become easily translated into useful recommendations on plant water use for these new varieties as they enter the marketplace.

Research Methods

Irrigation field trials:

In October 2012, 24 each of 14 species or cultivar were planted in a UC Davis field with clay loam soil (USDA zone 9; *Sunset* zone 14), (Table 1). Another cultivar, *Helichrysum amorginum* 'Ruby clusters' was planted in early April 2013, as it was deemed unadvisable from previous experience to plant a small semi-succulent plant into heavy soil in late fall. All plants were placed two meters apart in rows two meters apart. The rows were covered with three inches of bark mulch, and two 2-gallon/hour drip emitters were laid beneath the mulch in the root zone of each plant. Each species was placed according to a randomized complete block pattern in two blocks to provide six of each species on each of the four irrigation levels.

The irrigation was based on percentages of reference evapotranspiration, or ET_0, as described in Water Use Classification of Landscape Species IV (WUCOLS IV, 2014.) All plants were given regular water at 80% - 100% of ET_0 during the first year and a half to encourage establishment of a deep, healthy root system. During the subsequent irrigated growing season (May through October), all of the plants received the same amount of water when irrigated to replace 50% of the soil's water holding capacity, but how often they received it was determined by their designated water use percentage of ET_0. Data from the local UC Davis CIMIS (California Irrigation Management System) station was used in a water budget to determine the irrigation timing for each treatment.

The percentages of ET_0 used in this trial were 20% (low), 40% (moderate-low), 60% (moderate), and 80% (high). The frequency of irrigation for 2014 is shown in Table 2.

Plant width, length, and height measurements were taken monthly. A plant growth index (PGI) was calculated to quantify the comparative growth of plants under different irrigation levels using the formula [(l +w)/2 +h]/2, where *l, w,* and *h* represent length, width, and height of the plant (Irmak, Suet et al, 2004). To account for differences in plant size not related to irrigation differences, a relative PGI was calculated for each plant each month during the deficit irrigation treatments using the formula PGI_m/PGI_i, where PGI_i stands for the initial PGI, and PGI_m stands for the specific monthly PGI. Means across treatments were compared using ANOVA and Tukey's HSD.

Qualitative performance ratings (on a scale of 1-5) were taken monthly in the following categories: foliage appearance, flowering abundance, pest tolerance, disease resistance, vigor, and overall appearance (the "WOW" factor). A description of the ratings is shown in Table 3.

Climate Zone Evaluations

Although we had originally planned to continue using UC Master Gardeners in the evaluation of plant material across California's diverse climate zones, we ran into obstacles that made it unfeasible to continue this facet of the research trials. The most significant issue was the inability of our grower cooperators to provide sufficient numbers of the trial entries in field size pots for each satellite garden site, in addition to the field trials in Davis. For this reason we reluctantly decided we were unable to execute this portion of the original trials plan.

Table 1. Irrigation trials plants for 2012-2014

2012-2014	**FULL SUN**	
Source	**Botanical name**	**Common name**
UC Davis Arboretum All-Stars	*Ceanothus* 'Concha'*[1]	Concha Ceanothus
	Epilobium 'Sierra Salmon'*	California fuchsia
	Miscanthus sinensus 'Little Zebra'	dwarf silver grass
Ball Ornamentals	*Buddleia* Flutterby Petite™ 'Tutti Fruitti'	dwarf butterfly bush
	Epilobium 'Sidewinder'*	California fuchsia
	Lomandra longifolia 'Bushland Green'	dwarf mat rush
	Lonicera 'Peaches and Cream'	honeysuckle
	Trachelospermum 'Sassy'[1]	star jasmine
Blooms of Bressingham	*Geranium* 'Rozanne'	cranesbill
	Helichrysum amorginum 'Ruby Clusters'	starflower
	Kniphofia 'Elvira'	poker plant
Hines Horticultural	*Dianthus* Everlast 'Orchid'	dianthus; pinks
	Buddleia 'Purple Splendor'	dwarf butterfly bush
	Mimulus 'Peekaboo White'*[1]	monkey flower
Kurapia Green Produce	*Lippia nodiflora* 'Kurapia'®*	Kurapia®

1. Plants did not survive in large enough numbers to perform statistical analysis.
*Denotes CA native/ native cultivar

Table 2. 2014 Deficit Irrigation Frequency Details – May to October

Irrigation % of ET_0	# of Irrigations	Dates of Irrigation (rainfall: 9/25, 0.42")	Total water applied in inches
80	9	5/29, 6/12, 6/23, 7/5, 7/17, 7/31, 8/15, 8/29, 9/14	25.49
60	7	6/2, 6/20, 7/4, 7/21, 8/8, 8/27, 9/19	19.52
40	4	6/11, 7/5, 7/31, 8/29	11.39
20	2	7/1, 8/23	5.4

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 form	same as 5 except for minor tip burn, edge damage, or minor damage to only a few leaves that does not much affect the overall appearance	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	11-25% of plant in bloom	1 bloom open to 10% in bloom
Pest Tolerance/ Disease Resistance	no visible damage	Serious damage to one or two leaves or stems, or 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 many 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 not likely to improve

Results and Discussion

Table 4 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 Table 4. Detailed plant growth index (PGI) charts, monthly average quality ratings in all categories for each species, and photos 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 exception is Kurapia, for which the entire year is shown; it had to be trimmed twice to contain it within its own space during the trial period. *Mimulus* 'Peekaboo White' is not shown as there were no survivors.

Table 4. Average annual overall quality ratings on 4 ET_0-based irrigation treatments for 14 perennial landscape species in 2014.

PLANT NAME	Overall Rating on each ET_0 % (1-5)				Recommended rate
	80	60	40	20	
Buddleia 'Purple Splendor'	4.0	4.1	4.1*	4.3	**20-40%**
Buddleia Flutterby Petite™ 'Tutti Fruitti'	3.9*	3.4	3.7	3.8	**80%**
Ceanothus 'Concha'*[1]	$4.3^{n=1}$	$3.1^{n=2}$	Ø	$3.9^{n=3}$	**20%[2]**
Dianthus Everlast 'Orchid'	3.4	3.8*	3.6*	3.7	**40-60%**
Epilobium 'Sidewinder'*	4.3*	4.4	4.4	4.2	**20-80%**
Epilobium 'Sierra Salmon'*	3.7*	3.7	3.5	3.7	**20-80%**
Geranium 'Rozanne'	3.6*	3.7	3.5	3.4	**60-80%**
Helichrysum amorginum 'Ruby Clusters'	3.9*	3.5	3.6*	3.6	**40- 80%**
Kniphofia 'Elvira'	3.3*	3.3	2.9	2.9	**60-80%**
Kurapia ®	4.2	4.1	4.1*	4.2*	**20-40%**
Lomandra longifolia 'Bushland Green'	4.1	3.7	4.3*	4.2	**20-40%**
Lonicera periclymenum 'Peaches and Cream'	3.5	3.4*	3.5	3.4	**60%**
Miscanthus sinensus 'Little Zebra'	3.8	4.2*	4.0	3.5	**40-60%**
Trachelospermum 'Sassy'[1]	$3.1^{n=2}$	$3.1^{n=1}$		$3.1^{n=1}$	**Not recommended in full sun in this zone**

1. Plants did not survive in large enough numbers to perform statistical analysis. n= number of surviving plants at the end of trial.
2. Based on survival rate in second year

*****Treatment with the highest average flowering rating

*CA native/ native cultivar

Ø means total mortality on this irrigation level

Tables and Figures referred to in this section are found in the Appendix.

***Buddleia* 'Purple Splendor'**

Purple Splendor was a vigorous grower in our trials obtaining an average size in two years of 4' 4" high (52.1 cm) and 6' 1" wide (185.9 cm). This butterfly bush showed no significant differences in growth between treatments, proving to be a true low-water use, flowering feature plant. All plants were cut back in December and January and deadheaded in June and July. The foliage on the lowest water treatment, 20% of ET_0, actually rated highest overall with just two irrigations during the summer, whereas the other treatments had various levels of scattered foliage necrosis beginning in July. Flowering was best throughout the year on the second lowest treatment of 40% of ET_0, which is very noteworthy, since this treatment was watered on average only monthly. The plant showed no pest damage, and very little signs of disease throughout the year. 'Purple Splendor' was a favorite of the trials staff for its repeat bloom, good form, and ability to hold up in the heat without wilting the way many other *Buddleia* cultivars do. It did begin to decline in appearance somewhat beginning in late August with some leaf necrosis. With an annual overall appearance rating of **4.0 or above on all treatments**, this should prove to be a versatile and garden-worthy introduction.

***Buddleia* Flutterby Petite™ 'Tutti Fruitti'**

This violet pink dwarf butterfly bush had a low, somewhat fountain-form habit and reached a height of 2' 2" (66 cm) with a spread of 4' 7" (141.6 cm) at the end of two years. All plants were cut back in December and January and deadheaded in June and July. There were no significant differences between treatments in the size of the plants, but the average foliage ratings were significantly better on the highest irrigation treatment. The leaves, which have very gray undersides, had a habit of rolling up during very warm weather, which detracted from the appearance of the plant while affording it a water conservation mechanism. For this reason, the highest overall appearance ratings are during the cooler weather of early spring and fall. Only the 80% treatment had an average annual foliage rating above 4.0; all other treatments were below that. The amount of bloom was also highest at this level and in July on all treatments, and the plant was very pretty in full bloom in July. The low PGIs at the 60% level seen in Table 6 are more reflective of breakage caused by wild turkeys to two of the plants on this treatment, rather than on direct effects of this irrigation level.

***Ceanothus* 'Concha'**

High mortality rates during the first year of establishment (15 dead out of 24) left us with only two plants on the 80% treatment at the beginning of the second year, with only one plant surviving past August. On the 60% treatment, there were also two plants, both of which survived through October. The 40% treatment had no plants left to treat, while the 20% had four plants until June and then finished the trial period with three plants. We could not conduct a statistical analysis with this kind of result. We feel that some of the mortality was the result of poor plant stock; a number of dead plants revealed poor root structure when removed. The average height and width attained by the surviving plants in two years was 4' by 7' 3" (121 cm by 220.8 cm). Overall, the best appearance and greatest vigor was seen on the plants with the highest irrigation treatment. However, since these results go contrary to what is known about this species, these averages may be somewhat skewed by a couple of poor specimens on the lowest treatment from the start of the second year. The high mortality rates during our

establishment irrigation has made us rethink ***how*** establishment irrigation is delivered in these trials, and prompted our current trial on California native plant establishment irrigation funded by Saratoga Horticultural Endowment.

***Dianthus* 'Orchid'**

This hardy little front-of-the-border perennial surprised us with its performance on moderate levels of irrigation. At the end of two years it attained an average height and width of 7.3" by 20" (18.5 cm by 50.8 cm). Only the 20% irrigation treatment was significantly lower than the other treatments during most of the irrigated growing season. By October, the only significant difference was that the 40% was significantly greater in size than the 80% treatment. The quality ratings did not coincide with the growth ratings; the 20% treatment had consistently high quality ratings, only lagging behind the other treatments in flowering abundance. The significantly highest average flowering rating was on the 40% treatment, while the highest average overall appearance rating went to the 60% level. It should be noted that while all the appearance ratings were fairly close, flowering is the best feature of this plant. The main thing that brought the overall appearance ratings of this *Dianthus* down was the abundance of dry, brown flower heads left on the plant after flowering. Without these, the grayish foliage makes an attractive dense mound, but to remain attractive this plant must be sheared after each bloom cycle. We deadheaded in December, April, and June. For us, bloom was heaviest in April and September, but there was some bloom on all the plants from March through October, with at least one treatment's floral display rating near or above 4.0 each month. These trends can be seen in Table 9.

***Epilobium* 'Sidewinder'**

A stunning introduction from Ball Ornamentals, 'Sidewinder' was a prolific orange bloomer from May to October, and a vigorous grower reaching an average of 2' 3" high (69.2 cm) and an impressive 7' 2" wide (219.8 cm). There were no significant differences in plant growth between treatments, and both flowering and average overall appearance were **rated 4.2 and above on all irrigation levels** (Table 10). It should be noted that as vigorous as this plant proved to be, caution should be taken not to plant it too near other plants where it may take over. It would probably also be wise not to use it in areas with ample water, since this might encourage it to spread aggressively. However, it would be truly beautiful in low-water landscape applications for large sweeps of color or spilling over a wall where its wide-spreading fountain-form habit could be used to advantage.

***Epilobium* 'Sierra Salmon'**

'Sierra Salmon' is an upright, gray-leaved cultivar of California fuchsia that attained an average height of 2' 6" (79.5 cm) in our two-year trial with a spread of 4' 8" (142.2 cm). There were no significant differences in growth indexes between treatments. Overall appearance and health of plants were consistent across irrigation levels, but the foliage appearance on the lowest treatment was marginally higher than others. All treatments began blooming in September, with the exception of the 80% treatment, which bloomed prolifically in July. After a rest period in August, it bloomed again in September and October at about the same rate as the other treatments. The overall appearance ratings of this cultivar rarely rose to the level of 4.0 during our two year trials. It would probably be best used in combination plantings where it did not have

to carry the look of the landscape on its own, and its "down time" could be balanced by other plants.

***Geranium* 'Rozanne'**

This hardy geranium cultivar has been in the trade for years, and was a recipient of the Royal Horticultural Society Award of Garden Merit (AGM) in 2006. In our hot climate, mortality during the establishment year meant we entered the second year with uneven numbers across treatments, which made really meaningful statistical comparison impossible. Each treatment lost one additional plant during the deficit irrigation season, leaving us at the end of the trial with 4 plants on 80%, 4 plants on 60%, 5 plants on 40%, and 2 plants on 20% of ET_0. The average size reached by these plants was 3' wide (91.2 cm) and 16.7" wide (42.3 cm). All treatments flowered at some level from April through October with the most abundant flowering in June and July, and the highest annual flowering rating on the highest irrigation treatment. All treatment levels were pest and disease free. The greatest vigor and overall appearance ratings were on the two highest irrigation levels, with ratings only falling under the acceptable 3.0 level in August on the 20% treatment, in September for the 60% and 40% treatments, and October for the 80% treatment. Since this is a tender perennial that dies back in fall anyway, these are not terribly surprising or disappointing findings. What is significant is that it rated as well as it did on our spare irrigation regimes in the full sun in our harsh site. We feel that this plant may best be suited to afternoon shade in interior sites where it would provide acceptable appearance on twice monthly deep irrigation.

***Helichrysum* 'Ruby Clusters'**

This petite member of the star flower genus forms an attractive, tight, mounding rosette of gray foliage with deep rose flower buds in early spring that open to small yellow flowers in April. The dried flowers remain appealing until about July, when the plants require deadheading to remain attractive. We handpicked the larvae of American painted lady butterflies that were chewing the leaves during the establishment year, and the plants only had minor trouble with the same pest the second year. We did have some damage from beetles in the Bupestridae family (Figures 8e and 8f). At the end of the two-year trial the average size of a plant was 4.3" high (10.9 cm) and 8.6" wide (21.9 cm). Although the plant growth index of the 80% treatment was larger than the other treatments in October, the relative plant growth index was not significantly larger, which means the plants on that treatment just happened to be larger to begin with. The quality ratings tell a different story: foliage, flowering, pest tolerance, vigor and overall appearance were all best on the highest level of irrigation at 80% of ET_0, and only this treatment approached an average annual rating of 4.0. While all the plants looked good in the springtime, they began to decline in June, sliding under the acceptable 3.0 mark on all treatments by August. There may be other conditions under which this plant looks good for a longer period of time, and though the trials staff really liked this plant when it was at its best, full sun and clay soil in the interior is not the best growing situation for it.

***Kniphofia* 'Elvira'**

'Elvira' is a small, summer-blooming cultivar of poker plant that was 2' 4" tall (70.2 cm) and 4' 2" (129 cm) wide at the end of the second year in our trials. Dead foliage was cleaned out of all plants at the beginning of April. There were no statistically significant differences in growth between treatments, but the two highest irrigation levels did have the best foliage and

overall appearance ratings. Only these two irrigation levels ever attained an average overall appearance rating of 4.0 or higher, and that was only for the month of May when they had the highest floral display rating. Plants began blooming lightly on some specimens in April and continued through July. The foliage of 'Elvira' was not consistently green and vigorous, and required monthly removal of yellowed, dying leaves to maintain appearance. There were also several plants affected adversely by mealy bugs. As shown in Table 14, the two lowest treatments did not yield an acceptable average annual overall appearance rating. The toughness and low-water habit of some *Kniphofia* seems to have been bred out of this cultivar.

***Lippia nodiflora* 'Kurapia'®**

The first thing to note about Kurapia is its vigor. Each plant quickly outgrew the space allotted to it for the length of the trial and had to be cut back twice in two years (the second time in July, 2014) to prevent it encroaching on nearby plants. Each time it was cut to a 1 m diameter circle. In the first year the plants grew from an average of 16" across (42 cm) to 4' 4" (130 cm) between April and November; in the second year it grew from a 3' 4" wide (1 m) circle in mid-June to a width of 11' 7" (351 cm) by October with a height of just 5" (13 cm). This is an average of about 7 in/week (18 cm/week)! During deficit irrigation the second year, there were no significant differences in growth between treatments, and none of the quality ratings was significantly affected by irrigation level. Although the flowers are not showy, they are attractive when the plant is in full bloom, and some bloom is on the plant from April through November. The overall appearance of the plant declines somewhat when spent brown flowers outnumber the white ones, but should this plant be used in applications where it would be viewed at close range, these could be removed with a string trimmer or a mower. The blooms were heavily visited by pollinators throughout the long blooming period. Plants were unaffected by disease during this trial, and only very minor leaf-chewing by insects was observed. The extremely vigorous nature of the plant along with its vivid green color made this minor damage unnoticeable except upon the closest scrutiny. The only major criticism of this plant is that its appearance was severely affected by frost beginning in late December. It generally died down from the edges, the centers went somewhat bare, and the long, stiff stems were unattractively exposed through March. It began to recover in late March, and by April all plants had grown back over the bare spots and had an acceptable appearance, **rating 4.0 and above on all treatments from May until the end of the trial**.

***Lomandra longifolia* 'Bushland Green'**

There is some controversy over the parentage and naming of this dwarf mat rush cultivar, but we received it under this cultivar name from Ball Ornamentals who now market it under the name 'Lime Tough'. This grass-like plant was a standout in our trials for its consistent good looks and bright chartreuse green color throughout almost the entire year. It has a stiff, upright fountain-form habit and reached a height of 3' 2" (96.7 cm) in our trials with an average width of 31" (79 cm). All plants were cut down with a hedge trimmer in February 2014 to a height of 2-3" (5 cm), and all dead foliage and flower spikes were removed. An unusual feature of this plant is the spiky flower heads held below the top of the foliage within the plant, which some find interesting and some disagreeable, but all agree trimming the plant is a proposition to be undertaken only with leather gloves. There were no significant differences in relative growth between treatments, nor were the quality ratings largely different. The highest average annual overall quality ratings were on the lowest two treatments while the highest flowering rating was

at 40% of ET_0. We feel this would be an excellent low-water landscape feature where a strong structural element and a splash of lime green were needed.

***Lonicera periclymenum* 'Peaches and Cream'**

This compact honeysuckle grew without support to just 3' 10" (118 cm) wide and 2' (60 cm) high in two years in our field. It flowered most heavily in late May/early June, and then lightly and intermittently to October, with the highest flowering rating on the 60% of ET_0 treatment and in May. Attractive red berries were displayed along with open flowers and buds beginning in July. The foliage was disease resistant, but leaf appearance was compromised by late spring thrips damage it did not outgrow. This damage was not apparent at a distance, but quite disfiguring up close. There were no significant differences in overall appearance ratings or growth measurements between treatments.

***Miscanthus sinensis* 'Little Zebra'**

'Little Zebra' is a variegated dwarf cultivar of silver grass that attained a height of 3' 7" (163.2 cm) and 5' 4" (104.9 cm) wide in two years. We found the variegation unreliable; it was faint on some of the specimens and on some it faded out over the course of the growing season. About 25% of the plants on all treatments were adversely affected by Miscanthus mealybug which was evidenced beginning in the establishment year. The pest causes reddening of the stems in the mildest cases and in the worst cases it stunts growth and reduces flowering. We cut the grasses back to several inches high in February 2014, and removed all the dead and as many of the infested stems as possible. When the grass is pest-free it is quite handsome in leaf, form, and flowering. With or without the mealybug infested plants factored in, there were no significant differences in growth between treatments, since all treatments were about equally infested. Irrigation did make a difference in plant quality, however, with the highest ratings in all quality categories on the 60% treatment, with 40% of ET_0 also yielding excellent ratings.

***Trachelospermum jasminoides* 'Sassy'**

This introduction of star jasmine bears flowers with a fragrance reminiscent of root beer or sarsaparilla. We were asked to trial this species in the full sun field, but previous experience caused us to caution the grower that it might not establish well in full sun in our area. Indeed, by the end of the second year we had only four plants remaining: two on 80% of ET_0, one on 60%, and one on 20%. The average size of these four plants was 15.6" high (39.7 cm) and 3'4" wide (102 cm). The foliage was sometimes pale, as might be expected without some afternoon shade, but was mostly unbothered by pests or disease. The average overall annual rating was barely acceptable on all treatments, but for the plants that did survive, they were rating 4.0 and above by the end of the second summer. We suspect that, if grown in partial or afternoon shade in our area, 'Sassy' would have fared much better.

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APPENDIX

Figure 1a. ***Buddleia*** **'Purple Splendor' in May 2014**

Figure 1b. ***Buddleia*** **'Purple Splendor' on 20% ET_0 in September 2014**

Figure 1c. *Buddleia* 'Purple Splendor' close-up with Common Buckeye butterfly (*Junonia coenia*)

Figure 1d. Close-up of *Buddleia* 'Purple Splendor' bloom in May 2014

Figure 2a. *Buddleia* 'Tutti Fruitti' in late May with Anise Swallowtail (*Papilio zelicaon*)

Figure 2b. *Buddleia* 'Tutti Fruitti' in May 2014

Figure 2c. *Buddleia* 'Tutti Fruitti' in July 2014 on 60% of ET_0

Figure 2d. *Buddleia* 'Tutti Fruitti' in October 2014 on 80% of ET_0

Figure 3a. *Ceanothus* 'Concha' in full bloom in March 2014

Figure 3b. One of the four remaining *Ceanothus* 'Concha' in July on 20% of ET_0

Figure 4a. *Dianthus* 'Orchid' in full bloom April 2014 (most plants not in full bloom until June)

Figure 4b. *Dianthus* 'Orchid' in July with handsome gray foliage on 20% of ET_0

Figure 5a. *Ebilobium* 'Sidewinder' with characteristic low spreading foliage in April 2014

Figure 5b. *Epilobium* 'Sidewinder' already in full bloom in June 2014 on 20% ET_0

Figure 5c. *Epilobium* 'Sidewinder' still blooming in September 2014 on 40% of ET_0

Figure 6a. *Epilobium* 'Sierra Salmon' in April 2014 with fresh gray foliage

Figure 6b. ***Epilobium*** **'Sierra Salmon' in October on 20% of ET_0**

Figure 7a. ***Geranium*** **'Rozanne' in April 2014**

Figure 7b. ***Geranium*** **'Rozanne' in full bloom in June 2014 on 20% of ET_0**

Figure 7c. ***Geranium*** **'Rozanne' in August 2014 blooming but looking tired on 80% ET_0**

Figure 8a. ***Helichrysum*** **'Ruby Clusters' in March 2014 with its characteristic rosy buds**

Figure 8b. ***Helichrysum*** **'Ruby Clusters' in April 2014 with flowers opening to cover plant**

Figure 8c. *Helichrysum* 'Ruby Clusters' in June 2014; dried flowers completely cover foliage

Figure 8d. *Helichrysum* 'Ruby Clusters' in September 2014 on the recommended 80% ET_0

Figure 8e. Beetle on *Helichrysum* 'Ruby Clusters'

Figure 8f. Insect damage on *Helichrysum* 'Ruby Clusters' in September 2014

Figure 9a. *Kniphofia* 'Elvira' in May 2014

Figure 9b. *Kniphofia* 'Elvira' in September 2014 on 60% of ET_0 displaying the ragged foliage that was typical of all treatment levels (another plant in top left of photo)

Figure 10a. Kurapia in June 2014 in full bloom, pruned to 1 m wide circle; 20% of ET_0

Figure 10b. Kurapia in August 2014 on 80% ET_0 outgrowing allotted space

Figure 10c. Kurapia on 20% ET_0 in September 2014 growing into surrounding areas; blooming around the edges with brown spent flower heads in the middle

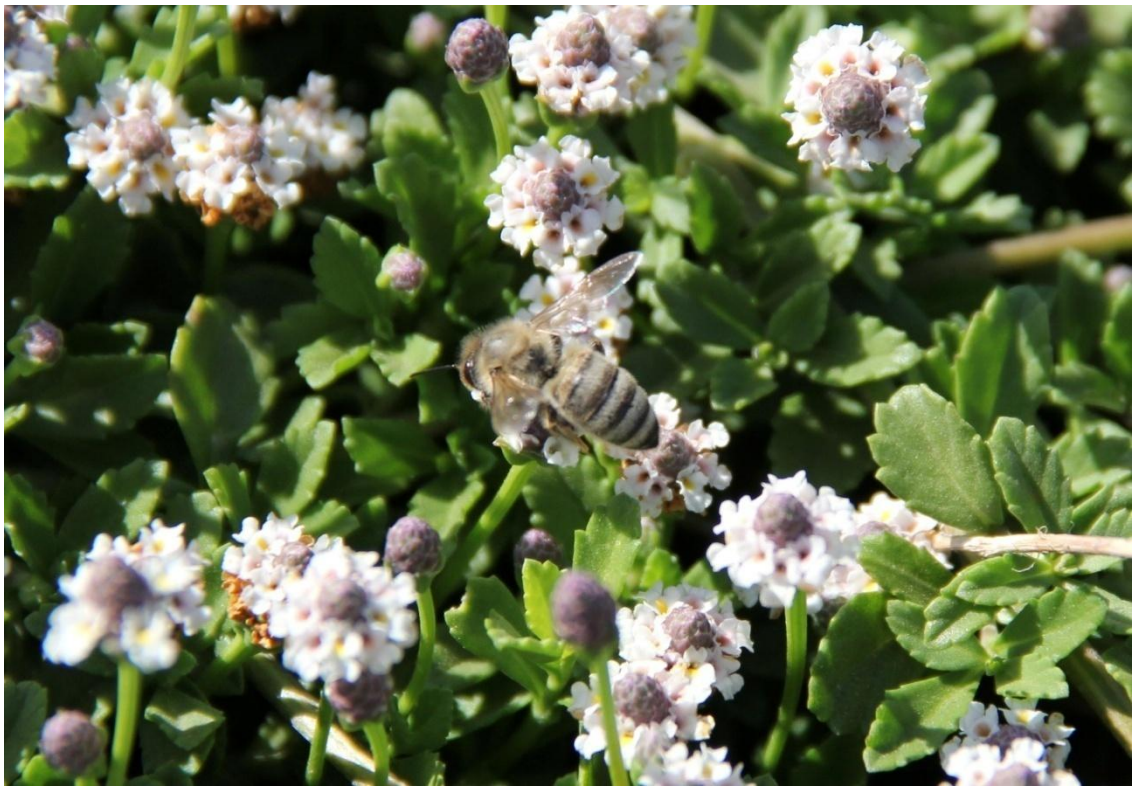


Figure 10d. Kurapia flowers in May 2014; sterile flowers still visited heavily by pollinators

Figure 11a. ***Lomandra*** **'Bushland Green' in April 2014**

Figure 11b. ***Lomandra*** **'Bushland Green' in October 2014 on 20% of ET_0**

Figure 11c. Close-up of *Lomandra* 'Bushland Green' foliage and flower spikes

Figure 12a. *Lonicera* 'Peaches and Cream' with clean attractive foliage in April 2014

Figure 12b. *Lonicera* 'Peaches and Cream' in bud and flower in May on 20% of ET_0

Figure 12c. *Lonicera* 'Peaches and Cream with flowers and berries in July 2014 on 40% of ET_0

Figure 12d. ***Lonicera*** **'Peaches and Cream' in September 2014 on 40% of ET_0**

Figure 12e. ***Lonicera*** **'Peaches and Cream' thrips damage**

Figure 13a. ***Miscanthus*** **'Little Zebra' in April 2014**

Figure 13b. ***Miscanthus*** **'Little Zebra' on 20% of ET_0 in July 2014**

Figure 13c. *Miscanthus* 'Little Zebra' on 60% of ET_0 in September 2014

Figure 13d. *Miscanthus* 'Little Zebra' showing the reddish stems indicative of mealybug infestation

Figure 14a. ***Trachelospermum*** **'Sassy' in April 2014**

Figure 14b. ***Trachelospermum*** **'Sassy' on 60% of ET_0 in September 201**

Table 5. Average monthly quality ratings for *Buddleia* 'Purple Splendor' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.3	4.7	4.5	3.8	3.5	3.5	3.2	3.2	**3.8**
60%	4.3	4.4	4.3	4.0	3.8	3.3	3.3	3.2	**3.8**
40%	4.3	4.8	4.5	4.0	3.8	3.3	3.2	3.0	**3.9**
20%	4.7	4.7	4.8	4.0	3.7	3.5	3.7	3.2	**4.0**
Flowering									
80%		1.0	5.0	3.7	4.3	3.8	2.8	2.7	**3.3**
60%		1.0	5.0	3.5	4.5	3.7	2.8	2.8	**3.3**
40%		1.0	5.0	4.2	4.8	3.7	3.7	2.7	**3.6**
20%		1.0	5.0	3.8	4.0	3.2	3.7	2.7	**3.3**
Pest Tolerance									
80%	5.0	5.0	4.8	4.5	4.4	5.0	5.0	5.0	**4.8**
60%	5.0	5.0	4.7	4.5	4.7	5.0	5.0	5.0	**4.9**
40%	5.0	5.0	4.7	4.8	4.7	5.0	5.0	5.0	**4.9**
20%	5.0	5.0	4.8	4.3	4.3	5.0	5.0	5.0	**4.8**
Disease Resistance									
80%	5.0	5.0	5.0	4.7	4.3	3.7	5.0	5.0	**4.7**
60%	5.0	4.8	5.0	4.7	4.0	3.5	5.0	5.0	**4.6**
40%	5.0	5.0	5.0	4.8	4.7	3.5	5.0	5.0	**4.8**
20%	5.0	5.0	5.0	4.8	4.5	3.7	5.0	5.0	**4.8**
Vigor									
80%	4.8	4.8	4.8	4.7	4.5	4.5	4.3	4.7	**4.6**
60%	4.8	5.0	5.0	4.8	4.8	3.8	4.3	4.3	**4.6**
40%	5.0	4.8	4.8	4.7	5.0	3.8	4.5	4.0	**4.6**
20%	4.8	4.7	4.8	4.8	4.8	4.7	4.8	4.7	**4.8**
Overall Appearance									
80%	4.0	4.0	5.0	4.3	4.2	4.1	3.3	3.3	**4.0**
60%	3.8	4.2	5.0	4.5	4.8	3.8	3.7	3.4	**4.1**
40%	3.8	4.0	5.0	4.7	4.8	3.8	3.7	3.1	**4.1**
20%	4.0	4.1	5.0	4.7	4.6	4.2	4.0	3.7	**4.3**

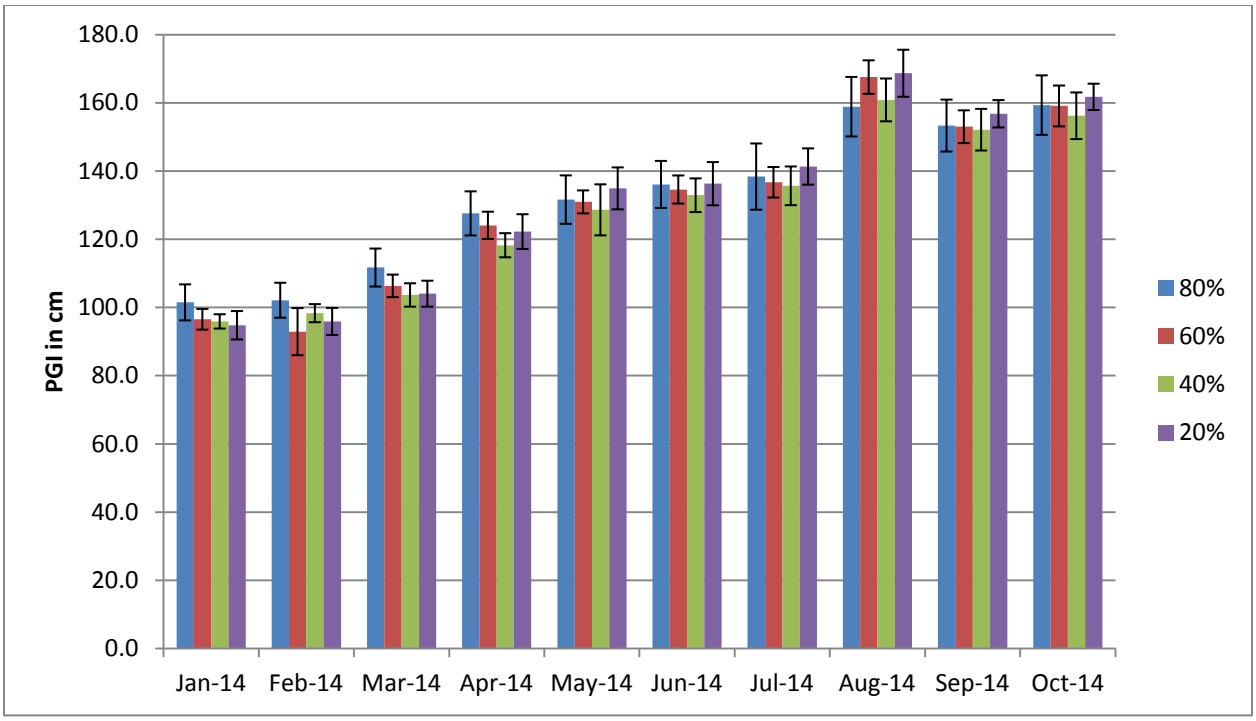


Figure 15a. Average monthly plant growth index of *Buddleia* 'Purple Splendor' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

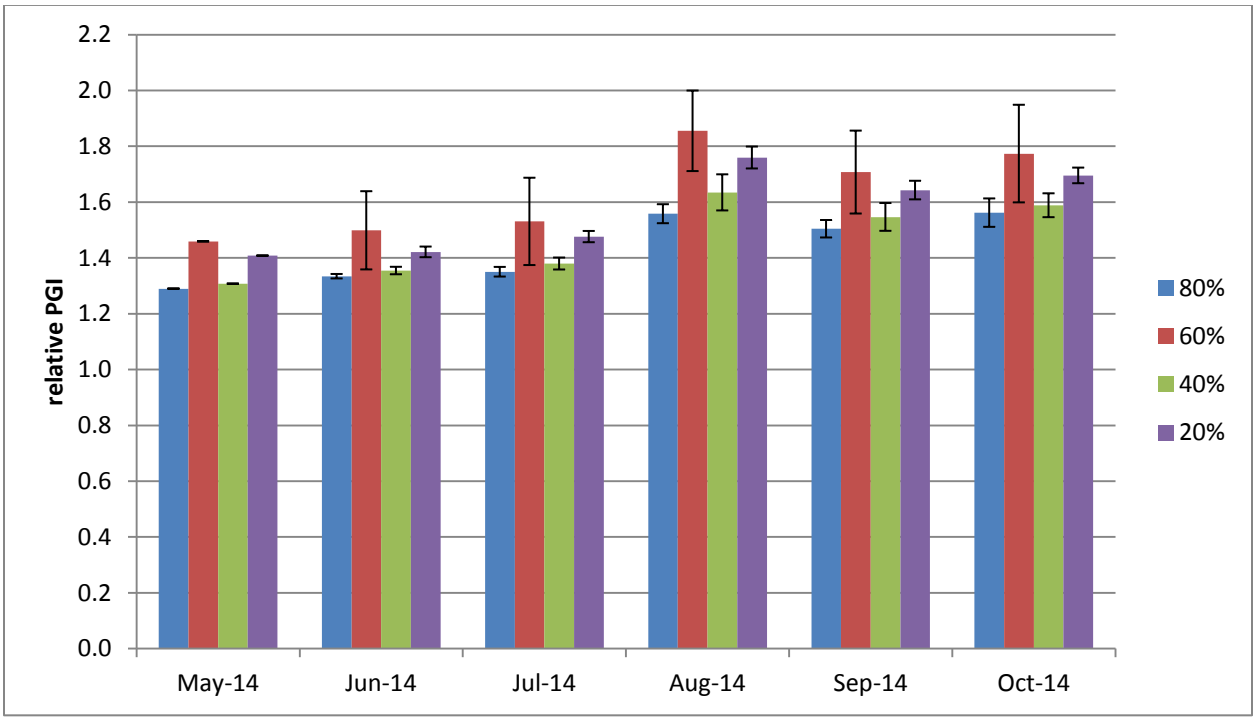


Figure 15b. Average monthly relative plant growth index of *Buddleia* 'Purple Splendor' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 6. Average monthly quality ratings for *Buddleia* 'Tutti-Fruitti' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	5.0	4.5	3.8	2.8	3.8	4.2	4.2	4.3	**4.1**
60%	4.8	4.3	3.8	2.4	2.8	3.0	3.3	3.4	**3.5**
40%	5.0	4.5	3.8	2.6	3.0	3.7	4.2	4.0	**3.8**
20%	5.0	4.5	4.0	2.7	3.3	3.8	3.8	3.8	**3.9**
Flowering									
80%		1.0	3.8	2.2	4.8	3.3	4.3	3.0	**3.2**
60%		1.0	3.3	1.5	3.3	3.2	3.0	2.6	**2.6**
40%		1.0	3.5	2.7	4.2	3.0	4.2	2.8	**3.0**
20%		1.0	4.0	2.2	4.2	3.3	3.7	2.7	**3.0**
Pest Tolerance									
80%	5.0	5.0	4.8	4.8	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	5.0	4.7	4.7	5.0	5.0	5.0	5.0	**4.9**
40%	5.0	5.0	4.7	4.7	4.8	5.0	5.0	5.0	**4.9**
20%	5.0	5.0	4.8	5.0	4.8	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**
60%	5.0	5.0	5.0	5.0	4.8	4.5	5.0	5.0	**4.9**
40%	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	4.8	4.8	5.0	5.0	**5.0**
Vigor									
80%	4.5	4.0	4.5	3.7	4.7	3.7	4.5	3.8	**4.2**
60%	3.8	3.8	4.0	2.8	3.3	3.0	3.3	3.2	**3.4**
40%	4.8	4.7	4.8	3.8	4.5	3.8	4.7	4.2	**4.4**
20%	4.8	4.7	4.8	3.7	4.3	3.7	4.7	4.2	**4.4**
Overall Appearance									
80%	4.0	4.0	3.8	2.6	3.8	4.3	4.8	4.2	**3.9**
60%	4.2	3.7	3.8	2.1	3.0	3.3	3.5	3.4	**3.4**
40%	4.0	3.8	3.7	2.5	3.4	3.7	4.7	4.1	**3.7**
20%	4.0	3.8	4.1	2.8	3.5	3.8	4.4	4.0	**3.8**

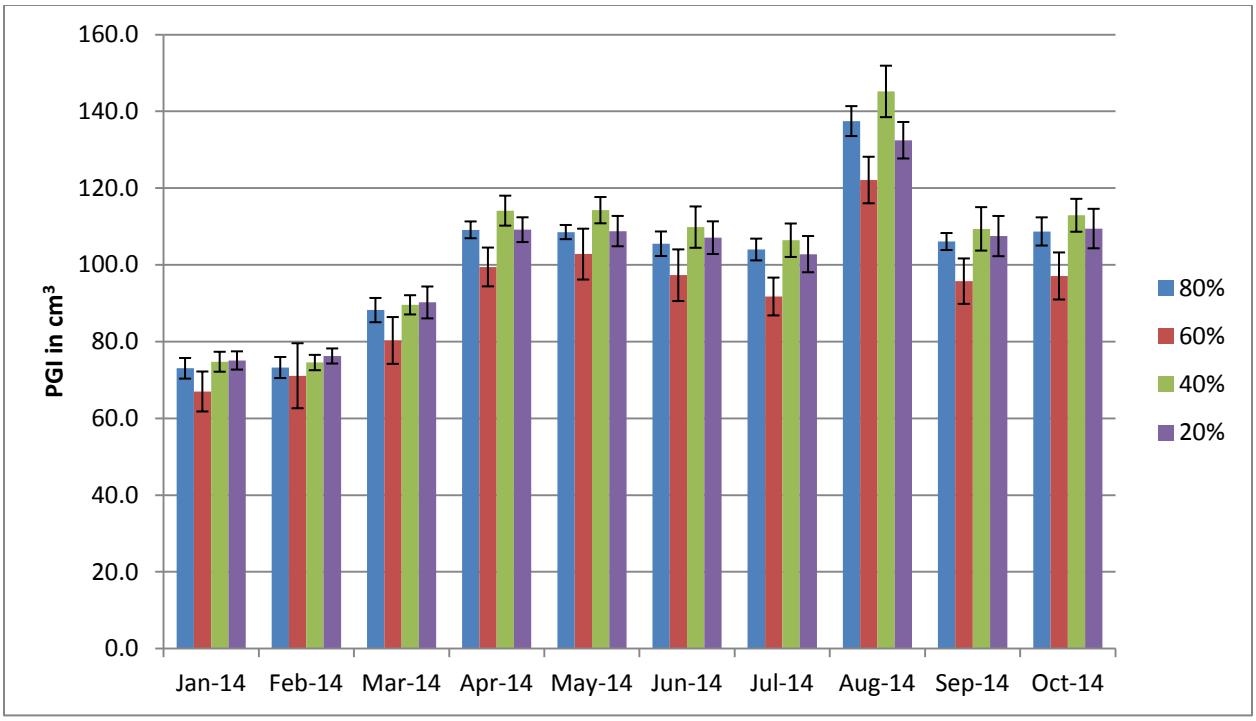


Figure 16a. Average monthly plant growth index of *Buddleia* 'Tutti-Fruitti' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$, except between 60% and 40% in the month of August.

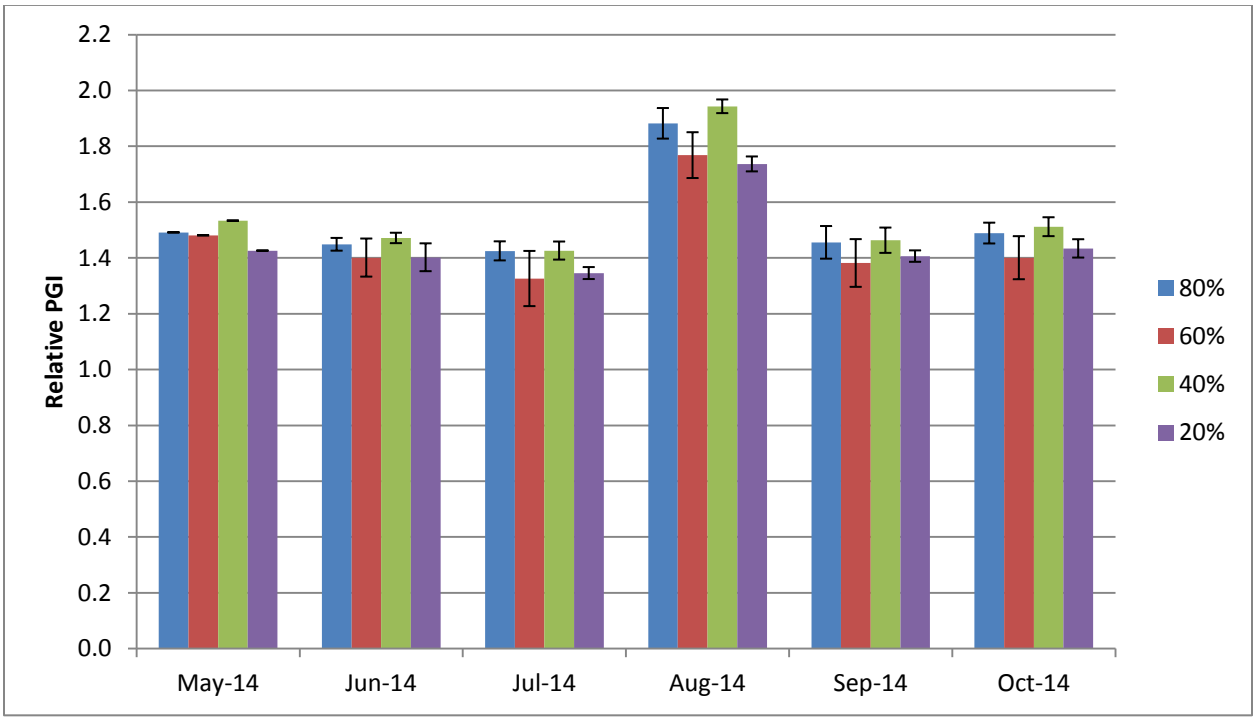


Figure 16b. Average monthly relative plant growth index of *Buddleia* 'Tutti-Fruitti' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 7. Average monthly quality ratings for *Ceanothus* 'Concha' on 4 ET_0-based irrigation levels in 2014. 80% n=2 through July, then n=1; 60% n=2; 20% n=3 through May, then n=3.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	5.0	3.0	4.0	4.0	4.5	5.0	5.0	5.0	**4.4**
60%	5.0	4.5	4.5	4.5	5.0	5.0	5.0	5.0	**4.8**
40%									
20%	3.5	3.0	4.0	5.0	5.0	5.0	5.0	5.0	**4.4**
Flowering									
80%	5.0	1.0	2.0	1.0					**2.3**
60%	5.0		2.0						**3.5**
40%									
20%	4.5	1.0	1.0						**2.2**
Pest Tolerance									
80%	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	3.0	5.0	5.0	5.0	5.0	**4.8**
40%									
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Disease Resistance									
80%	5.0	3.0	4.0	5.0	5.0	5.0	5.0	5.0	**4.6**
60%	5.0	4.0	4.5	5.0	5.0	5.0	5.0	5.0	**4.8**
40%									
20%	4.3	4.3	4.3	5.0	5.0	5.0	5.0	5.0	**4.7**
Vigor									
80%	4.5	4.5	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
60%	4.5	4.0	5.0	4.5	5.0	5.0	5.0	4.5	**4.7**
40%									
20%	3.5	4.0	3.8	4.3	4.7	4.7	5.0	4.0	**4.2**
Overall Appearance									
80%	5.0	3.5	3.5	4.0	4.3	4.5	4.5	5.0	**4.3**
60%	5.0	3.5	4.0	3.8	4.3	4.0	4.0	4.5	**4.1**
40%									
20%	4.3	3.3	3.5	4.0	4.3	4.0	4.0	4.2	**3.9**

Table 8. Final growth indexes for *Ceanothus* 'Concha' on 3 ET_0-based irrigation levels in 2014. No statistical analysis possible due to high mortality.

Irrigation treatment (% of ET_0)	Plant growth index (cm^3)	Relative plant growth index
80 (n=1)	211.0	1.8
60 (n=2)	164.3	1.9
20 (n=3)	162.0	1.9

Table 9. Average monthly quality ratings for *Dianthus* 'Orchid' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	3.5	3.0	4.0	4.8	5.0	4.2	4.3	4.3	**4.1**
60%	3.5	4.0	3.8	4.7	5.0	5.0	5.0	5.0	**4.5**
40%	3.7	3.7	4.2	5.0	4.8	4.8	5.0	5.0	**4.5**
20%	4.5	4.3	4.7	5.0	4.8	4.3	5.0	5.0	**4.7**
Flowering									
80%	1.7	5.0	1.8	2.3	4.0	3.2	3.2	2.5	**2.9**
60%	1.7	2.8	1.8	4.2	3.3	3.3	4.2	3.5	**3.1**
40%	2.0	5.0	4.0	3.2	3.3	3.7	4.2	2.8	**3.5**
20%	1.4	2.8	1.4	3.3	2.7	3.5	2.7	2.5	**2.5**
Pest Tolerance									
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.3	**4.9**
60%	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**
20%	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**
60%	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**
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Vigor									
80%	3.2	3.2	3.8	4.5	4.7	3.8	4.0	3.8	**3.9**
60%	3.8	3.7	3.8	4.7	4.8	4.7	5.0	4.7	**4.4**
40%	3.7	3.7	3.8	4.7	4.5	4.0	4.7	4.3	**4.2**
20%	3.8	4.3	4.5	4.7	4.3	3.8	4.3	4.5	**4.3**
Overall Appearance									
80%	2.8	2.8	3.3	3.9	4.0	3.7	3.3	3.7	**3.4**
60%	2.8	3.5	3.1	4.4	3.6	4.3	4.3	4.2	**3.8**
40%	2.7	3.2	3.3	4.3	3.6	4.3	3.9	3.7	**3.6**
20%	3.7	3.5	3.2	4.2	3.5	3.8	3.8	3.8	**3.7**

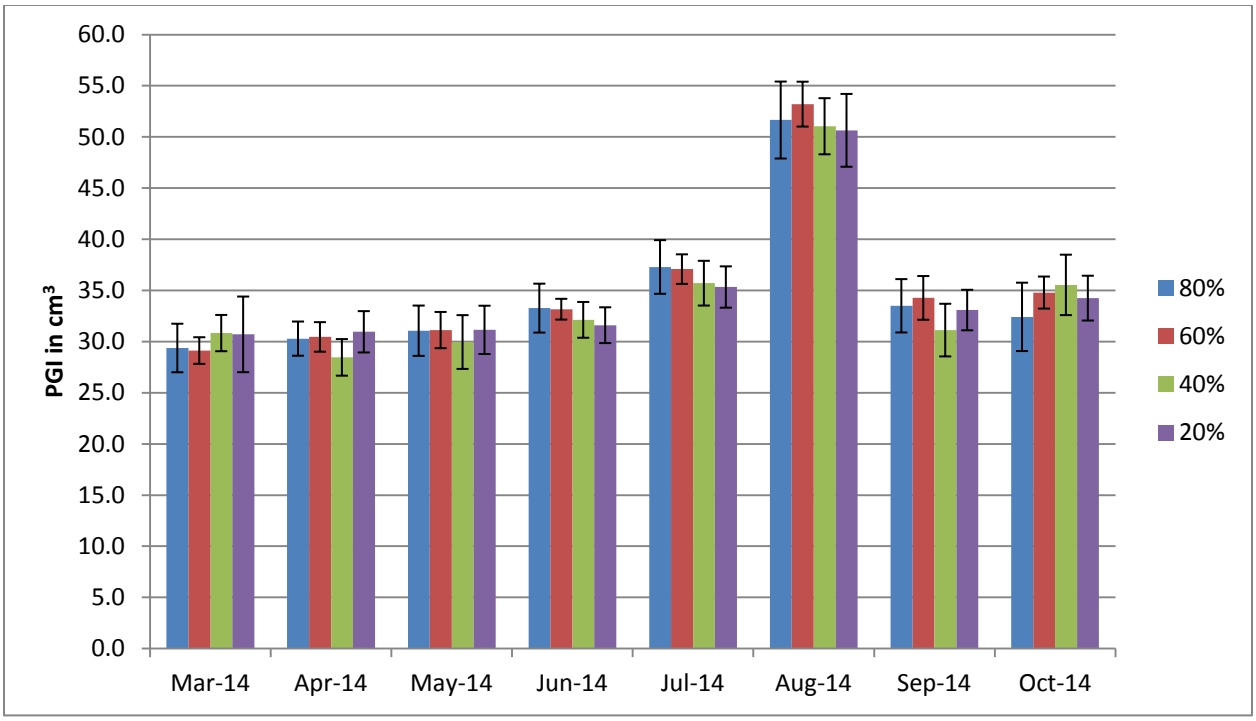


Figure 17a. Average monthly plant growth index of *Dianthus* 'Orchid' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p < 0.05$.

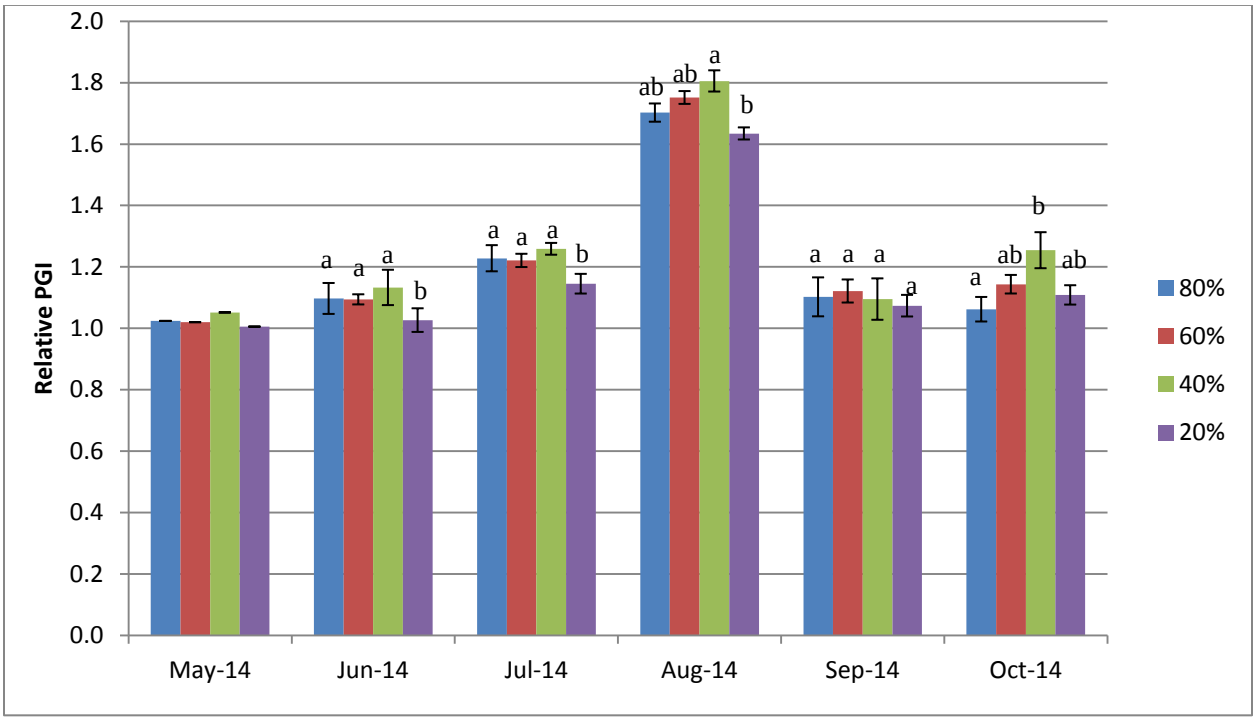


Figure 17b. Average monthly relative plant growth index of *Dianthus* 'Orchid' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. Bars with the same letters were not significantly different using ANOVA and Tukey's HSD at $p < 0.05$.

Table 10. Average monthly quality ratings for *Epilobium* 'Sidewinder' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.7	5.0	4.7	4.8	5.0	4.8	4.8	4.7	**4.8**
60%	5.0	5.0	5.0	4.8	5.0	4.7	4.7	4.7	**4.9**
40%	5.0	5.0	5.0	4.7	4.8	4.8	4.7	4.7	**4.8**
20%	4.8	5.0	5.0	5.0	5.0	4.5	4.8	4.2	**4.8**
Flowering									
80%			5.0	5.0	5.0	3.3	5.0	3.8	**4.5**
60%			2.0	5.0	5.0	2.8	5.0	4.2	**4.0**
40%				5.0	5.0	3.0	5.0	3.7	**4.3**
20%				5.0	5.0	2.3	5.0	3.7	**4.2**
Pest Tolerance									
80%	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**
40%	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**
Disease Resistance									
80%	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**
40%	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**
Vigor									
80%	4.7	5.0	4.8	5.0	5.0	4.3	5.0	4.5	**4.8**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.7	**5.0**
40%	5.0	5.0	5.0	5.0	5.0	4.5	4.5	4.2	**4.8**
20%	4.8	5.0	5.0	5.0	5.0	4.7	5.0	4.5	**4.9**
Overall Appearance									
80%	3.8	4.0	3.8	5.0	5.0	4.0	5.0	4.0	**4.3**
60%	3.8	4.2	4.2	5.0	5.0	4.0	5.0	4.0	**4.4**
40%	4.0	4.3	4.2	4.9	5.0	3.8	5.0	3.8	**4.4**
20%	3.5	4.0	4.0	5.0	5.0	3.7	5.0	3.6	**4.2**

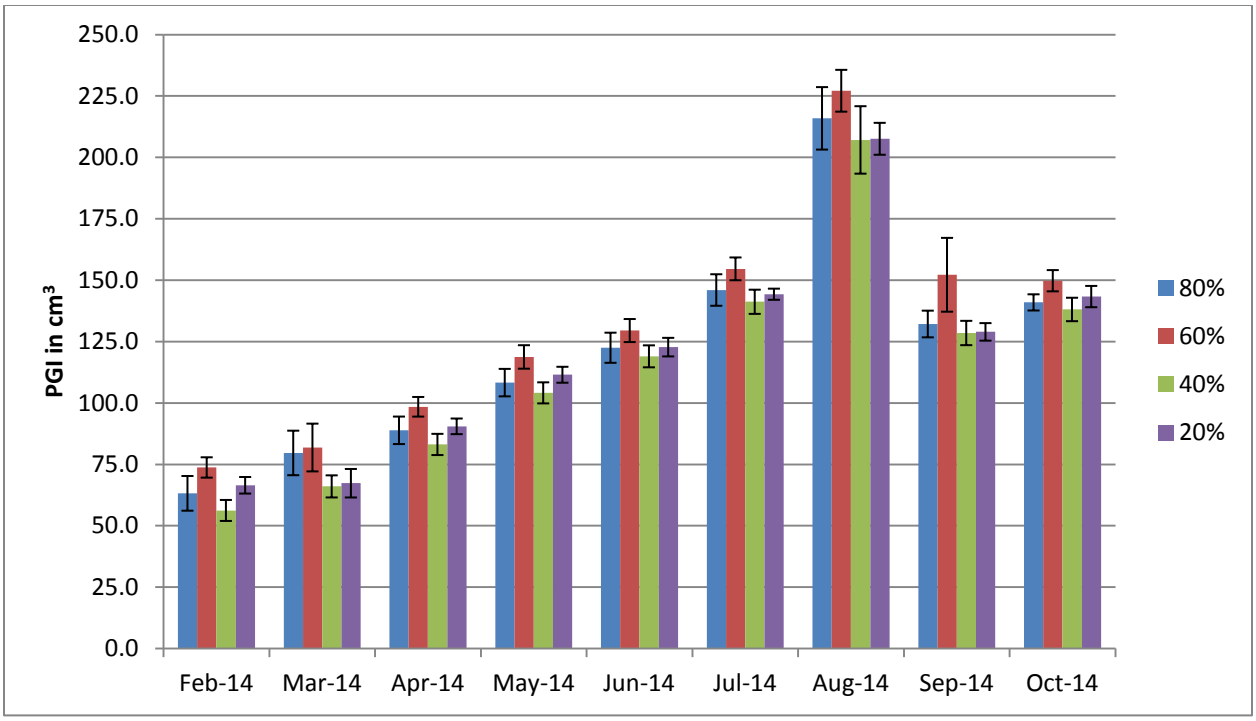


Figure 18a. Average monthly plant growth index of *Epilobium* 'Sidewinder' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

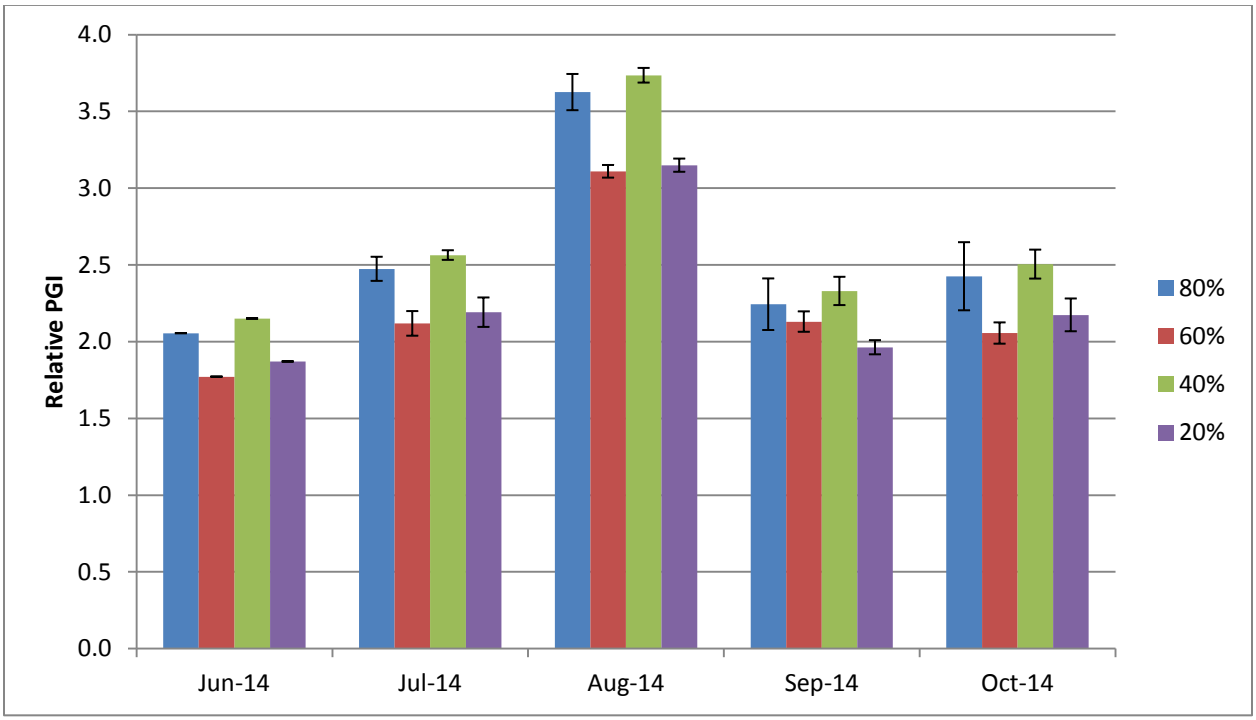


Figure 18b. Average monthly relative plant growth index of *Epilobium* 'Sidewinder in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 11. Average monthly quality ratings for *Epilobium* 'Sierra Salmon' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.8	4.6	4.8	4.4	4.8	4.2	4.0	3.4	**4.4**
60%	5.0	4.8	5.0	4.8	5.0	4.3	3.8	3.0	**4.4**
40%	5.0	4.8	4.5	4.5	4.3	3.8	3.2	3.0	**4.1**
20%	5.0	4.8	4.5	4.7	4.8	4.3	4.7	3.7	**4.6**
Flowering									
80%					5.0		2.3	1.6	**3.0**
60%							1.0	2.0	**1.5**
40%							2.4	2.0	**2.2**
20%							1.3	1.7	**1.5**
Pest Tolerance									
80%	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**
40%	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**
Disease Resistance									
80%	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**
40%	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**
Vigor									
80%	4.0	4.0	4.0	4.2	4.4	4.0	4.4	4.0	**4.1**
60%	3.8	3.8	4.3	4.3	4.3	4.5	4.0	3.5	**4.0**
40%	4.5	4.3	4.0	4.0	4.2	4.0	3.8	3.8	**4.1**
20%	4.0	4.2	4.2	4.7	4.3	4.3	4.7	4.0	**4.3**
Overall Appearance									
80%	3.6	3.6	3.6	4.0	4.2	3.4	3.6	3.2	**3.7**
60%	3.5	3.8	3.8	4.0	4.3	3.8	3.3	3.0	**3.7**
40%	3.9	3.7	3.5	3.8	3.8	3.2	3.3	3.2	**3.5**
20%	3.7	3.7	3.7	3.8	4.0	3.5	3.8	3.6	**3.7**

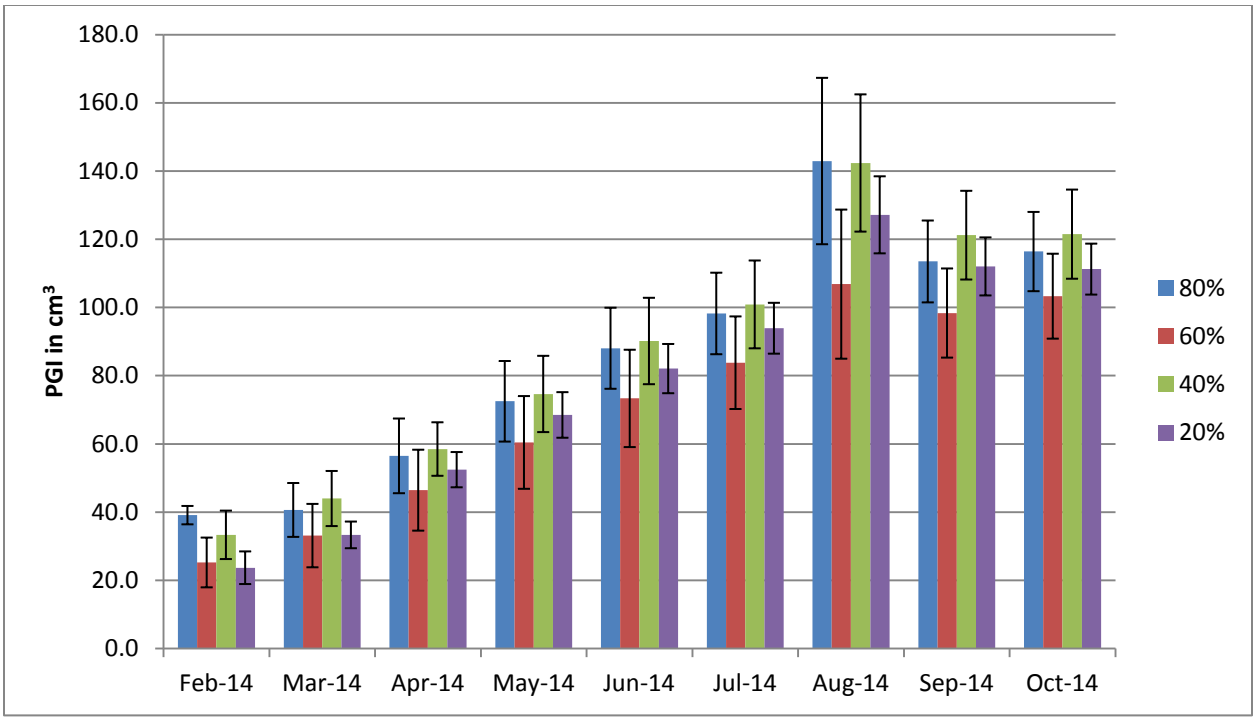


Figure 19a. Average monthly plant growth index of *Epilobium* 'Sierra Salmon' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

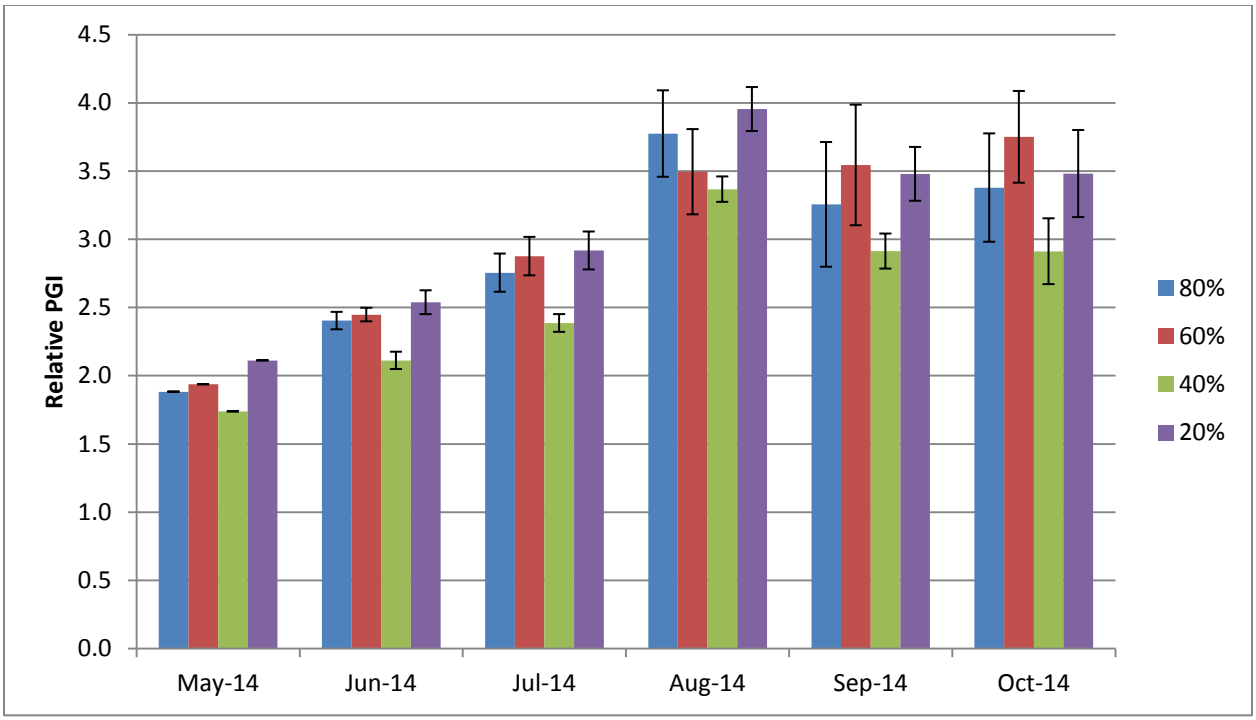


Figure 19b. Average monthly relative plant growth index of *Epilobium* 'Sidewinder in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 12. Average monthly quality ratings for *Geranium* 'Rozanne' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.4	5.0	5.0	4.6	4.0	3.8	3.0	2.5	**4.0**
60%	5.0	4.8	5.0	4.5	4.5	3.3	3.0	2.5	**4.1**
40%	4.8	4.5	4.5	4.8	4.7	2.8	3.0	2.0	**3.9**
20%	4.3	5.0	4.7	5.0	4.5	3.0	3.0	2.5	**4.0**
Flowering									
80%		1.8	3.2	4.4	3.8	4.3	3.0	2.0	**3.2**
60%		1.2	3.0	4.3	4.8	2.8	3.0	2.0	**3.0**
40%		1.4	2.8	4.3	4.5	2.2	2.3	1.0	**2.6**
20%		1.7	2.7	4.5	4.0	3.0	1.5	2.0	**2.8**
Pest Tolerance									
80%	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**
40%	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**
Disease Resistance									
80%	4.8	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**
40%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	4.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Vigor									
80%	3.4	5.0	5.0	4.6	4.2	4.5	4.5	3.8	**4.4**
60%	3.8	4.8	5.0	5.0	4.5	3.8	4.5	3.8	**4.4**
40%	3.3	4.2	3.8	4.8	4.7	3.0	4.0	3.0	**3.9**
20%	3.7	4.3	4.3	5.0	4.5	3.5	3.5	3.5	**4.0**
Overall Appearance									
80%	3.2	4.0	4.2	4.5	4.0	3.6	3.3	2.3	**3.6**
60%	3.8	4.0	4.2	4.5	4.5	3.3	2.9	2.3	**3.7**
40%	3.3	3.9	4.0	4.5	4.5	3.0	2.7	2.1	**3.5**
20%	3.0	4.0	4.0	4.5	4.5	2.5	2.5	2.5	**3.4**

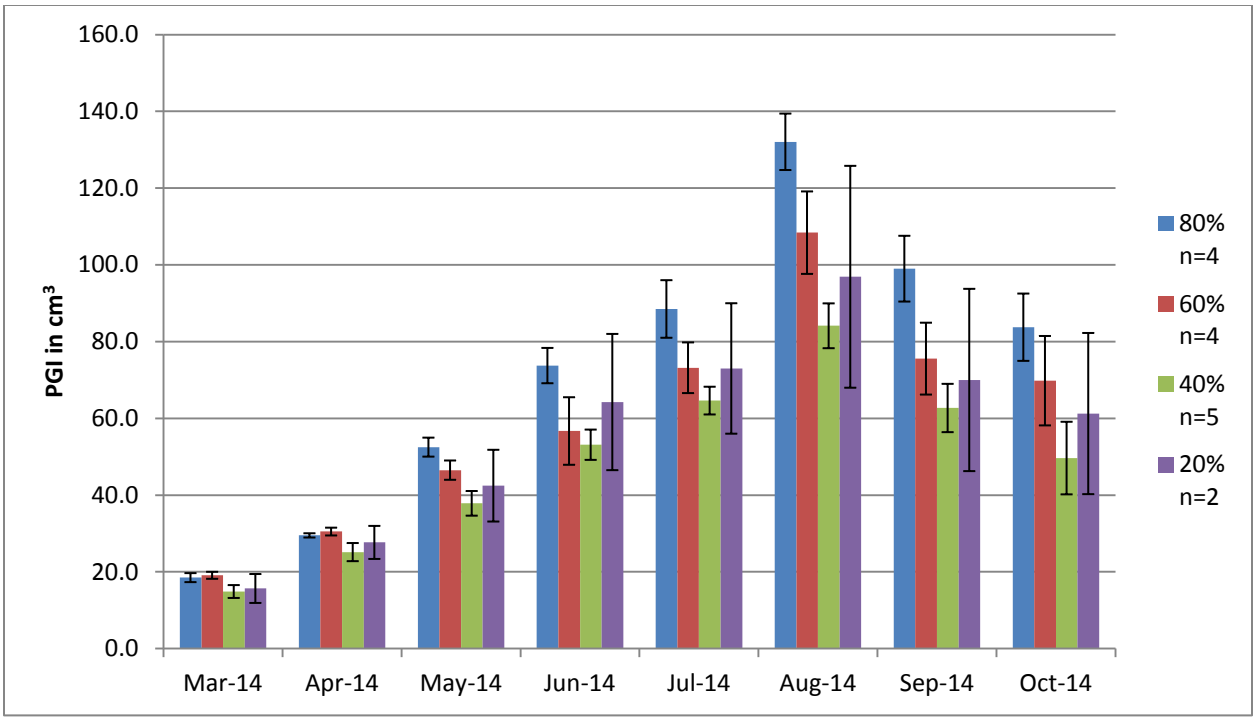


Figure 20a. Average monthly plant growth index of *Geranium* 'Rozanne' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. Differences not significant at the 5% level (PROC GLM, SAS ver 8).

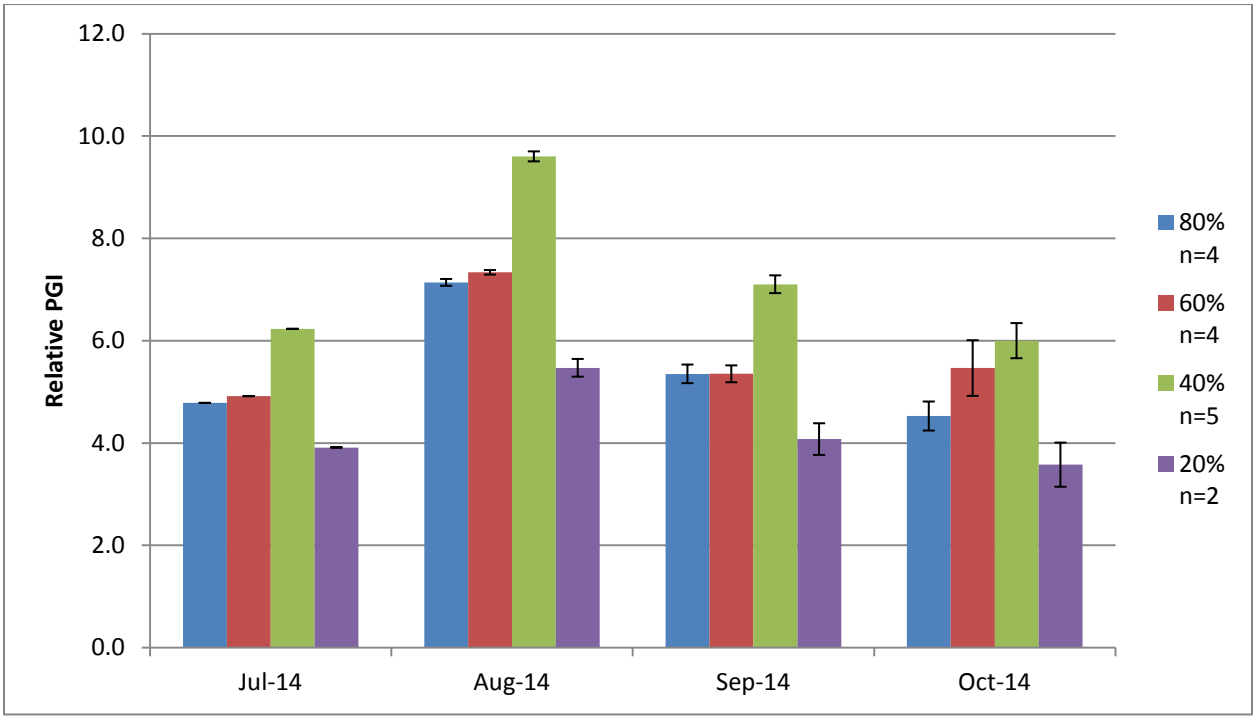


Figure 20b. Average monthly relative plant growth index of *Geranium* 'Rozanne' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. Differences not significant at the 5% level (PROC GLM, SAS ver 8).

Table 13. Average monthly quality ratings for *Helichrysum* 'Ruby Clusters' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	5.0	5.0	5.0	5.0	4.0	2.3	3.0	4.3	**4.2**
60%	5.0	5.0	5.0	4.5	3.7	2.5	2.3	2.4	**3.8**
40%	4.8	5.0	5.0	5.0	4.2	3.0	2.3	2.8	**4.0**
20%	5.0	5.0	4.8	4.6	4.2	3.5	2.0	3.3	**4.0**
Flowering									
80%	5.0	4.8	5.0	5.0	1.3				**4.2**
60%	4.3	4.6	4.8	4.7	1.0		1.0		**3.4**
40%	4.7	4.3	4.8	5.0	1.8				**4.1**
20%	4.2	3.8	4.7	4.4	1.5				**3.7**
Pest Tolerance									
80%	5.0	5.0	5.0	5.0	4.5	5.0	3.0	4.3	**4.6**
60%	5.0	5.0	5.0	5.0	4.7	4.7	2.7	2.4	**4.3**
40%	4.8	5.0	5.0	5.0	4.8	5.0	3.3	3.0	**4.5**
20%	5.0	5.0	4.8	4.6	4.2	4.8	2.3	3.3	**4.2**
Disease Resistance									
80%	5.0	5.0	5.0	5.0	4.5	5.0	5.0	5.0	**4.9**
60%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.7	**5.0**
40%	5.0	5.0	5.0	5.0	4.7	5.0	4.3	4.3	**4.8**
20%	5.0	5.0	5.0	5.0	4.8	5.0	5.0	5.0	**5.0**
Vigor									
80%	5.0	5.0	5.0	4.8	4.5	3.0	3.7	4.3	**4.4**
60%	4.7	4.8	4.8	4.3	3.8	2.5	2.8	2.5	**3.8**
40%	4.7	4.7	4.7	4.8	4.3	3.0	2.7	3.5	**4.0**
20%	3.8	4.5	4.5	4.0	4.0	3.5	2.5	3.8	**3.8**
Overall Appearance									
80%	5.0	5.0	5.0	4.6	4.0	2.3	2.2	3.2	**3.9**
60%	4.7	4.6	4.8	3.9	3.3	2.3	2.0	2.1	**3.5**
40%	4.7	4.6	4.8	4.8	3.7	2.7	1.7	2.1	**3.6**
20%	4.8	4.3	4.7	3.7	3.8	2.9	2.0	2.8	**3.6**

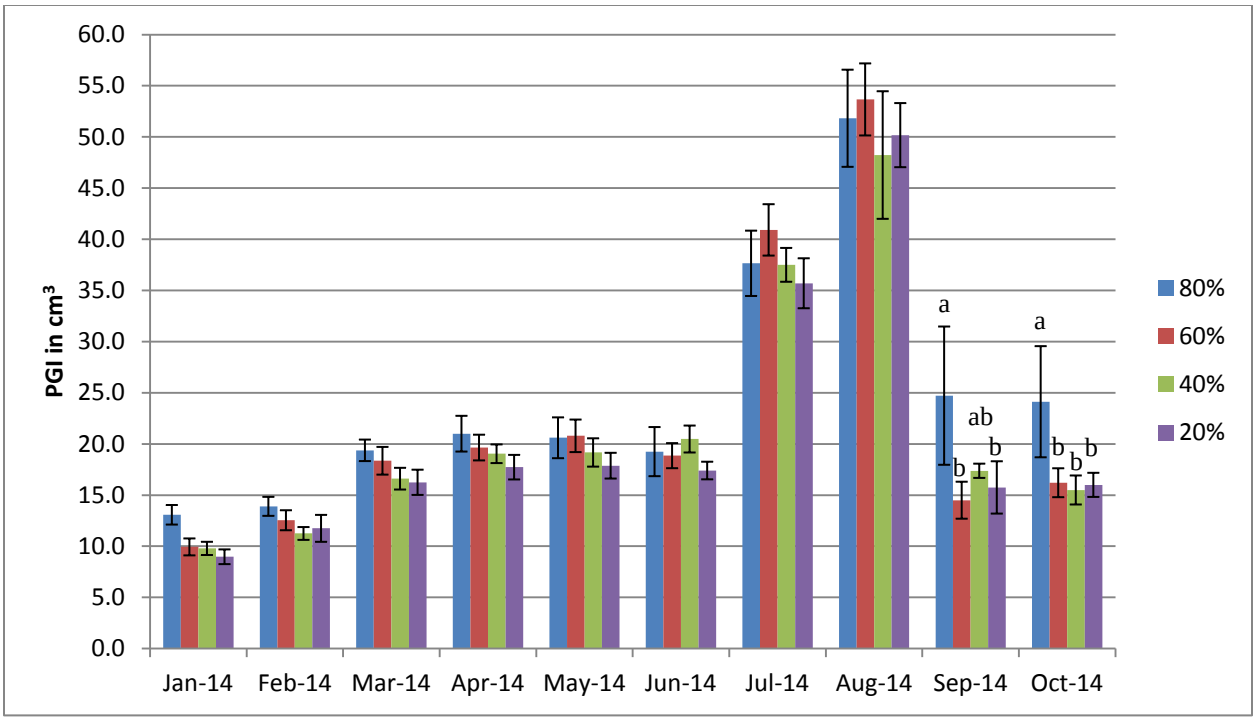


Figure 21a. Average monthly plant growth index of *Helichrysum* 'Ruby Clusters' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences January through August. Bars with the same letters were not significantly different using ANOVA and Tukey's HSD at $p< 0.05$.

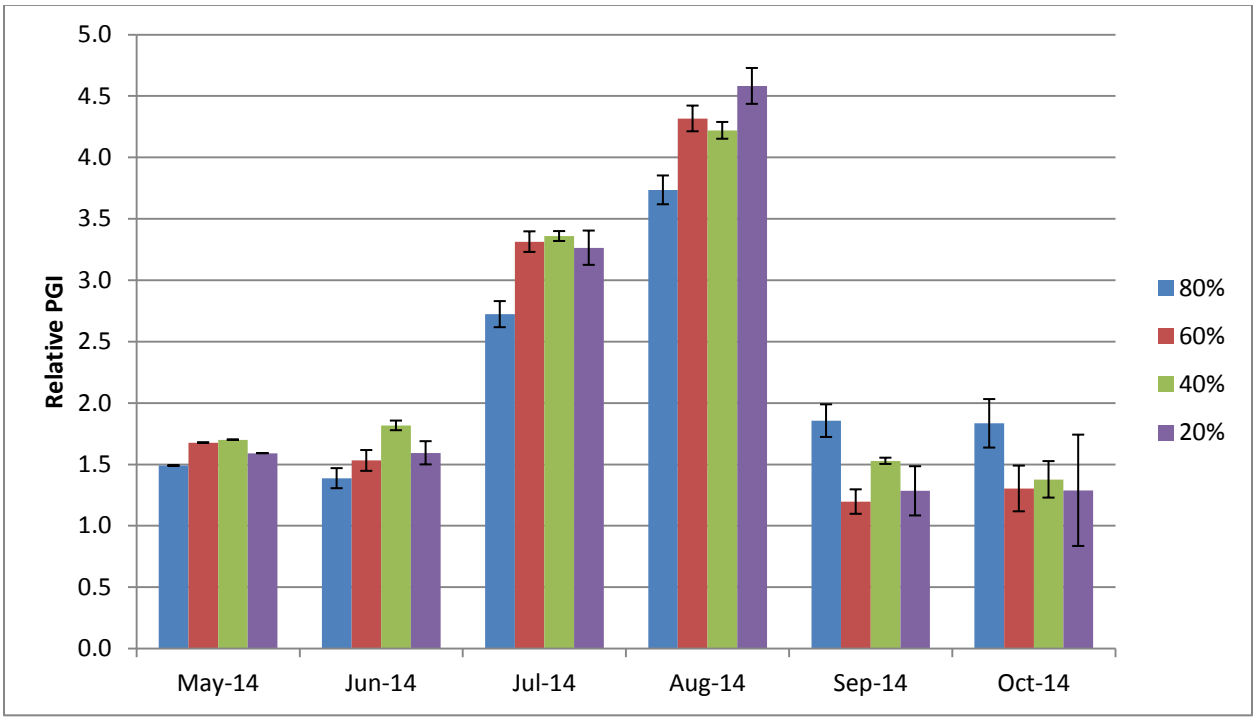


Figure 21b. Average monthly relative plant growth index of *Helichrysum* 'Ruby Clusters' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. There were no significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 14. Average monthly quality ratings for *Kniphofia* 'Elvira' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	2.8	3.7	4.2	3.2	3.2	3.3	2.8	2.9	**3.3**
60%	3.2	3.5	3.8	3.3	2.3	3.0	3.2	2.9	**3.1**
40%	2.6	2.6	3.8	3.2	3.2	3.4	3.0	3.0	**3.1**
20%	3.0	3.8	3.7	3.3	2.8	3.0	3.2	2.3	**3.1**
Flowering									
80%		2.3	4.3	4.2	1.7	1.0			**2.7**
60%		1.0	4.2	3.5	1.5				**2.5**
40%		1.5	3.7	3.7	2.0				**2.7**
20%			3.8	4.0	1.5	1.0			**2.6**
Pest Tolerance									
80%	4.7	4.5	5.0	3.8	4.5	5.0	5.0	3.3	**4.5**
60%	4.8	5.0	4.7	3.9	4.0	5.0	5.0	3.8	**4.5**
40%	4.4	3.0	4.3	3.8	4.4	5.0	5.0	3.4	**4.2**
20%	4.8	5.0	4.8	4.5	4.7	5.0	5.0	3.3	**4.6**
Disease Resistance									
80%	4.8	4.0	4.7	5.0	5.0	5.0	5.0	5.0	**4.8**
60%	4.8	4.5	4.7	5.0	5.0	5.0	5.0	5.0	**4.9**
40%	4.0	3.4	5.0	4.6	5.0	5.0	5.0	5.0	**4.6**
20%	4.8	5.0	4.6	4.8	5.0	5.0	5.0	5.0	**4.9**
Vigor									
80%	4.3	4.0	4.2	4.0	3.8	4.0	4.0	4.0	**4.0**
60%	4.5	4.2	4.2	4.5	3.3	4.2	4.3	4.7	**4.2**
40%	3.4	3.0	3.5	3.4	3.6	3.8	3.6	3.8	**3.5**
20%	4.4	4.0	3.8	4.0	3.5	3.2	3.5	3.3	**3.7**
Overall Appearance									
80%	2.8	3.4	4.8	3.7	3.2	3.2	2.7	2.9	**3.3**
60%	2.8	3.3	4.3	3.7	2.4	3.1	3.0	2.9	**3.2**
40%	2.2	2.6	3.5	2.9	3.0	3.3	2.8	2.9	**2.9**
20%	2.2	3.0	3.9	3.4	2.7	3.0	2.7	2.3	**2.9**

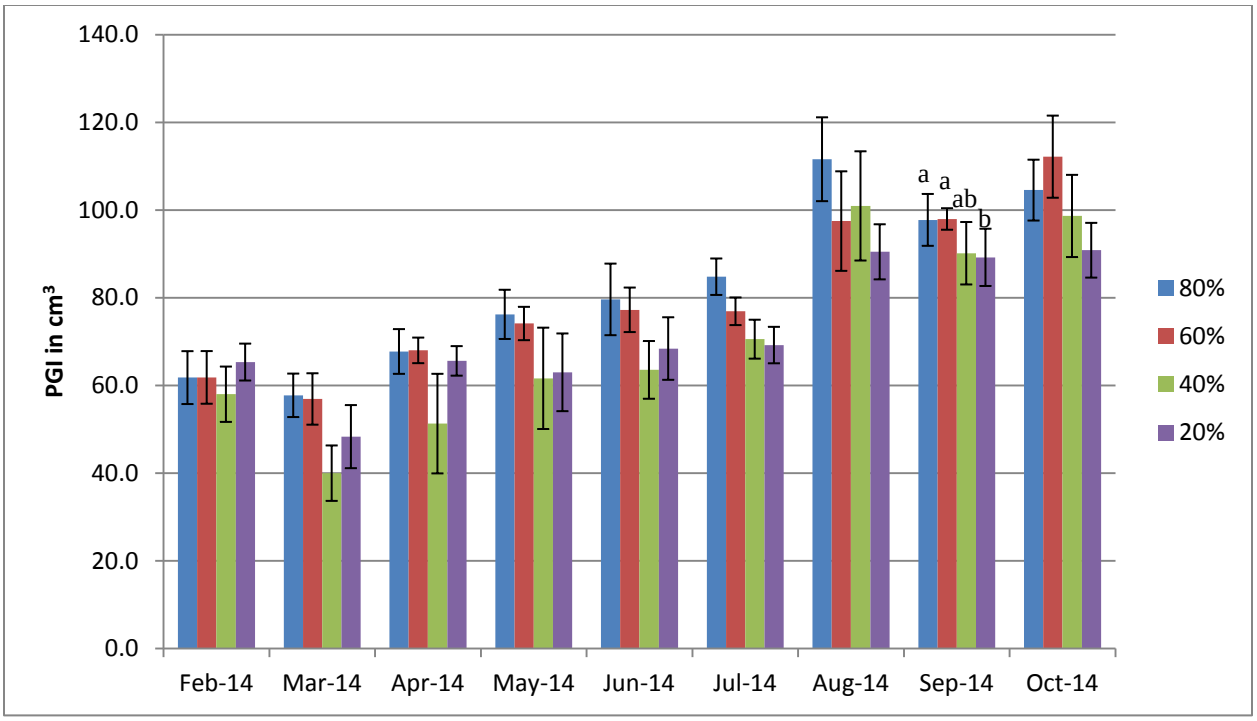


Figure 22a. Average monthly plant growth index of *Kniphofia* 'Elvira' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences except in September. Bars with the same letters were not significantly different using ANOVA and Tukey's HSD at $p< 0.05$.

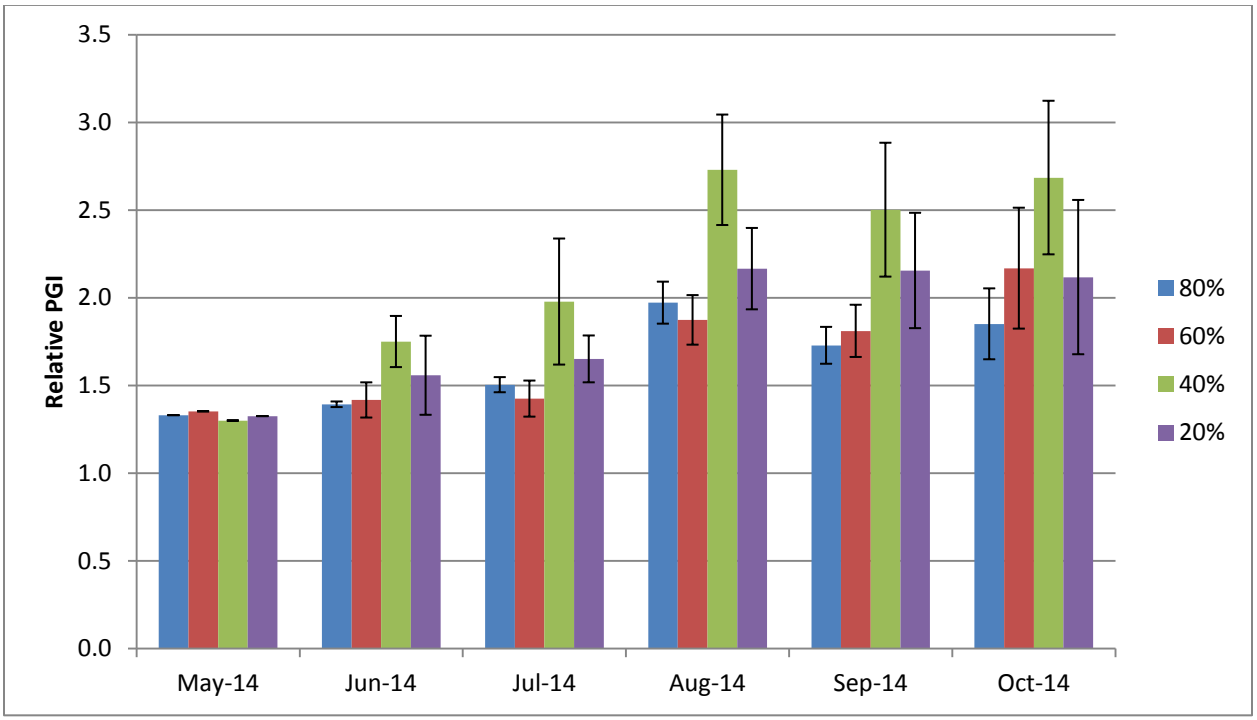


Figure 22b. Average monthly relative plant growth index of *Kniphofia* 'Elvira' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 15. Average monthly quality ratings for Kurapia on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.7	4.8	5.0	5.0	5.0	5.0	5.0	4.8	**4.9**
60%	4.8	5.0	5.0	5.0	5.0	5.0	5.0	4.8	**5.0**
40%	4.7	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
20%	4.5	5.0	5.0	5.0	5.0	5.0	5.0	4.8	**4.9**
Flowering									
80%		1.0	4.3	5.0	5.0	5.0	5.0	3.7	**4.1**
60%		1.0	5.0	5.0	5.0	5.0	5.0	3.0	**4.1**
40%		1.0	5.0	5.0	5.0	5.0	5.0	3.1	**4.2**
20%		1.0	5.0	5.0	5.0	5.0	5.0	3.2	**4.2**
Pest Tolerance									
80%	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**
40%	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**
Disease Resistance									
80%	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**
40%	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**
Vigor									
80%	4.7	4.5	4.8	5.0	5.0	5.0	5.0	5.0	**4.9**
60%	4.2	4.2	4.6	5.0	5.0	5.0	5.0	4.8	**4.7**
40%	3.9	4.3	5.0	5.0	5.0	5.0	5.0	5.0	**4.8**
20%	4.5	4.5	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
Overall Appearance									
80%	2.3	3.7	4.0	4.8	5.0	5.0	5.0	4.2	**4.2**
60%	2.2	3.4	4.0	4.4	5.0	5.0	5.0	3.8	**4.1**
40%	2.2	3.3	4.0	4.6	5.0	5.0	5.0	4.0	**4.1**
20%	2.3	3.2	4.0	4.9	5.0	5.0	5.0	3.9	**4.2**

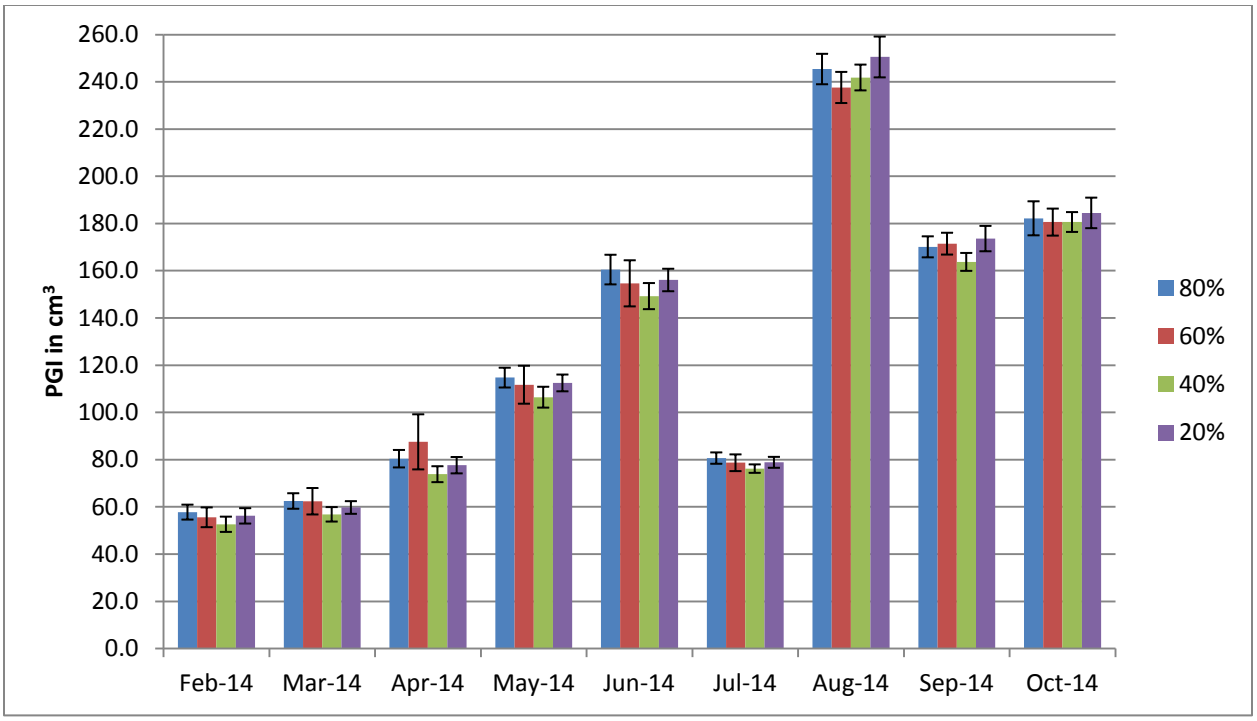


Figure 23a. Average monthly plant growth index of Kurapia in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$. Drop in July reflects pruning to 1m-diameter circle.

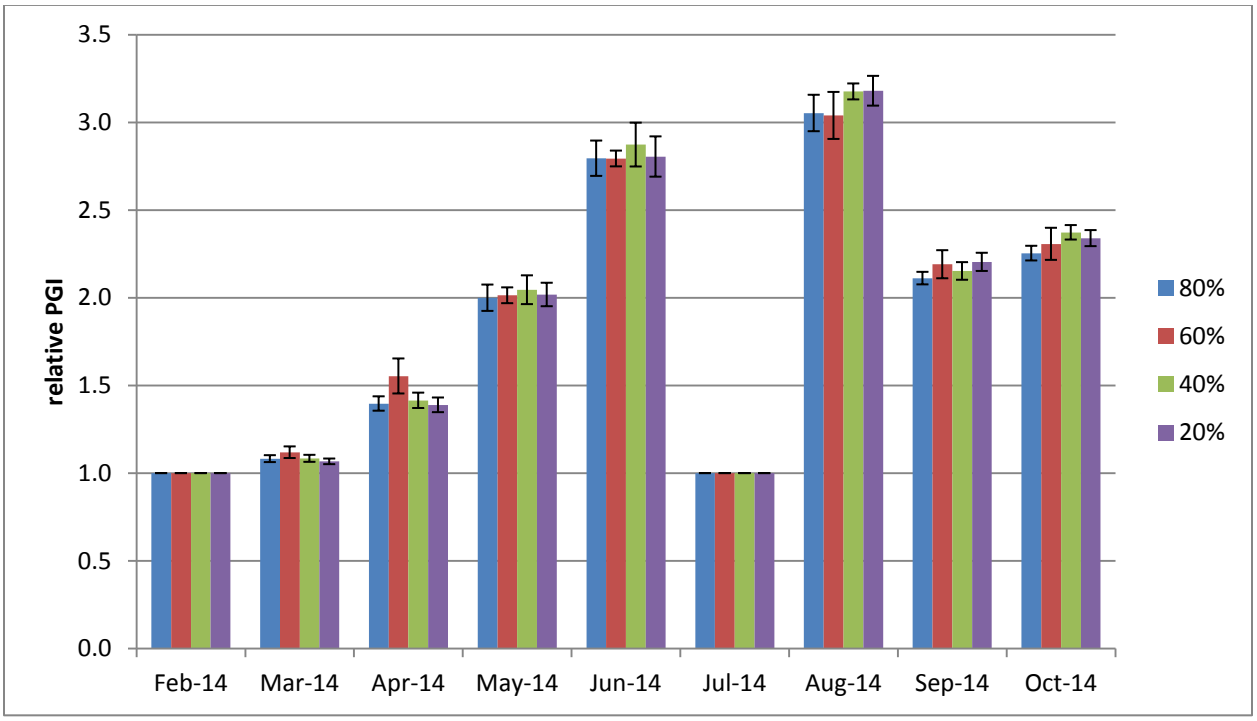


Figure 23b. Average monthly relative plant growth index of Kurapia in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$. Drop in July reflects pruning to 1m-diameter circle.

Table 16. Average monthly quality ratings for *Lomandra* 'Bushland Green' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.0	5.0	5.0	5.0	4.6	4.2	4.4	4.4	**4.6**
60%	3.5	4.5	4.5	4.8	5.0	4.5	4.5	4.3	**4.4**
40%	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.9**
20%	4.0	5.0	5.0	5.0	5.0	4.6	4.6	4.6	**4.7**
Flowering									
80%	4.0	4.6	4.5	4.8	5.0		1.0	2.0	**3.7**
60%	3.3	4.0	4.3	4.3	4.0		1.5	1.8	**3.3**
40%	4.5	5.0	4.8	5.0	5.0		1.5	1.8	**3.9**
20%	4.4	5.0	4.8	4.4	4.4	1.0	1.3	1.8	**3.4**
Pest Tolerance									
80%	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**
40%	4.8	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**
Disease Resistance									
80%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
60%	5.0	4.8	4.5	5.0	5.0	5.0	5.0	5.0	**4.9**
40%	4.8	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**
Vigor									
80%	4.4	5.0	5.0	5.0	4.4	4.0	4.2	4.0	**4.5**
60%	3.3	4.0	3.8	4.5	4.5	4.5	4.3	4.0	**4.1**
40%	4.8	4.8	4.8	5.0	5.0	4.8	5.0	4.8	**4.8**
20%	4.4	5.0	4.8	5.0	5.0	4.6	4.0	4.2	**4.6**
Overall Appearance									
80%	3.2	4.4	4.5	4.8	4.6	3.4	3.8	4.1	**4.1**
60%	2.8	3.8	3.6	4.3	4.5	4.0	3.5	3.5	**3.7**
40%	3.0	4.1	4.3	5.0	5.0	4.3	4.0	4.8	**4.3**
20%	3.4	4.3	4.4	4.6	4.8	4.2	3.6	4.3	**4.2**

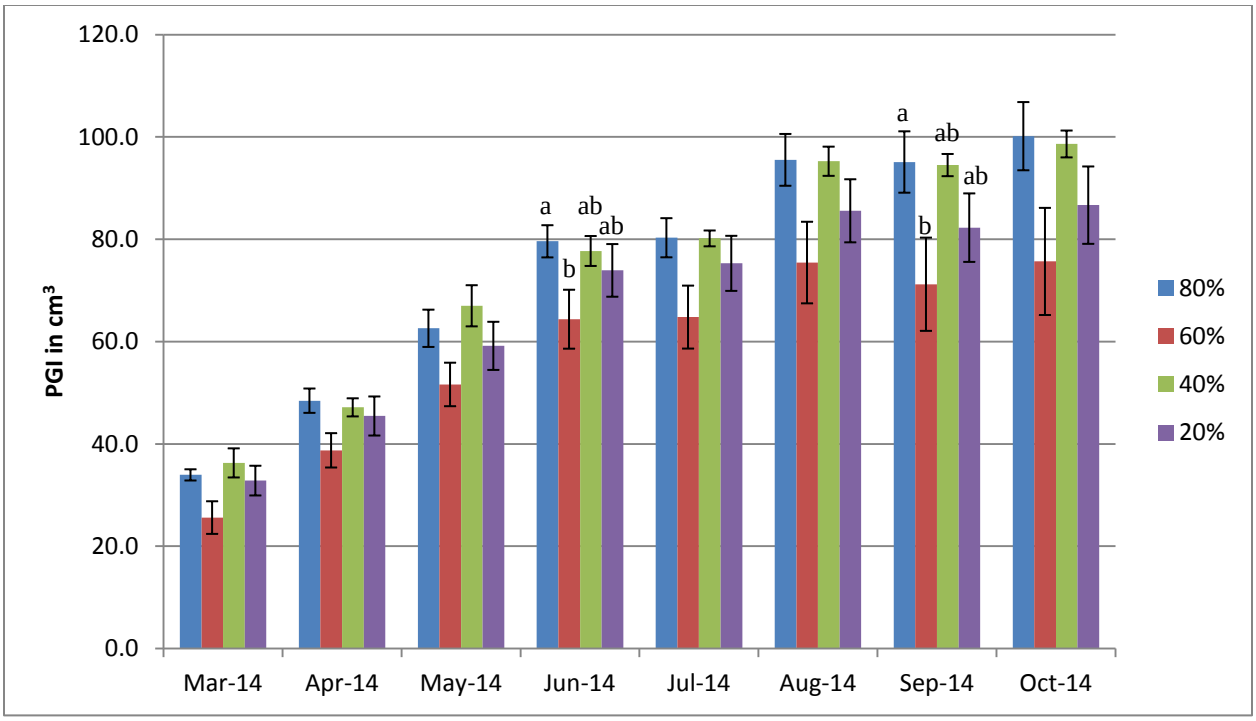


Figure 24a. Average monthly plant growth index of *Lomandra* 'Bushland Green' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$, except for June and August, where bars with the same letters were not significantly different, and differences are probably reflective of original plant size and not necessarily the treatment.

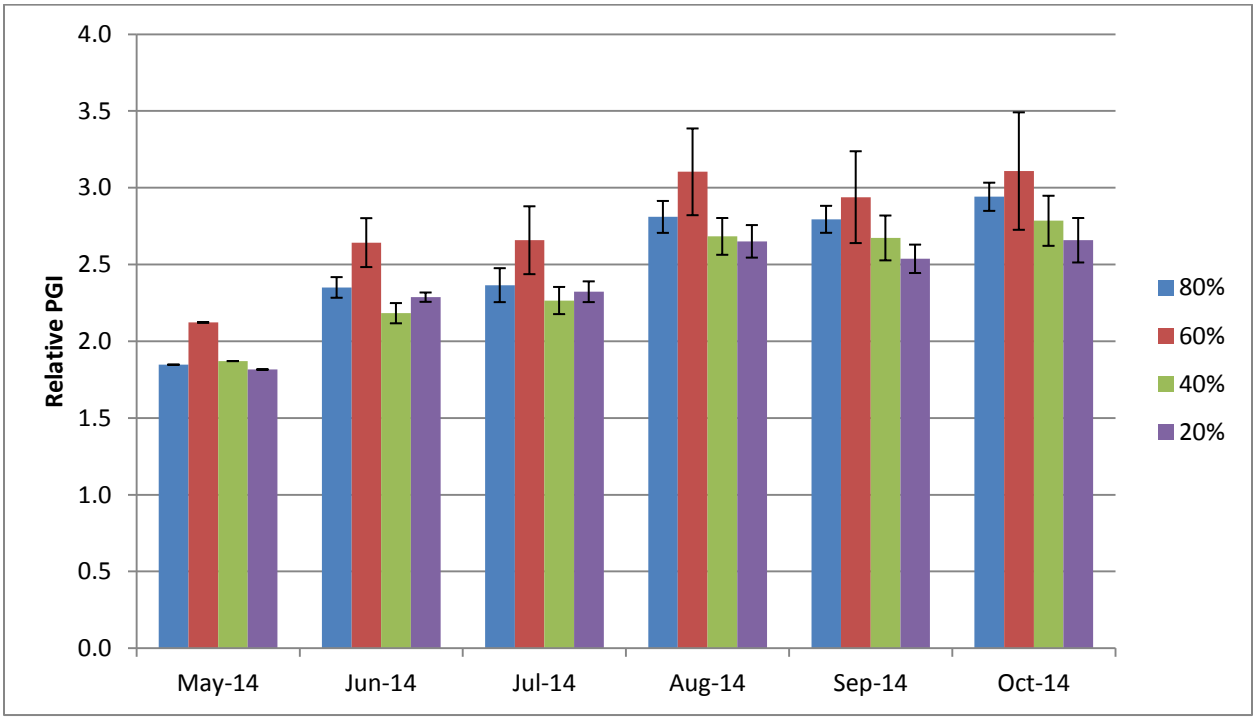


Figure 24b. Average monthly relative plant growth index of *Lomandra* 'Bushland Green' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$.

Table 17. Average monthly quality ratings for *Lonicera* 'Peaches and Cream' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	5.0	5.0	5.0	4.8	3.8	3.0	2.0	2.0	**3.8**
60%	5.0	5.0	5.0	4.6	3.9	3.4	2.1	2.0	**3.9**
40%	5.0	5.0	5.0	4.5	3.8	3.0	2.3	2.0	**3.8**
20%	4.8	5.0	4.8	4.2	3.5	2.5	2.2	2.0	**3.6**
Flowering									
80%			1.0	1.0	1.6	1.0	2.0	1.0	**1.3**
60%			5.0	1.0	1.4	1.5	1.3	1.0	**1.9**
40%			1.3	1.0	2.2	1.0	1.3	1.0	**1.3**
20%			1.0	1.5	1.2	1.0	1.0		**1.1**
Pest Tolerance									
80%	5.0	5.0	5.0	5.0	3.8	3.0	2.0	2.0	**3.9**
60%	5.0	5.0	5.0	5.0	3.9	3.4	2.1	2.0	**3.9**
40%	5.0	5.0	5.0	5.0	4.0	3.0	2.2	2.0	**3.9**
20%	5.0	5.0	5.0	5.0	3.5	2.5	2.2	1.8	**3.8**
Disease Resistance									
80%	5.0	5.0	5.0	5.0	5.0	4.8	4.4	5.0	**4.9**
60%	5.0	5.0	5.0	4.9	5.0	5.0	5.0	5.0	**5.0**
40%	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	**5.0**
20%	5.0	5.0	4.8	4.8	5.0	4.2	5.0	5.0	**4.9**
Vigor									
80%	4.4	4.8	5.0	5.0	4.8	4.0	4.2	4.8	**4.6**
60%	4.0	4.6	4.4	4.4	4.3	4.1	4.1	4.0	**4.3**
40%	4.3	4.7	4.7	4.5	4.8	4.3	4.5	4.2	**4.5**
20%	4.3	4.8	4.7	4.8	4.7	3.3	4.8	3.8	**4.4**
Overall Appearance									
80%	3.5	4.0	4.0	4.0	4.0	3.5	2.6	2.0	**3.5**
60%	3.6	3.9	3.9	3.9	3.9	3.7	2.5	1.9	**3.4**
40%	3.7	3.8	4.1	3.8	4.3	3.6	2.7	2.0	**3.5**
20%	3.5	4.0	4.0	3.9	3.8	3.2	2.7	1.8	**3.4**

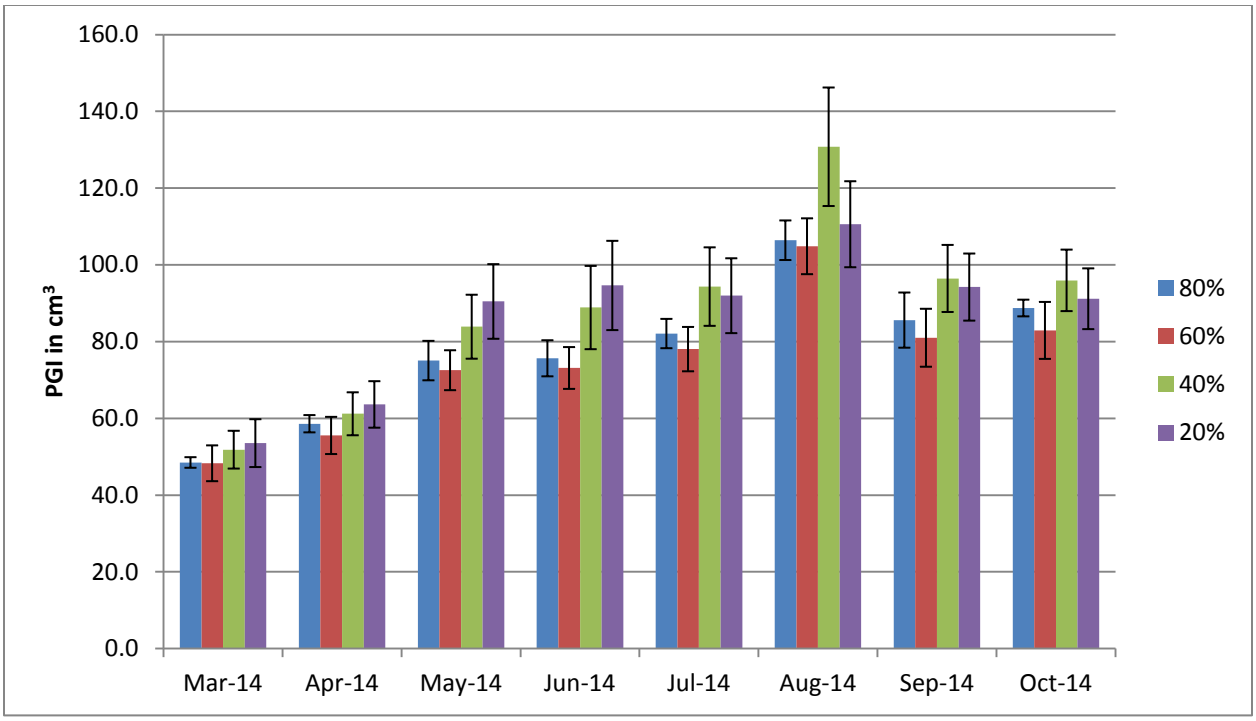


Figure 25a. Average monthly plant growth index of *Lonicera* 'Peaches and Cream' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$.

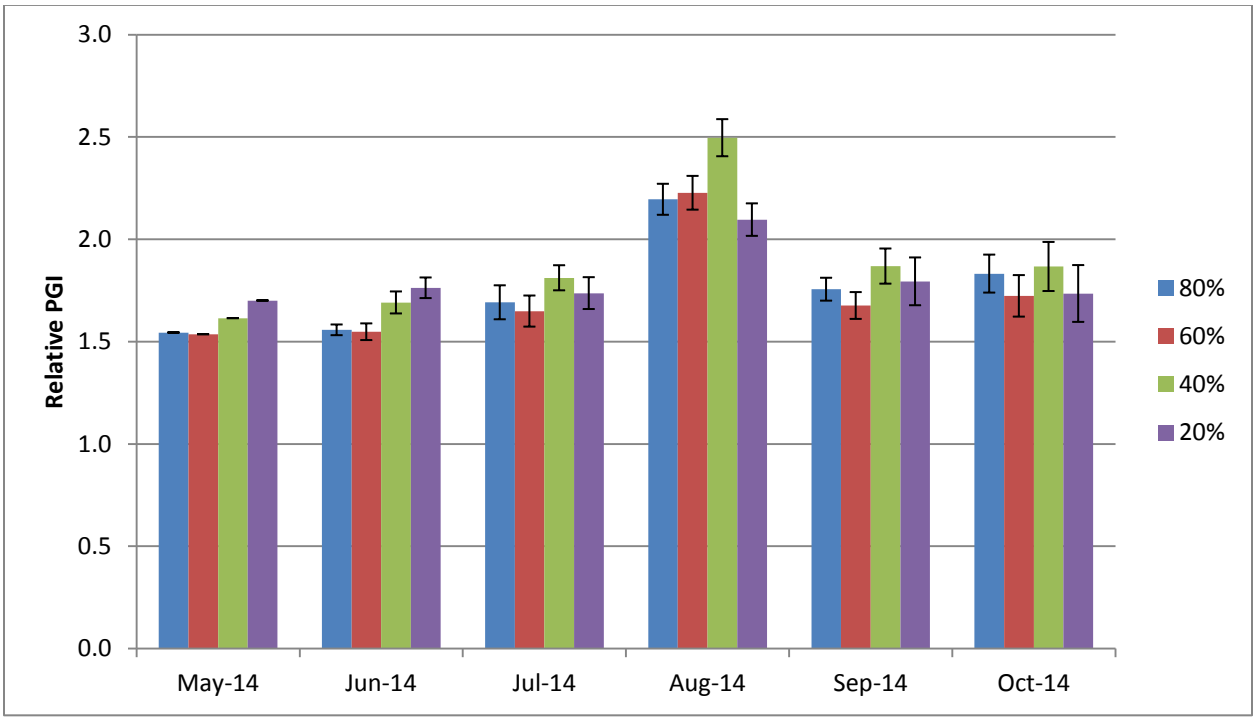
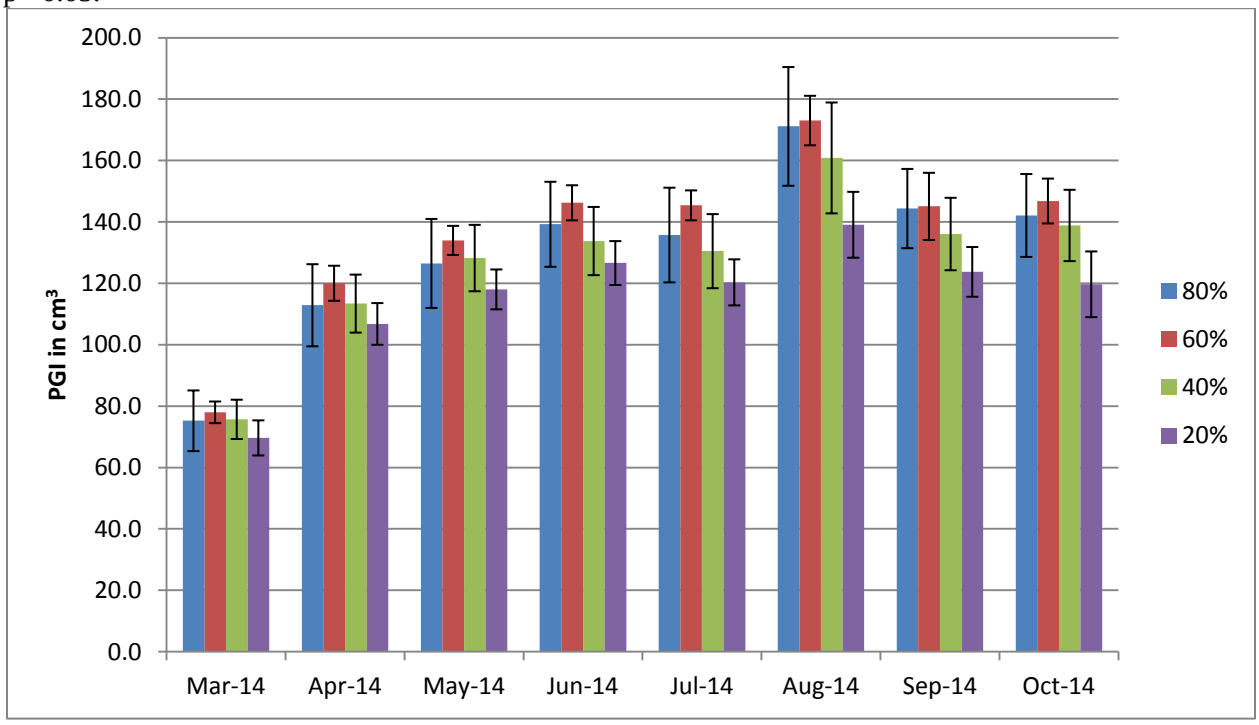


Figure 25b. Average relative monthly plant growth index of *Lonicera* 'Peaches and Cream' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p < 0.05$.

Table 18. Average monthly quality ratings for *Miscanthus* 'Little Zebra' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	4.2	4.6	4.2	4.5	4.5	3.4	3.3	2.0	**3.8**
60%	5.0	5.0	5.0	4.7	4.5	3.8	3.5	2.2	**4.2**
40%	5.0	4.8	4.7	4.0	4.2	4.0	3.0	2.0	**4.0**
20%	4.8	5.0	4.8	4.3	3.4	3.2	2.7	1.7	**3.7**
Flowering									
80%					1.8	3.8	4.8	4.7	**3.7**
60%			5.0	5.0	2.0	4.3	4.8	4.3	**4.3**
40%					1.0	4.2	4.8	3.5	**3.4**
20%		5.0	5.0	5.0	1.0	3.3	3.8	2.8	**3.7**
Pest Tolerance									
80%	5.0	4.2	4.4	4.3	4.5	3.2	3.3	2.0	**3.9**
60%	5.0	5.0	5.0	4.7	4.7	3.8	3.8	2.0	**4.3**
40%	5.0	4.7	4.7	4.0	4.3	4.3	3.2	2.0	**4.0**
20%	5.0	5.0	5.0	4.0	4.0	3.5	3.2	1.8	**3.9**
Disease Resistance									
80%	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**
40%	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**
Vigor									
80%	3.3	3.8	3.8	4.3	4.0	3.8	4.5	3.6	**3.9**
60%	4.7	4.3	4.3	4.5	4.3	4.5	4.3	3.8	**4.4**
40%	4.7	4.3	4.5	4.0	4.0	3.8	3.8	3.8	**4.1**
20%	4.2	3.8	3.8	3.3	3.3	3.3	3.2	3.0	**3.5**
Overall Appearance									
80%	3.3	4.0	3.6	4.1	4.5	3.5	4.5	3.0	**3.8**
60%	4.0	4.3	4.2	4.3	4.2	4.5	4.5	3.3	**4.2**
40%	3.8	4.2	4.1	3.9	4.0	4.3	4.1	3.3	**4.0**
20%	3.8	4.2	3.9	3.8	3.4	3.3	3.3	2.3	**3.5**

Figure 26a. Average monthly plant growth index of *Miscanthus* 'Little Zebra' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p< 0.05$.



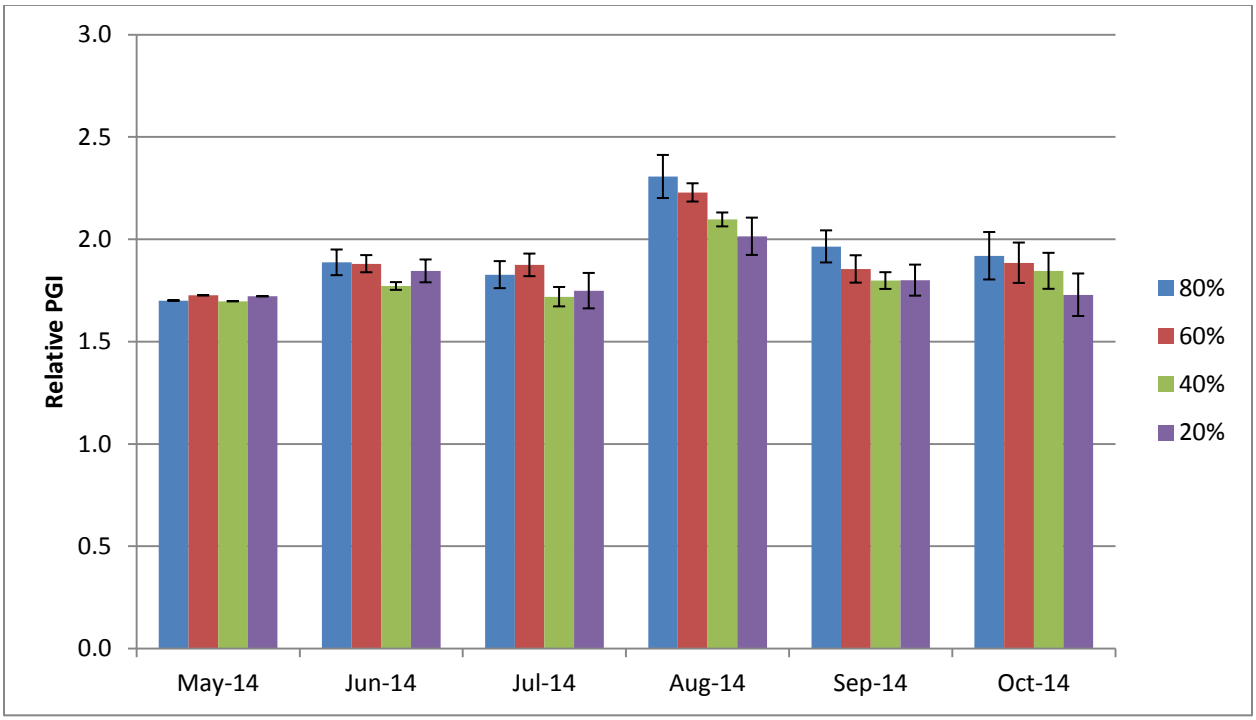


Figure 26b. Average monthly relative plant growth index of *Miscanthus* 'Little Zebra' in 2014 on 4 ET_o–based irrigation levels. Bars represent ± 1 SE. No significant differences using ANOVA and Tukey's HSD at $p< 0.05$.

Table 19. Average monthly quality ratings for *Trachelospermum jasminoides* 'Sassy' on 4 ET_0-based irrigation levels in 2014.

	March	April	May	June	July	Aug	Sept	Oct	AVG
Foliage									
80%	1.7	3.0	3.5	4.0	4.3	5.0	4.5	4.0	**3.7**
60%	2.0	2.0	4.0	4.0	4.0	5.0	5.0	4.0	**3.8**
40%									
20%	2.0	2.5	2.5	4.0	4.5	5.0	4.0	4.0	**3.6**
Flowering									
80%		1.0	1.0	1.0	1.0				**1.0**
60%				1.0	1.0				**1.0**
40%									
20%				1.0	1.0				**1.0**
Pest Tolerance									
80%	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**
40%									
20%	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Disease Resistance									
80%	4.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	**4.8**
60%	5.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.6**
40%									
20%	5.0	2.0	5.0	5.0	5.0	5.0	5.0	5.0	**4.6**
Vigor									
80%	1.7	2.5	3.0	3.5	4.5	4.5	5.0	3.5	**3.5**
60%	2.0	3.0	3.0	3.0	5.0	5.0	5.0	4.0	**3.8**
40%									
20%	2.0	3.0	3.0	3.0	4.0	4.0	5.0	4.0	**3.5**
Overall Appearance									
80%	1.7	2.5	3.0	3.0	3.5	4.0	4.0	3.5	**3.1**
60%	2.0	2.0	3.0	3.0	4.0	4.0	4.0	3.0	**3.1**
40%									
20%	2.0	2.0	2.0	3.0	4.0	4.0	4.0	3.5	**3.1**

Table 20. Final growth indexes for *Trachelospermum* 'Sassy' on 3 ET_0-based irrigation levels in 2014. No statistical analysis possible due to high mortality.

Irrigation treatment (% of ET_0)	Plant growth index (cm^3)	Relative plant growth index
80 (n=2)	72.4	2.4
60 (n=1)	79.3	2.5
20 (n=1)	71.0	1.8