

## Use of Potassium to Improve Foliage Plant Growth with Reclaimed Waste Water

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### Brief Summary of the project:

High salinity in irrigation water from reclaimed waste water (RWW) or salt water intrusion reduces the plants ability to take up water. Plant salt tolerance varies and involves some form of osmoregulation (accumulation of ions). Bidirectional pumps maintain selectivity between sodium (Na) and potassium (K) operating in opposite directions. As salts accumulate there is increased selectivity for K, resulting in transport of K inward and Na outward. However, in plants with a low salt tolerance, excess Na interferes with K absorption and could lead to K deficiency.

Knowing that K contributes to osmoregulation, we question if the addition of K to the growing substrate would improve plant growth when watered with RWW or salt water. If the addition of K to the substrate improves plant growth of low salt tolerant plants when watered with RWW, this would improve grower's results when using RWW. Our hypothesis was that the addition of K to the growing substrate would improve the growth of salt sensitive and salt tolerant foliage plant species irrigated with RWW. The benefit is that regardless of the salt tolerance of the plant and the source of the RWW, the addition of K to the substrate would allow growers to use RWW effectively. The goal is to expand the use of RWW in the foliage industry in Florida by using the data on foliage plant growth in substrates supplemented with K and irrigated with RWW.

### Specific research conducted:

1. Experiment 1 – We treated *Duranta repens* 'Gold Mound', *Ficus* 'Green Island' and *Ixora coccinea* with CaSO<sub>4</sub> (10 mM Ca), K<sub>2</sub>SO<sub>4</sub> (8 mM K), or K<sub>2</sub>SO<sub>4</sub> (4 mM K) and irrigated plants with a 50 mM NaCl solution. One set of plants received only tap water (control). All plants were fertilized with Osmocote 15-9-12, 9 month release. Leachate was collected to analyze pH, EC, Na, and K. We also collected leaf tissue to analyze Na and K concentrations.

Table 1. Final shoot dry weight (SDW) of plants watered with tap water (control) or salt water with CaSO<sub>4</sub> or K<sub>2</sub>SO<sub>4</sub> added to the substrate.

| Treatment                             | Duranta SDW (g) | Ficus SDW (g) | Ixora SDW (g) |
|---------------------------------------|-----------------|---------------|---------------|
| Control                               | 57.3A           | 22.9A         | 48.9A         |
| Salt                                  | 41.3C           | 19.7B         | 43.3C         |
| CaSO <sub>4</sub> (10 mM)             | 46.1B           | 24.2A         | 48.3A         |
| K <sub>2</sub> SO <sub>4</sub> (8 mM) | 45.3B           | 22.8A         | 45.8B         |
| K <sub>2</sub> SO <sub>4</sub> (4 mM) | 53.7AB          | 19.9B         | 46.9B         |

Table 2. Final tissue sodium (Na) and potassium (K) concentrations in plants watered with tap water (control) or salt water with CaSO<sub>4</sub> or K<sub>2</sub>SO<sub>4</sub> added to the substrate.

|                                       | Duranta |        | Ficus   |        | Ixora   |        |
|---------------------------------------|---------|--------|---------|--------|---------|--------|
| Treatment                             | Na (mg) | K (mg) | Na (mg) | K (mg) | Na (mg) | K (mg) |
| Control                               | 2.28    | 9.12   | 0.29    | 6.73   | 0.98    | 2.38   |
| Salt                                  | 10.42   | 5.22   | 0.70    | 4.72   | 4.59    | 1.65   |
| CaSO <sub>4</sub> (10 mM)             | 4.99    | 8.51   | 0.47    | 7.12   | 3.50    | 4.89   |
| K <sub>2</sub> SO <sub>4</sub> (8 mM) | 7.82    | 8.92   | 0.42    | 6.18   | 3.33    | 4.75   |
| K <sub>2</sub> SO <sub>4</sub> (4 mM) | 6.00    | 8.21   | 0.38    | 6.93   | 2.73    | 3.94   |

Results from this experiment indicate that the addition of CaSO<sub>4</sub> and K<sub>2</sub>SO<sub>4</sub> to plants irrigated with salt water improved plant growth over plants watered with salt water only (no additions) (Table 1). Tissue K concentrations were greater in substrates irrigated with salt water and treated with CaSO<sub>4</sub> and K<sub>2</sub>SO<sub>4</sub> compared to substrates irrigated with salt water with no additions (Table 2). Plants in the salt water only treatments had the highest tissue sodium concentrations. The leachate data is still being analyzed.

2. Experiment 2 – We treated *Breynia disticha* ‘Snowbush’ and *Begonia odorata* ‘Alba’ with CaSO<sub>4</sub> (10 mM Ca), K<sub>2</sub>SO<sub>4</sub> (8 mM K), or K<sub>2</sub>SO<sub>4</sub> (4 mM K) and irrigated plants with RWW, salt water (50 mM NaCl), or tap water. All plants were fertilized with Osmocote 15-9-12, 9 month release. Leachate was collected to analyze pH, EC, Na, and K. We also collected leaf tissue to analyze Na and K concentrations.

Table 3. Final shoot dry weight (g) of *Breynia disticha* ‘Snowbush’ irrigated with tap water, salt water, or reclaimed waste water and treated with nothing, CaSO<sub>4</sub>, or K<sub>2</sub>SO<sub>4</sub>.

| Treatment                             | Tap  | Salt | RWW  |
|---------------------------------------|------|------|------|
| Control                               | 9.38 | 8.39 | 8.54 |
| CaSO <sub>4</sub> (10 mM)             | 9.17 | 8.54 | 9.32 |
| K <sub>2</sub> SO <sub>4</sub> (8 mM) | 9.45 | 8.51 | 8.88 |
| K <sub>2</sub> SO <sub>4</sub> (4 mM) | 9.55 | 8.56 | 9.33 |

Table 4. Final shoot dry weight (g) of *Begonia odorata* 'Alba' irrigated with tap water, salt water, or reclaimed waste water and treated with nothing, CaSO<sub>4</sub>, or K<sub>2</sub>SO<sub>4</sub>.

| Treatment                             | Tap   | Salt | RWW  |
|---------------------------------------|-------|------|------|
| Control                               | 10.04 | 8.76 | 9.61 |
| CaSO <sub>4</sub> (10 mM)             | 10.81 | 8.92 | 9.82 |
| K <sub>2</sub> SO <sub>4</sub> (8 mM) | 10.23 | 8.88 | 9.73 |
| K <sub>2</sub> SO <sub>4</sub> (4 mM) | 10.27 | 8.86 | 9.75 |

Plants watered with tap water were larger than plants watered with salt water or RWW (Tables 3 and 4). The addition of CaSO<sub>4</sub> and K<sub>2</sub>SO<sub>4</sub> to substrates improved plant growth with salt water and RWW. The tissue and leachate data is being analyzed.

An additional experiment will be conducted in January 2020 to confirm results.

*Published results:*

Nothing has been published.