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RESEARCH NEWSLETTER

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Research Newsletter No. 36
Bill Miller, Cornell University

Dirty Bucket Water and Cut Lilies

The question of "how does dirty bucket water affect lily flower life" was brought up in 2015 during a presentation I gave at Dutch Lily Days. The question was asked by a group of large North American lily growers who attended the lecture. They were very interested in this question, as they all agreed their bucket washing operations are expensive, in several cases costing $10-20,000 annually.

The question was an interesting one, as cut lilies are actually relatively forgiving when it comes to water versus, for example a rose or gerbera. They can be stored dry in a cooler for relatively long periods and the stems usually rehydrate easily, even without re-cutting. And, certainly, if bucket washing was not needed, then the money saved would be good for the bottom line.

However, as a floriculturist who spends part of his time with postharvest physiology, I would be crazy to suggest anything other than to wash the buckets. Clean buckets are just one step in the "Chain of Life", which was identified many years ago to promote longer vase life for cut flowers and potted plants. Any compromise in this chain can and usually does lead to reduced vase life and reduced value for the consumer.

With cut flowers of all types, water uptake is every bit as important for longevity as is sugar (flower food). The various cut flower solutions used in the industry from the grower to wholesaler to retail shop to consumer have several functions that help to optimize water uptake and provision of sugar (food) to the stem and flower. Whether it is a biocide to reduce microbial populations or an acidifying agent (to enhance direct water uptake), adequate water uptake is key to a long display life.

With this background, we did several studies in the fall of 2015 to address the general question of how "dirty bucket (vase) water" affects lily flower life. We consider this to be an initial set of experiments, and that more work could certainly be done here. But the bottom line is that, yes, you should wash your buckets!

What we did
For this work, we generated "dirty water" by soaking several handfuls of leaves and stems of cut lilies in a 5 gallon bucket of tap water.
We let this sit in the greenhouse for 2 weeks. The result was very dirty water. In experiments 1 and 2, Yelloween and After Eight stems were tested with various dilutions of this water.

A third experiment was done with another batch of dirty water that was made up as above, but with less leaf and stem material. The result was water that was indeed dirty, but it was much less dirty than in the first two experiments. Crystal Blanca was used in this trial. Again, we prepared dilutions of the dirty water with tap water as the vase solution. In the third experiment, the dilutions yielded solutions that appeared clean and clear.

Lilies were grown in Cornell greenhouses and stems were harvested when the largest bud was puffy, and trimmed to ca. 45 cm for Yelloween and Crystal Blanca and about 30 cm for After Eight. Six stems were used for each water treatment. Each bud was tagged the day it opened and senesced so that the lifespan of each individual flower could be determined.

During the experiment, stems were held in a growth chamber at 20C, with 12 hours/day of low fluorescent light, as in a home or office. To avoid interactions in the vase, we did not include flower food (sugar) in the vase water.

Details per cultivar follow. Yelloween: In this experiment, the (very) dirty water was used as is (100 parts), or with a 50% dilution with tap water. Pure tap water was the control. After Eight: After Eight was tested with 2, 10, 20 or 100% dirty water. Crystal Blanca used the less-dirty batch of water. This water was used at 2, 10 20 or 100%.

Results:

Similar results were seen in the three experiments. *Simply put, dirty water led to shorter lived flowers and reduced water uptake.*

Water Uptake. Two points were clear in the results. First, stem water uptake decreased each day of the experiment. In the first experiment, Yelloween had a maximum water uptake of about 28 ml per stem on the first day, but only 12-13 ml for the two dirty water treatments (Fig. 1), about a 50% reduction. Thus, dirty water rapidly reduced water uptake in these stems. By day 5, water uptake was essentially zero in the dirty water treatments while stems in the tap water treatment absorbed more than the dirty water treatments did on the first day.

Similar results were seen in the second experiment with After Eight (Fig. 2). Regardless of the treatment, less water was absorbed per stem after each elapsed day. But, the dirtier the water was, the less was absorbed per stem.

Expt. 3, with Crystal Blanca, also showed similar results (Fig. 3). In Fig. 4, it is clear that across the entire experiment, the dirtier the water the less water was absorbed.

Flower life. Water uptake is important for postharvest flower life. While maybe not the total controlling factor, it is nonetheless very important and it was clear that individual flower lifespan was reduced with dirtier water (Figs. 5-7).

In Expt. 1, Yelloween, dirtier water generally reduced flower life, regardless of bud age but the effect was less than expected. In the second experiment, with After Eight, dirty water had a very significant effect even at the greatest dilutions (the "cleanest" water). In this cultivar, vase water made from 2, 10 or 20 parts of dirty water showed consistent reductions in flower life (Fig. 6). For all 5 bud ages, there was no difference between 20 parts of dirty water versus 100% dirty water. Thus, the major detrimental effects were seen in the "relatively clean" water.

The final experiment with Crystal Blanca (Fig. 7) was similar to After Eight. Most of the detrimental effect on flower life occurred at the lower parts of dirty water (2, 10 and 20 parts). With the oldest (lower) buds, there was no difference on flower life between 20 and 100 parts of dirty water. With younger buds, there was an increasing detrimental effect on flower life even between 20 and 100 parts. This probably makes sense as they would have developed for the longest time with the least water (due to clogging?).

Bottom line: dirty water reduces water uptake and shortens flower life in lilies.

But, questions do remain. How does this actually relate to real-life situations? It certainly indicates the importance of a clean vase and clean *vase water*, but does this relate closely to didry water in the grower or wholesaler phase? These experiments could be repeated with more of a flower grower/wholesaler focus, with shorter exposure to dirty water (1-2 days?) to simulate shorter term effects of holding water in the wholesale phase.

Also, we did not quantify the level of fungi, bacteria or yeast in the water, so in an absolute sense, we cannot give a quantified number of microbes that reduce lily flower life, or more importantly, a number below which no problems occur. Perhaps this could be a focus for future work.

While bucket washing costs a lot of money for large operations, the bottom line is that growers and flower handlers should always be advised to keep their buckets clean and sanitized to the greatest extent possible. While seemingly expensive on an annual basis, on a daily or per-stem basis the cost is negligible, especially relative to many other inputs for cut lily growing.

At some point, dirty water will reduce flower postharvest life. So…wash your buckets!

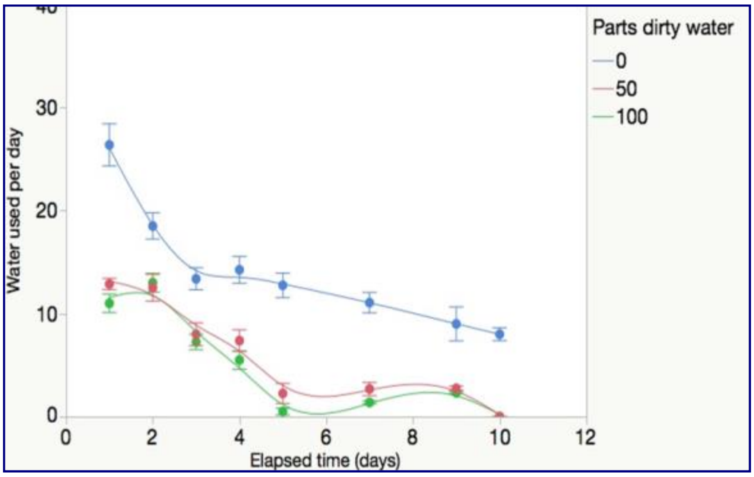

Fig. 1. Water use (ml/stem per day) over the 10 day experiment for Yelloween stems held in 0, 50 or 100 parts of dirty water.

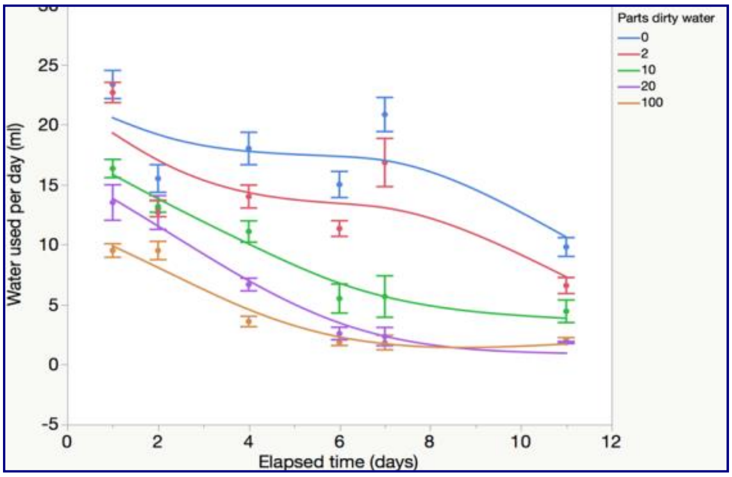

Fig. 2. Water use (ml/stem per day) over the 10 day experiment for After Eight stems held in 0, 2, 10, 20 or 100 parts of dirty water.

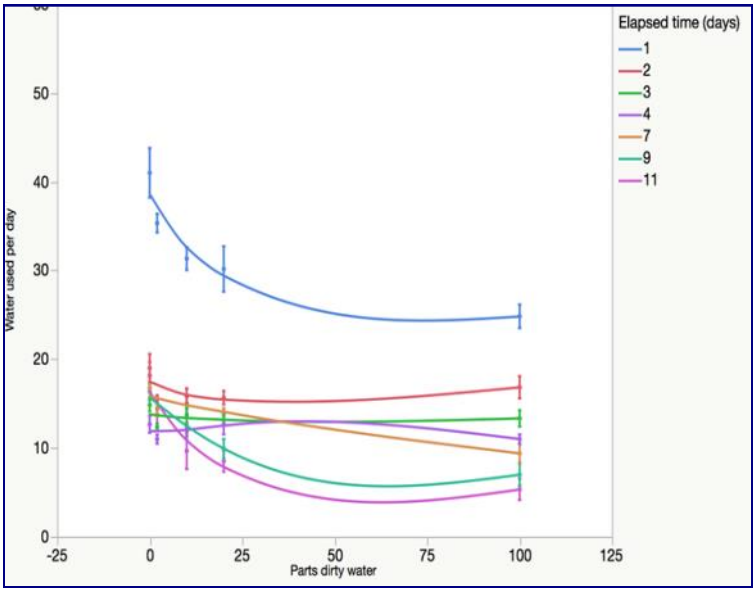

Fig. 3. Water use (ml/stem) of After Eight stems as a function of parts of dirty water. Stems were held in 0, 2, 10, 20 or 100 parts of dirty water.

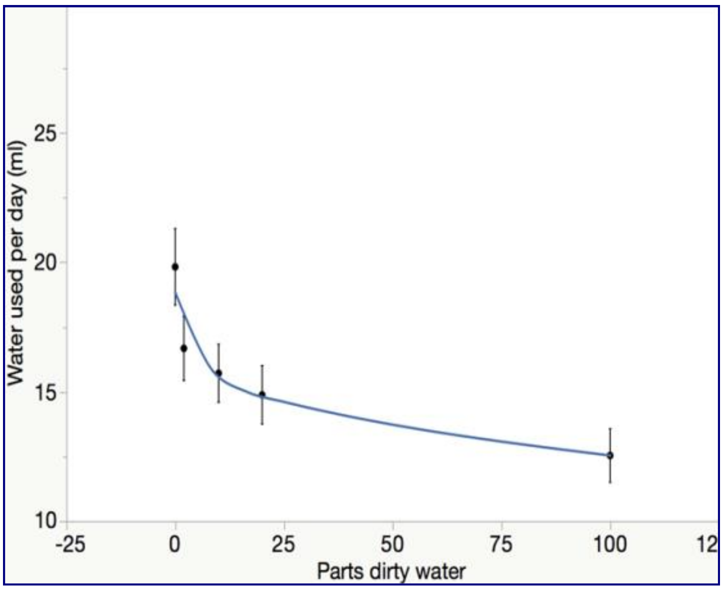

Fig. 4. Effect of parts of dirty water on water use (ml/stem) over the entire experiment for After Eight stems, averaged over the entire experiment. Stems were held in 0, 2, 10, 20 or 100 parts of dirty water.

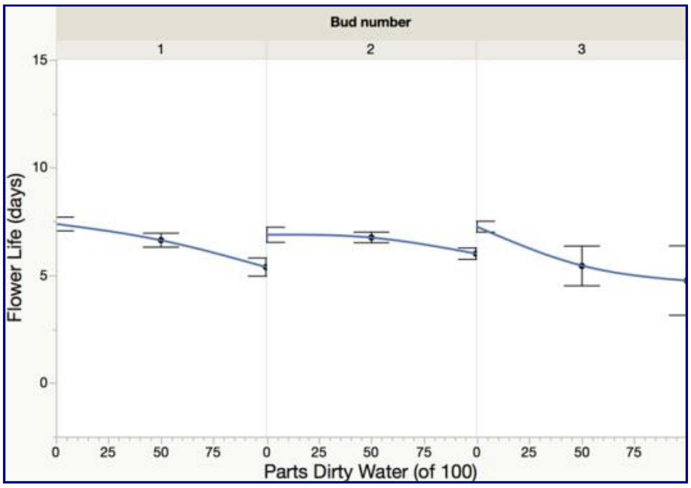

Fig. 5. Longevity Yelloween flowers with stems held in 0, 50 or 100 parts of dirty water. Bud no. 1 is always the bottom (oldest) bud, higher numbers are younger buds.

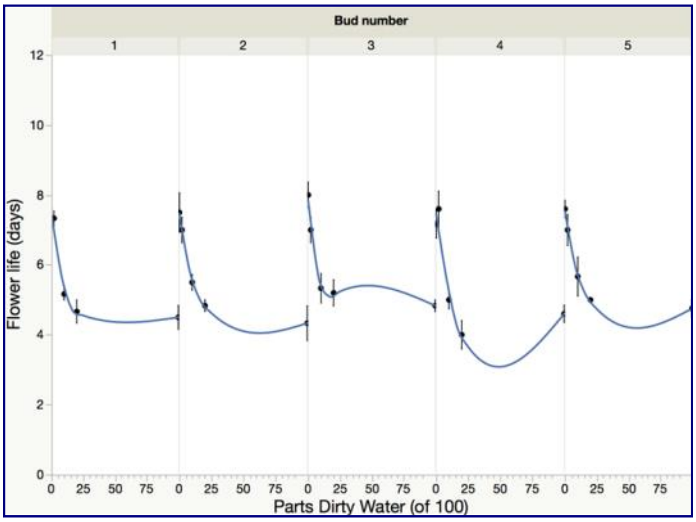

Fig. 6. Longevity of After Eight flowers with stems held in 0, 2, 10, 20 or 100 parts of dirty water. Bud no. 1 is always the bottom (oldest) bud, higher numbers are younger buds.

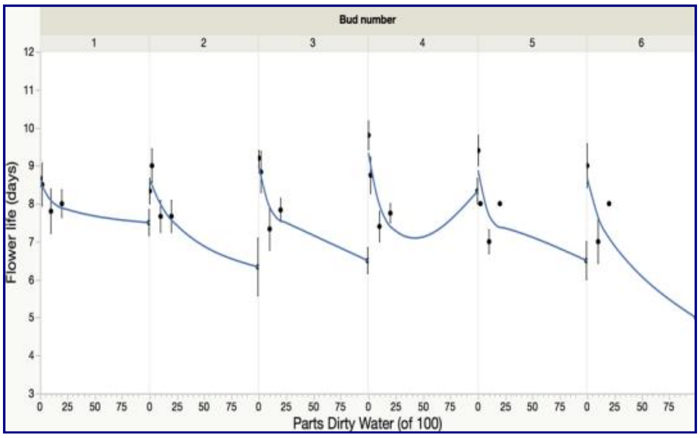

Fig. 7. Longevity of Crystal Blanca flowers with stems held in 0, 2, 10, 20 or 100 parts of dirty water. Bud no. 1 is always the bottom (oldest) bud, higher numbers are younger buds.

"Bud sticks" for timing hybrid lilies. As of May 2016, we have developed "bud sticks" for more than 50 cultivars of hybrid lilies, encompassing all the major forcing groups: asiatics, orientals, LAs and OTs. We grow plants at different temperatures, starting from the visible bud stage. The length of buds are measured every 3 or 4 days and ultimately we are able to generate mathematical relationships of days to open at various temperatures, for any bud length. This allows a grower to determine the temperature a crop must be grown to ensure flowering by the required selling date. Complete information is available on our website at http://www.flowerbulbs.cornell.edu/forcing/Bud Stick tables March 2016.pdf

Research newsletter on cut lily postharvest

In case you missed it, we published a newsletter on cut lily postharvest problems. It can be found on our website at http://www.flowerbulbs.cornell.edu/newsletter/32 Lily postharvest May 2014.pdf In that newsletter we review ethylene effects on lily flower life, the very positive effects of gibberellin 4+7 (GA_{4+7}) on reducing leaf yellowing and improving flower life, the importance of cut flower food for maximal vase life and the relationship of cold storage temperature and duration on bud necrosis and flower life.