WATER QUALITY
WHY IT IS SO IMPORTANT FOR FLORISTS

By
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Water is the most overlooked part of the fresh-cut flower handling process. Water and water quality often is taken for granted. Florists may buy the best flowers and floral preservatives, and have state-of-the-art processing equipment, but if they have low quality water, their flowers won't last and customers will be unhappy. Water is expected to be pure and healthy for flowers, but that is not always the case. Water is an important part of flowers, making up 80 to 90 percent of flowers, and keeps them turgid or firm.

The properties or characteristics of water quality are:

1. pH
2. temperature
3. soluble salts
   a. alkalinity
   b. hardness

pH – Acid, Neutral, Base

pH often is described as acid, base or neutral, based on a scale of 1 to 14. A neutral pH is 7, an acid pH is less than 7 and a base pH is greater than 7. Most municipal water and well water is usually pH 8 to 9.

An acid pH of 3.5-5.0 is best for fresh-cut flowers.

Water with a low pH is taken up by the flowers more easily. The lower pH slows the growth of microbes that can slow or stop flowers from taking up water because they block the water conducting tissues of the flower stem. Flowers that quit taking up water have shorter vase lives. Citric acid is a safe organic acid that can be added to the water to acidify it.

Temperature

The best water temperature for flower handling is a warm 100°F.

Warm water contains fewer dissolved gases than cool water. The dissolved gas bubbles can cause blockages in the water conducting tissues in the flower stem just like microbes. Flowers also take up warm water better.

Soluble Salts

Unless water is pure, it will contain dissolved mineral salts. These affect the pH of the water and contribute to the hardness and alkalinity of the water. Total soluble salts (TDS) are made up of alkalinity, hardness and salinity. A low soluble salt content is best. Soluble salts can interfere with water uptake and cause burning on the tips of leaves and flowers. They also can interfere with the effectiveness of a floral preservative's ability to lower the pH of the water.

Alkalinity

Alkalinity is a measure of water's ability to neutralize or buffer acid. If it is too high, the pH of the water cannot be adjusted with a floral preservative. Alkalinity makes the floral preservatives ineffective since the acidifiers in them may be “buffered out” or neutralized by the alkalinity of the water. To make the floral preservative more effective, an acid like citric acid should be added instead of more floral preservative. Alkalinity is measured in mg/liter $CaCO_3$ equilivalents or parts per million (ppm).

Water with less than 100 mg/liter $CaCO_3$ equilivalents or ppm is best.

Hardness

Hardness often is used interchangeably with alkalinity but it is different. It measures the positive ion salts in the water—magnesium and calcium. High levels cause burning of the leaves and petals and slow water uptake by the flowers. The standard practice to decrease water hardness is to soften it by exchanging the magnesium and calcium ions with sodium ions. Sodium, though, is more toxic to flowers than calcium and magnesium. This method of decreasing water hardness should not be used for cut flowers unless the water is then treated with a reverse osmosis system after "softening."

TABLE 1. Toxic Soluble Salt Levels for Selected Flowers

Flower	Toxic Soluble Salt Level
Glads	700 ppm
Roses	200 ppm
Mums	200 ppm
Carnations	200 ppm

Other Water Quality Problems

Fluoride is a specific ion that can cause problems. It often is added to municipal water supplies to prevent tooth decay in humans. Flowers in the lily family and other monocots are more sensitive to fluoride than others. Fluoride toxicity is more of a problem at a lower pH, which is best for holding flowers. Following, are flowers more sensitive to fluoride.

TABLE 2. Fluoride Sensitivity for Select Flowers

Flower	Toxic Level
Freesias	1 ppm
Gladiolus	1 ppm
Gerberas	1 ppm
Mums	5 ppm
Snapdragon	5 ppm
Roses	5 ppm

Floral Preservatives

Floral preservatives often are formulated to remedy low water quality problems. pH adjustors are included to lower the pH to the optimum, and more acid is added to deal with "hard" water. Sometimes, the soluble salt content, fluoride levels, hardness, and alkalinity are so bad the florist will need to obtain a reverse osmosis, deionizing or distillation system to purify their water. Pure water has no contaminants, no soluble salts, no fluoride, and no buffering effect so floral preservative pH adjustors work well.

Water Testing

Florists need to have their water tested by an independent water testing laboratory to determine the problems and how to remedy them. Many water "conditioning" companies that sell water purifying equipment have laboratories. Consult the local yellow pages or call the local county K-State Research and Extension office for the nearest water testing laboratory. Some floral preservative companies conduct water testing—Floralife of Waterboro, South Carolina, conducts water testing and has a line of products for various water qualities.

Florists should request testing on alkalinity, hardness, pH, total dissolved salts/solids and fluoride. Let the water run a few minutes before taking a sample of 8 ounces or so, in a clean container. The laboratory may have sample bottles, too. Florists also should send a water sample with their floral preservative prepared in it.

TABLE 3. Sample water testing report. This is a water sample without floral preservative. Comments are noted beside each water quality component. Most water laboratories do not have recommendations for florists—the florist will need to interpret them using guidelines in this publication.

SAMPLE Water Testing Results
ABC Water Laboratory
Anywhere, KS

Sample #	9999	Date Received	9/8/99
Sample	Water Sample	Date Reported	9/11/99
		Fee	$10.00

ABC Florist
Everywhere, KS

Alkalinity	220 mg/l	***note: This level is too high***
Fluoride	0.60 mg/l	***note: This level is acceptable***
Hardness	410 mg/l	
pH	7.35	***note: This level is too high***
Total Dissolved Salts (TDS)	980 mg/l	

TABLE 4. Results of water tests on four different water samples before and after adding a standard floral preservative. First, check the alkalinity recommendation—high alkalinity usually means it will be hard to adjust the pH. Information in this table was provided by Floralife, Inc.

	pH	**TDS mg/l**	**Alkalinity mg/l**	**Hardiness mg/l**
Sample #1				
Before	7.60	1217	400	360
After	6.60	1524	240	440

Comments: For this water sample, the standard floral preservative did not lower the pH and the alkalinity and hardness remained high. The addition of extra acid and the use of a special floral preservative for "hard" water might not work. A water purification system should be considered.

	pH	**TDS mg/l**	**Alkalinity mg/l**	**Hardiness mg/l**
Sample #2				
Before	7.77	570	220	80
After	6.56	837	180	220

Comments: For the water sample, the standard floral preservative did not lower the pH and alkalinity to an acceptable level. An addition of extra acid to the water or the use of a floral preservative specially formulated for "hard" water should help.

	pH	**TDS mg/l**	**Alkalinity mg/l**	**Hardiness mg/l**
Sample #3				
Before	8.28	613	120	160
After	4.54	504	40	140

Comments: For this water sample, the standard floral preservative is adequate. The pH is lowered apprecia-bly to the acceptable level. This was due to the fact that the lower alkalinity and hardness of the water enabled the pH adjusters to work effectively.

	pH	**TDS mg/l**	**Alkalinity mg/l**	**Hardiness mg/l**
Sample #4				
Before	5.97	90	40	60
After	4.33	336	20	180

Comments: For this water sample, the standard floral preservative is adequate. The changes in alkalinity, hardness and TDS are acceptable. The increase in TDS is due to the addition of sucrose as the energy source in the floral preservative.

More Information

The number scale for pH is 1 to 14, which is the negative log of the hydrogen ion concentration in a solution. A solution with a pH of 14 has 1 x 10^{-14} hydrogen ions per liter of solution.

Alkalinity measures the negative ion salts in water. It is measured as mg/liter Calcium Carbonate, $CaCO_3$ equilivalents or ppm Calcium Carbonate, $CaCO_3$. The active ions are bicarbonate, HCO_3^-; carbonate, $CO_3^=$; and hydroxide, $OH^=$.

Hardness measures the positive ion salts in water. They usually are calcium Ca^{+2} and magnesium Mg^{+2}. It usually is measured in parts per million, ppm. Most Kansas water sources have a high level of hardness because Kansas soils are high in calcium and magnesium.

When water is tested, the results usually will show a total soluble salts or total dissolved salts (TDS) number. This usually is expressed as ppm (parts per million) or mg/liter, or microsiemans. These units are not interchangeable.

1 ppm = 1 mg/liter = 700 microsiemans

References

Nowak, J. and R.M. Rudnicki, 1990. *Postharvest Handling and Storage of Cut Flowers, Florist Greens, and Potted Plants*. Timber Press, Portland OR-USA.

Special Thanks to

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2436 March 2000

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File code: Horticulture—11 (commercial)