FEEDING YOUR ORCHIDS

Part 2 *Preparing the Table*

by Douglas B. Harris

Orchids, whether grown in a green house, on a window seal, under lights, in a shaded lath house, or in a basement-all have a commonality besides the need to control humidity, temperature, light levels, and air flows. These plants must have water given to them, and in the watering process, the occasional feeding of fertilizer of some sort.

In this second of a series, we will investigate the concentrations of fertilizer in common use. There are many opinions about the quality of given fertilizers, which is the 'best' to use, and all sorts of advice given to novice growers like myself. To us 'beginners', the discussions we hear or read tend to be mysterious and ambiguous, largely because we have little or no knowledge about such things like concentrations, solution strengths, PPM, CEC and more terms of this nature. But we know that we must feed our plants, that we come to understand quickly.

Several scientific studies on fertilizers have been conducted, both by those who furnish fertilizer products, and by many bodies in government, agriculture, and educational pursuits. These too tend to be highly technical and hard for we hobbyists to understand (unless you happen to be both a horticulturist/chemist AND also an orchid hobbyist). So, based on my poor knowledge of the field, I hope to introduce some simple terms, or at least some easier explanations of some of the technical jargon found in use.

We beginners want some rather simple answers to often difficult questions. So, based on my very limited experience, I shall try to answer the questions, or extract answers from articles and papers that explain enough so we can understand.

When fertilizer is mixed in water, it hopefully dissolves. Once dissolved, it is said to be in solution. That's like saying 'sweetened tea' that is poured over ice is in solution with the sugar. Scientists insist on using terms like PPM and grams per liter to describe solution strength. To a beginner, they might as well be speaking in a foreign language. But what they're trying to say, in simple terms, is how much fertilizer is mixed in the water to achieve its desired strength. PPM is 'parts per million' and in like form, 'grams per liter' is the weight of fertilizer mixed in a container of water that is a little more than a quart. To us, neither still makes sense. We use terms like ounces, teaspoons, cups, quarts and gallons. So we need a conversion, or at least a translation into Texas' version of speaking.

So here goes. If I take a level teaspoon of a substance like sugar and dissolve it in a gallon pitcher of tea, the tea isn't very sweet. At least to my taste buds. But that's for starters. Six teaspoons (or two tablespoons) holds about one ounce of sugar.

If I use one teaspoon of fertilizer in a gallon of water, I've added about one-sixth of an ounce of fertilizer, assuming that six teaspoons holds one ounce of the dry fertilizer. That I can figure. But how strong is this orchid tea I've mixed?

When the bag, bottle or whatever container gives you the percentage breakdown such as 10% N, 10% P_2O_5, and 10% K_2O, the amount of each contained in one ounce is 1/10th of an ounce, or the equivalent. A gallon of pure water which is around 68 to 70 degrees in temperature weighs 8.3757 pounds, or roughly 134 ounces. If I put 1/10th of an ounce of nitrogen as a part of a one ounce of the fertilizer compound into an empty gallon container, then add enough water to fill the container to the gallon mark, I have 1/10 of an ounce nitrogen divided by 133 ounces of water and one ounce of the compound, making the total ounces 134. The nitrogen is then 1 part in 1,340 parts total. In terms of parts per million, that's 1000 parts of nitrogen in 1,340,000 parts, or 746.3 parts in a million parts. Let's round that off to 750 parts per million.

In order to set up how many ounces of a particular fertilizer must be added to a 100 gallon bulk tank, the fertilizer folks and the smart guys developed a Universal number of 75. Multiple that by the percentage of say nitrogen (nitrogen is THE '**normal'** component usually selected) and you get a "guide" number. For a 10% nitrogen fertilizer, we would use 0.10 (10% expressed as a decimal) times 75, and get a Guide number of 7.5. If you want to have a solution strength of 100 PPM of nitrogen, divide 100 by the Guide number and you get the number of ounces of the 10% N fertilizer required in 100 gallons of water.

In our case here, we would get 100/7.5, or 13.33 ounces. For 1 gallon, we would use 0.1333 ounces since our container is only 1/100th the size. Converting 0.1333 ounces x 6 teaspoons per ounce gives us 0.8 teaspoon, a little over 3/4 of one teaspoon. So not much is required, you see.

On the matter of grams per liter (gm/liter), the conversion is simple. Since a liter contains one thousand milliliters, water at our reference temperature weighs one gram for each milliliter or cubic centimeter. Therefore, knowing that a solution has a strength of 200 PPM of nitrogen, the value expressed in gm/liter is obtained by dividing PPM by 1000, or 0.2 gm/liter. To get PPM from gm/liter, multiply by 1000. Now we can utilize articles on fertilizers and solution strengths, or at least, understand what the article is saying.

Okay, what should we do if we want a different ratio? Or have a fertilizer with different ratios of the NPK components? Let someone who can do numbers on a computer provide us a chart. And make it for a one gallon tank, and for those who might use a 100 gallon tank, expand the tabled values. Give answers so that you can use ounces/gallon, teaspoons/gallon, Tablespoons/volume, (some measurements you use). In fact, combine that with a means of determining how much to put in a conentrate for use with a proportioner device.

Done! See the chart at the end of this article. You might want to keep the chart handy.

Should you desire to be even more precise, you can use a device used to measure dissolved solids or salts contained in water. You can usually find these as a test kit for checking water hardness in a swimming pool or hot tub. And you'll probably find the stuff required to check the pH (how acidious or alkaline) the water is. First, check the water itself for the hardness. If you find it to be somewhere around 70 to 100, you probably have the basic water from a tap. The amount of fertilizer you add increases the hardness in the water, and can be used to determine a rather exact solution strength. For example, an amount of fertilizer in 1/8 teaspoon would increase the overall hardness index by 16 points when mixed in a gallon of tap water, or a level teaspoon by 124.3 points.

Then, if you check how acid or alkaline the solution is, the best pH seems to fall in the range of 5.6 to 6.0 pH, which is slightly acid. (Pure distilled water has a pH of 7.0). You can adjust the pH by dripping a few drops of vinegar in and retest after mixing well if the pH is above 6.0, or add a small amount of dissolved sodium bicarb to raise pH if it is well below say 5.0 pH. Most tap water here along the coast tends to be slightly alkaline, for your information.

Test a small container of the tap water mixed with your fertilizer for its pH, and get an idea of how much is required to adjust that container's content to the appropriate pH range. Since a pint is 1/8th of a gallon, you would use 8 times that amount in the gallon container. If your container is a cup, you'll need 16 times that amount to adjust the gallon to the same pH. Awesome on first try, but very useful and satisfactory when you get the hang of it.

Now, on to the subject of strength of the solution we desire, or that our orchids prefer. First of all, orchids growing out in the jungle get very, very diluted mixtures of nutrients dissolved in rain water. As a rule, the mixture has nitrogen somewhere in the range of 5 to 15 parts per million. Maybe that's why they seem to take forever to grow big enough to bloom, then wait until conditions of light, temperature and other factors are right, and what they receive in nutrients over a long period can be stored in the plants to provide enough energy to bloom. The point is, the wild orchid doesn't eat heartily, and just popping it in new conditions like a green house and force feeding it with high concentrations that it isn't used to getting may be harmful.

A strong fertilizer mixture may burn the roots, build up high concentrations of the nutrients so that the leaves start dying at their tips, or harm the plant in other ways. So consider, less is good, TOO MUCH kills or harms the plant.

A number of species of orchids do not adapt to having too much of a good thing forced down their gullet, or should one say, up their roots? Paphs, phrags, and others are notorious for having problems with high concentrations in feedings. Cattletas are notably considered light feeders as well. If an orchid culture sheet indicates using one-quarter or one-half strength, it is for a reason.

Studies indicate that using higher nitrogen levels may only be done when adaptation is made to higher light levels, over a relatively long period of time, possibly even through several generations of an orchid. Sudden increases of nitrogen can cause spindly growths if sufficient light levels aren't increased as well. Again, realize that too much increase in light intensity will burn the leaves of your orchid who has spent most of its life in 70% or less sunlight, due to shade cloth in the green house, or leaves of trees overhead in the natural growing conditions in the wild. If you don't believe this axiom, test it by setting a phalaenopsis plant in full sunshine during a Houston summer and watch the leaves get sunburned. Quickly.

When you buy an orchid, feel free to ask about fertilizer strengths that should be used, based on the vendor's knowledge, or on more experienced growers who probably fried an orchid or 10 before learning their lesson the hard way. If you don't know, ask people until you're satisfied that you can give your new baby it's preferred food in measures that it can use safely, along with its preferred light level. Overfeeding is a waste of your money, both in the cost of plants you have to replace and the cost of wasted fertilizer. If you are going to make a mistake in feeding, err on the side of too little fertilizer-the plant will live. Too much and it will probably die.

For the beginner, a good rule of thumb is to use one-quarter or one-half maximum of the strength recommended on the fertilizer container. If it says add 1 teaspoon on the container to a gallon of water, use ½ teaspoon or $^1/_4$ teaspoon in a gallon for starters. Most of the recommended strengths, or the amount stated for you to use are based the concentration of nitrogen to be used.

A word about what nitrogen forms are used in fertilizers: **Urea**, an organic form of nitrogen found in many fertilizers, requires bacterial or fungal action in soil or media to break it down so plants can absorb it. The process can take up to 2 months, and requires that moisture be present during that entire period. In orchid media commonly used like bark or peat moss-based media, the bacteria are not there in large enough numbers until the media is almost deteriorated into a mush.

Consequently, in my own humble opinion, urea is of little use to most orchids, and usually gets flushed out of the media before it can be absorbed by plants. Urea is a major component in the salts that can build up in your media since it is left there as water evaporates, and is the principal reason that pure water flushing is recommended monthly. According to a number of experienced orchidists, (I actually asked the question!) the urea should not be con-sidered in calculating nitrogen strength in solutions, and they strongly recommend fertilizers with little or no urea in them. Only use urea in pots where the media remains constantly moist, or wet. If your pot is set in a saucer where a level of water is always present, urea can be used, but solution strength of nitrogen will increase in the media as the urea is converted to ammonium nitrate. So this technique still requires emptying the saucer, flushing the media and refilling the saucer with just water. Some orchidists grow phragmipediums in this manner.

While plants in non-soil media can readily absorb the **nitrate** form almost instantly, and the **nitrite** nitrogen forms within 2 to 3 days, the nitrogen furnished as ***urea*** only tends to dry on the outside of roots or coats the media surfaces, hopefully only until the next watering washes it off and out of the pot. Why pay for stuff that the plant can't use? Particularly if there's a good possibilty that it may be harmful?

In Part 3 in this series, we will address the specific levels of solutions for specific orchid genera. Based on the experience of some knowledgeable growers and fellow members that I've asked like Joe Fields, Marvin and Renee' Gerber, and Bill Tippit plus info from a couple of recent studies by Dr. Yin-Tung Wang, who is also a member of HOS, we'll try to get some really good information into your hands.

References:

Rebecca Tyson Northern, "Home Orchid Growing," 3rd ed., 1970

Paul Gibson, HOS member, charts for proportioners, published in the HOS Member Directory, several years including 1999

Rod Venger, "Basic Orchid Culture", CD 1999, available from Venger's Orchids, http://www.vengers.com

University of Hawaii , Hort. Dept., various studies and published papers on orchid nutrition, referred by Earl Dunn

A Chart to Calculate Solution Strength in One Gallon, 100 Gallon, and in Proportioning Devices

Prepared by Doug Harris, Houston Orchid Society -

Using Ounce/Gallon

	Percentage of fertilizer component in fertilizer compound:						
PPM desired	10%	15%	20%	30%	40%	50%	55%
50 PPM	0.067	0.044	0.033	0.022	0.017	0.013	0.012
65 PPM	0.087	0.058	0.043	0.029	0.022	0.017	0.016
100 PPM	0.133	0.089	0.067	0.044	0.033	0.027	0.024
150 PPM	0.200	0.133	0.100	0.067	0.050	0.040	0.036
200 PPM	0.267	0.178	0.133	0.089	0.067	0.053	0.049

Using Ounces/100 Gallons

	Percentage of fertilizer component in fertilizer compound:						
PPM desired	10%	15%	20%	30%	40%	50%	55%
50 PPM	6.67	4.44	3.33	2.22	1.67	1.33	1.21
100 PPM	13.33	8.89	6.67	4.44	3.33	2.67	2.42
150 PPM	20.00	13.33	10.00	6.67	5.00	4.00	3.64
200 PPM	26.67	17.78	13.33	8.89	6.67	5.33	4.85

Using teaspoons/Gallon

	Percentage of fertilizer component in fertilizer compound:						
PPM desired	10%	15%	20%	30%	40%	50%	55%
50 PPM	3/8	17/54	3/16	1/8	3/32	5/64	1/16
100 PPM	25/32	17/32	25/64	17/64	3/16	5/32	9/64
150 PPM	13/16	51/64	19/32	25/64	19/64	15/64	7/32
200 PPM	1 19/32	1 1/16	51/64	17/32	25/64	5/16	9/32

Using teaspoons/100 Gallons

	Percentage of fertilizer component in fertilizer compound:						
PPM desired	10%	15%	20%	30%	40%	50%	55%
50 PPM	40.00	26.67	20.00	13.33	10.00	8.00	7.27
100 PPM	80.00	53.33	40.00	26.67	20.00	16.00	14.55
150 PPM	120.0	80.00	60.00	40.00	30.00	24.00	21.82
200 PPM	160.0	106.7	80.00	53.33	40.00	32.00	29.09
	Using Tablepoons/100 Gallons						
50 PPM	13.33	8.89	6.67	4.44	3.33	2.67	2.42
100 PPM	26.67	17.78	13.33	8.89	6.67	5.33	4.85
150 PPM	40.00	26.67	20.00	13.33	10.00	8.00	7.27
200 PPM	53.33	35.56	26.67	17.78	13.33	10.67	9.70

See next page for examples.

To convert PPM to grams/liter, divide PPM by 1000.
To convert grams/liter to PPM, multiply g/l by 1000.

Example 1: Say you are using a one gallon sprayer, and want 65 PPM of nitrogen in your solution.

You are using a 20-20-20 fertilizer (powdered water soluable).
You look at the "teaspoons per gallon" group and find "1/4" teaspoon under the 20% column on the 65 PPM line (or row, if you prefer). Add that of fertilizer into the tank, then fill with water to the one gallon mark. Ta-Daaaa! You have your desired solution.

Example 2: For a 100 gallon bulk tank, you desire a 150 PPM nitrogen mix to put on your phals.
Your fertilizer is a 15N-56P-12K liquid. Using the ounces/100 gallon group, you find 13.33 ounces/100 gallons under the 15% column on the 150 PPM row. Put that amount in the bulk tank and fill to the 100 gallon mark.

Example 3: To use with a proportioner device, whose mix tank is say one gallon with a final proportion ratio of 1:200, multiply the desired PPM measurement by 200, or add double the amount required for a 100 gallon bulk tank, put that amount in your concentrate container, fill it with water, then spray.

Example 4: To use a small hose end mixing or proportioner whose volume is 1 quart (1/4 gallon), multiply the desired mixture measurement by 1/4 times the ratio of 15. If you want a 200 PPM final spray, using a 20-20-20 fertilizer, FIND the amount to add for a gallon of concentrate, either in oz/gal or tsp/gal.
Let's use tsp/gal here. You'd find 51/64 teaspoon. Multiply that by 1/4 x 15. Use 51/64 x 1/4 x 15. The answer comes out to 765/256 or 2.988 tsp. Add 3 teaspoons to the container, fill to the quart line, then spray.

Note from Doug Harris - Example 4 has been corrected. Thanks is expressed to Dr. James D. Brasch, Ph.D (retired) of McMaster University, Canada who used this series in his classes.