The Atlanta Orchid Society Bulletin

Affiliated with the American Orchid Society, the Orchid Digest Corporation and the Mid-America Orchid Congress
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Newsletter Editor: Danny Lentz **Society Librarian: Elaine Jacobson**

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SEPTEMBER EVENTS

The Meeting:

8:00 PM Monday, September 13 at Atlanta Botanical Garden - Day Hall
Speaker: Mr. Ervin Granier

Ervin Granier from Louisiana will be our speaker for September. Ervin will talk about growing specimen plants of Cattleya and Dendrobium using slides from his AOS awarded plants to demonstrate his knowledge and skill. Some of you have probably met Ervin as he periodically brings plants to the Atlanta judging center and is well-known for breeding blue Cattleyas. Because of his numerous AOS awards, you're likely to hear a lot of abbreviations, such as CCM, CCE, HCC, AM, and maybe even an FCC. Look for an explanation of these awards elsewhere in this bulletin. He will bring plants to sell.

Greengrowers: Peach State Orchids, 920 Homer Rd., Woodstock, GA 30188
Saturday September 18 from 9:00 to 3:00
Bill will have special sale prices for Greengrowers. Come out and visit the largest orchid nursery in our area. Peach State has many thousands of orchids available from a large number of genera. You can get directions from the Peach State website at www.peachstateorchids.com/contact.htm, or call Bill at (770) 751-8770.

Inside This Issue

COLLECTOR'S ITEM

Tetramicra canaliculata (Aubl) Urb

Tet-ra-MY-kra can-ah-lik-u-LAY-ta

Tribe: Epidendreae

Subtribe: Laeliinae

Etymology: Greek *tetra*, fourfold; *micros*, small; referring to the four small compartments in the anther cap

The genus *Tetramicra* comprises some 14 species of scrambling terrestrials distributed from south Florida throughout the Caribbean. Plants of this genus are characterized as having either very small or absent pseudobulbs separated by elongated rhizomes, carrying from one to three fleshy stiff leaves. The inflorescences are erect, unbranched and carry several to many flowers opening one or two at a time. Although individual flowers do not last long, the successive flowering habit of these species greatly lengthens the blooming period. Most species prefer limestone outcroppings or sandy/rocky soils derived from sandstone.

Tertramicra canaliculata has been reported from near Jupiter, Florida southward to Hispaniola. The one- to three-leaved growths are separated by up to 8 cm (about 3") along the wiry rhizome. Leaves are fleshy, semiterete, linear to somewhat falcate, and reach as much as 20 cm (about 8") in length. Inflorescences of robust clones can reach 60 cm (2 feet) in length and carry flowers up to 5 cm (2") in natural spread.

Tetramicra canaliculata is closely related to *Tetramicra elegans*, and it can be somewhat difficult to distinguish between the two. In cultivation *Tetramicra canaliculata* flowers from late spring to summer while *Tetramicra elegans* typically flowers from January to March.

In addition to the typically striped flowers, at least one alba clone with flowers without a trace of yellow has been observed as well as pink and blue types that lack the dark veining typical of the species. Plants adapt to cultivation reasonably well once established on a cork mount, piece of driftwood, or in pans of sandy/rocky medium if given a very sunny, warm location and little water once established.

Photo courtesy of Andy's Orchids

Events Out and About

September
Saturday, 9/11. American Orchid Society monthly judging, Atlanta Center, 2 pm, ABG basement workshop. If entering plants, please arrive before 1:30 pm to allow time for research and paperwork.

Monday, 9/13. Atlanta Orchid Society monthly meeting, ABG, Day Hall. Ervin Granier will talk about growing specimen plants of Cattleya and Dendrobium.

Friday, 9/17 to Sunday 9/19. Orchid Show and Mid-America Meeting. Sponsored by the Orchid Society of Middle Tennessee & the Mid-America Orchid Congress, Hilton Suites Hotel, 121 4th Ave. S, Nashville, TN. Contact: John Cranshaw, 3520 Trimble Rd., Nashville, TN 37215; (615) 292-7886; ajartist@comcast.net. For more information and a listing of speakers for the fall Mid-America, go to this website: http://www.midamericanorchids.org/our_next_meeting.htm

Saturday, 9/18. Greengrowers at Peach State Orchids from 9:00 to 3:00

Saturday, 9/25. Orchid Show. Birmingham Botanical Gardens, sponsored by the Alabama Orchid Society, Birmingham, AL. Show Chair: Sally Mickle, 205-823-2810.

October
Saturday, 10/9. American Orchid Society monthly judging, Atlanta Center, 2 pm, ABG basement workshop. If entering plants, please arrive before 1:30 pm to allow time for research and paperwork.

Wednesday, 10/6 to Sunday, 10/10. American Orchid Society members meeting in Denver, Colorado. Pre-registration is recommended. For more information, visit the DOS website at http://denverorchidsociety.org/society_events.html

Monday, 10/11. Atlanta Orchid Society monthly meeting, ABG, Day Hall, 8 p.m. Howard Gunn from California will speak on Bulbophyllums.

MINUTES OF THE AUGUST MEETING

- The August 9th meeting of the Atlanta Orchid Society was brought to order in Day Hall of the Atlanta Botanical Garden by President E.D.Dessasau. The minutes of the July meeting were accepted as published.
- Roy Harrow gave the details about attending the upcoming plant auction at his home.
- An announcement was made about the need for Docents at the Orchid House at the Atlanta Botanical Gardens. Please contact volunteer coordinator Mary Woehrel at 404.591.1548 if you are interested.
- Announcements were made about the following upcoming shows and meetings (see calendar for details):
  Mid-America Orchid Congress, Nashville in Sept.
  Alabama Orchid Society Show, Birmingham in Sept.
  AOS Members Meeting, Denver, Oct.
  AOS Judging Atlanta Center, monthly.
- A complete calendar of up coming events can be seen at www.aos.org
- We Welcomed a new member, Gregg Daugherty
- An announcement was made about the upcoming Board meeting August 14, 2004 at 10:00am in the downstairs classroom of Atlanta Botanical Gardens before the Atlanta Orchid Judging.
- Mark Reinke did a wonderful job presenting this month's show table results. The judging teams were organized by Jeff Whitfield in the absence of Rob Rinn. A very BIG Thanks ! to both of you.
- Fred Missbach did a wonderful job getting our speaker to the meeting and introducing him.
- Our speaker for the evening Mr. Norman Fang of Norman's Orchids gave a wonderful state of the art presentation on Harlequin Phalaenopsis.
- The raffle was held. Raffle plants were donated by Mark Reinke and Gary Collier and others I'm sure. Please remember to leave your name on the list when you donate ORCHID PLANTS for the raffle.
- I would like to give a very BIG THANK YOU !!! to everyone that stepped in and helped make the meeting run smoothly. This is very much appreciated by your President. Also, a big thank you to everyone for bringing your plants for all to see. To me this makes the meeting.
- Without further business the meeting was adjourned for the evening.

Respectfully Submitted,
E.D. Dessasau

AUGUST 2004 EXHIBITION TABLE AWARDS

with notes by Ron McHatton

Cattleya maxima

CLASS 1: CATTLEYA ALLIANCE

Blue	*Cattleya maxima*	Lyda
Red	*Pot.* Hoku Gem 'Super Spots' AM/AOS	Emerson
White	*Cattleya* Fabia	Missbach

(Blue) ***Cattleya maxima* :** This is an unusual time to see *C. maxima* in flower. Normally, the lowland types tend to be in peak flower during late February and early March, while the upland types are usually at their peak in October and November. That notwithstanding, this is a beautiful example of this distinctive species. The name is in reference to the exceptional size of the lowland plants and not to size of flower. A well-grown lowland clone can be over 2 feet tall and carry as many as 12-15 flowers up to 5" across. Upland clones usually carry only 3-5 flowers.

Cym. finlaysonianum

CLASS 2: CYMBIDIUM

Blue	*Cym. finlaysonianum*	Dott
Red	*Cym.* Golden Elf 'Sundust' HCC/AOS	Lentz/Morgan

(Blue) ***Cymbidium finlaysonianum* :** This plant was entered as *Cymbidium aliciae*. *Cymbidium aliciae* is a member of the section of the genus that contains *Cym. cyperifolium* (the former has been at various times considered a synonym) and *Cym. sinense*. This section is characterized by grass-like, thin foliage that comes to a sharp, symmetrical point and sharply erect inflorescences. The plant exhibited is most likely *Cymbidium finlaysonianum*. This species is distinguished by its coarse habit, thick leathery leaves that have asymmetrical tips and thin, whip-like pendulous inflorescences. Other related species are *C. aloifolium*, *bicolor*, *rectum*, and *atropurpureum*, none with a similar flower. *Cymbidium finlaysonianum* is widespread throughout tropical southeast Asia at elevations below 300m making these plants remarkably warm growing.

Den. aberrans

CLASS 3: DENDROBIUM

Blue	*Den. aberrans*	Gilmore

(Blue) ***Dendrobium aberrans* :** This delightful little species is the smallest member of section *Latouria*. This section also contains *D. spectabile*, one of the largest in the genus. *Dendrobium aberrans* (meaning deviate) is native to the eastern part of Papua New Guinea. It is a moderate elevation species (300-1900m) and its habitat experiences year-round high rainfall and humidity. The species is rather adaptable, thriving in intermediate to cool conditions. Interestingly, this is also flowering at an unusual time. While flowering can occur at any time of the year, peak flowering is typically during the winter months.

Encyclia (*gracilis x alata*)

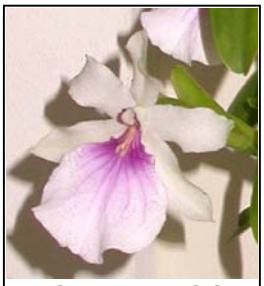
CLASS 4: EPIDENDRUM

Blue	*Encyclia* (*gracilis* x *alata*)	Collier/Reinke
Red	*Prosthechea prismatocarpa*	Collier/Reinke
White	*Epi. rigidum*	Hallberg

(Blue) ***Encyclia* (*gracilis x alata*) :** *Encyclia alata* has proven to be such a dominant parent that it often completely overwhelms the other parent. In this case, it has definitely dominated the flower shape but not the color (*E. alata* is basically a yellow flower overlaid at the sepal and petal tips with red-brown). While I didn't see the plant, most clones of this hybrid I've seen have rather elongated, narrow pseudobulbs (almost spindle-shaped) inherited from the *E. gracilis* parent rather than the distinctly egg-shaped ones typical of other Encyclias.

(Red) ***Prosthechea prismatocarpa* :** This plant was entered as *Encyclia prismatocarpa*. It is fairly well accepted now that this species belongs in the genus *Prosthechea*. This genus is not new, being described first in 1838; however it wasn't until Wesley Higgins resurrected it in 1998

that it appears likely to stick. The genus includes the former *Encyclia* species *fragrans, bacculus, cochleata,* and some 94 other similar species. Also, for those of you who have recently purchased Carl Withner's new book The Cattleya Species and their Relatives, Number 6: Those Dubious Epidendrums, Dr. Withner has proposed a new genus *Ponarica* that would include this species as well as a number of others. At the present time this revision is not generally accepted.



Miltonia spectabilis

CLASS 5: ONCIDIUM ALLIANCE

Blue	*Miltonia spectabilis*	Hallberg
Red	*Trichocentrum microchilum*	Aberson
White	*Aliceara* Sheila Mobley 'Cathy' HCC/AOS	Brinton/Park

(Red) ***Trichocentrum microchilum* :** This species was entered as *Oncidium microchilum.* It is now generally accepted that all of the mule-ear Oncidiums belong in the genus *Trichocentrum* along with the miniature species traditionally circumscribed. A number of new combinations have been accepted recently and include *Cyrtochilum, Caucaea, Chelyorchids, Rhynchostele, Otoglossum, Palumbrina, Miltonioides, Zelenkoa,* and others. If you are interested in where all those "Oncidiums" went, please see the article on orchid nomenclature in next month's newsletter.

Phrag. Lutz Rollke

CLASS 6: CYPRIPEDIUM ALLIANCE

Blue	*Phrag.* Lutz Rollke	Brinton/Park
Red	*Phrag.* Praying Mantis	Brannon
White	*Paph. superbiens*	Lentz/Morgan

(Blue) ***Phragmipedium* Lutz Rollke :** This is a great example of this cross. The dorsal sepal is unusually flat, giving the flower a wonderfully balanced presentation. The cross is *Phrag.* (*besseae x boissierianum*) and its unfortunate that the RHS does not list varietal forms used as parents. Many of the plants we see are actually seedlings from a cross using a yellow form of *P. besseae* giving the resulting hybrids that wonderful yellow base color.

Phal. buyssoniana

CLASS 7: PHALAENOPSIS ALLIANCE

Blue	*Phal.* (*Doritis*) *buyssoniana*	Whitfield
Red	*Phal.* (*Doritis*) *pulcherrima fma. rosea*	Hallberg
White	*Dtps.* (*Phal.* Golden Peoker x *Dtps.* Inferno)	Grzesik

(Blue) ***Phalaenopsis buyssoniana* :** This was entered as *Doritis boisieranum.* First, it is now generally accepted that *Doritis* species are actually terrestrial *Phalaenopsis*. The correct spelling of the species name is *buyssoniana* (named to honor Le Comte Francois Du Buysson, a French horticulturist). In the past there has been significant speculation that this species is a polyploid form of *pulcherrima.* Recently, as colchicine treated plants of *pulcherrima* have been flowered, it has become clear that the two species are distinct. Unfortunately the RHS does not recognize *buyssoniana* and *pulcherrima* as distinct species, continuing to use only *pulcherrima.*

Ascda. Mem. Louis Hatos

CLASS 8: VANDACEOUS ALLIANCE

Blue	*Ascda.* Mem. Louis Hatos	Hansen
Red	*Neostylis* Lou Sneary	Dott
White	*Ang.* Lemforde White Beautry	Gilmore

(Blue) ***Ascocenda* Memoria Louis Hatos :** This plant was entered as Ascocenda Memoria Louis Hatto. *Vanda tessellata* is clearly one of the parents. I have recently seen a number of plants of similar breeding lines (one parent *V. tessellata* and the other a complex, full-formed *Ascocenda* or straight *Vanda*). As is the case here, *V. tessellata* opens the form, increases the substance and imparts varying degrees of tessellation or reticulation to the flower. In this case the base color of *V. tessellata* is also dominant,

suppressing the blue or violet tones from *Ascda.* John De Biase. One added benefit of these crosses is that the fragrance of *V. tessellata* usually comes through in its hybrids.

Stanhopea Penelope

CLASS 9: MISCELLANEOUS OTHER GENERA

Blue	*Stanhopea* Penelope	Thurner
Red	*Masdevallia herradurae*	Jacobson
White	*Habenaria rhodocheila* (orange)	Gilmore

(Blue) ***Stanhopea* Penelope :** I seriously doubt that this is actually *Stanhopea* Penelope. The cross is *Stanhopea* (*ecornuta x oculata*). The former parent is a member of a distinctive group of species with non-existent to very tiny horns on the lip epichile. In all hybrids I've seen of this group of species, the very reduced horns are dominant giving rise to a lip with a pair of very tiny horns. Nonetheless, this is a beautiful example of the genus!

Report of the 3rd Quarter Board of Directors Meeting

The Board met on August 14, 2004 at 10:00AM at the Atlanta Judging Center's meeting space in the Classroom of ABG. Board members in attendance were: David Mellard, Scott Smith, Frank Decaminada, Mark Reinke, Jeff Whitfield, and Evan D. Dessasau. Visitors in attendance were: Danny Lentz.

- The upcoming AtOS elections were discussed. The board voted to let the president pick two members of the society to be on the nominating committee.
- Advertising in the AtOS newsletter was discussed. It was decided that the newsletter editor will have discretion to set the amount of advertising allowed in each issue of the newsletter, and whether to accept full page ads. Advertising rates as determined at the January board meeting are: 1/4 page $10, 1/2 page $20, full page $40 per issue.
- An announcement should be made to the membership to acknowledge Danny Lentz and Dianne Morgan as the new Orchid Class advisors for the 2005 Southeastern Flower Show.
- The treasurer reported that the society is within its budget for the year so far.
- The treasurer reported that the AtOS auction in June raised $1311.75.
- The board discussed the auction that Roy is holding Aug. 21.
- The next board meeting will take place at 12:00PM Dec. 4 at the home of Scott Smith.

Respectfully submitted ,
Evan D. Dessasau,III

JOIN THE ORCHID DIGEST CORPORATION

Don't let the name fool you, the Orchid Digest is a non-profit membership-based organization dedicated to orchids. Designed to appeal to the mid-range to advanced grower nothing beats the *Orchid Digest*. For just $32/year you get 4 issues of full-color, in-depth articles about orchids. The magazine is large format and the fourth issue of the year is always an extra-special issue devoted to a single genus.

For membership application forms contact Fred Missbach.

JOIN THE AMERICAN ORCHID SOCIETY

For $46.50/year, you reap the following benefits:

- 12 issues of *Orchids*, the Society's monthly full color magazine chock full of insightful articles and tempting ads for plants and supplies.
- 10% off on purchases from the Society's Bookstore and Orchid Emporium. Reduced or free admission to participating botanical gardens.

For a limited time, if you join for two years ($84) you will also get a $30 gift certificate (good on an order of $100 or more) at any one of 13 commercial growers who advertise in *Orchids.* **JOIN TODAY**. For information, contact Evan Dessasau.

Something to think about:

Roy Harrow submitted this item that he saw on the IPA internet bulletin:

The following are recommendations from "Lester W. Poole" <lwp@TNTIE.COM>

"Growers need to look at taking several steps now to instill confidence that their product is healthy. A number of these steps are as follows:

1. Test their tissue prior to initial propagation to insure it is viral free and refrain from propagating virused tissue.
2. The production lab should provide a certificate that the tissue is virus indexed and is free from the tested virus at the 'time' of release from the lab. This is in addition to the one done by the grower prior to lab production.
3. Growers need to observe cultural practices that insure that certified plant materials are maintained virus free. Product on bench for more than 12 months should be randomly tested at time of release.
4. Growers should also offer a guarantee that any certified plants that test positive within one year of purchase will be replaced with virus free product or offer a full refund of the purchase price upon return of the infected plant."

Report on Roy Harrow's Auction

We had about 20 buyers and about 8 sellers. The weather held off nicely. We sold about $500 worth of plants with the most expensive one going for about $18 and more than 10 went for $1. Most sold for between 3 and 5 dollars. We sold about $20 of society's plants so the total to the society was about $120. I'd like to thank Judy Bradley for helping make the greenhouse presentable and heading up the financials, Gerard Aberson for helping with the accounting, and Sal for taking over the grill when things got hectic. We gave away over 3 wheelbarrow loads of other plants in a free raffle format after the auction. We even had one person ask about taking the Black with white paws Cat-laya under the wheelbarrow. A good time was had by all.

Roy Harrow (770 763 2583)

The Atlanta Botanical Garden is looking for volunteers to work in the orchid greenhouses during the Chihuly exhibit, which goes through the fall. Hours are very flexible. Please contact Mary Woehrel at 404-591-1548.

Julie's Super Potato Delight

Julie Walkosky received several requests for this recipe at the recent AtOS Auction.

(makes 12-15 Servings)

2 lbs frozen hash browns (Publix) (thaw 30 minutes, won't be completely thawed)

mix well together:
1 cup diced onion
1 can cream of chicken soup
1 lb (16 oz.) sour cream (nonfat or reduced, Breakstone good also)
1 stick melted margarine
8 oz. grated sharp cheese
salt & pepper to taste

Fold in potatoes.
Put in greased 9" x 13" dish.
Bake 1 hour at 375 degrees

Please visit our web site at http://www.atlantaorchidsociety.org . If you have suggestions or, better yet, material to contribute to the site, contact Tom Kaschak at 678-474-9001

Remember that Tom is a volunteer also and will certainly appreciate the help.

To submit material for the newsletter, or to sign up for the email version of the newsletter, please contact Danny Lentz:

DBLGONGORA@BELLSOUTH.NET

MAIL TO: Danny Lentz
1045 Wordsworth Dr.
Roswell, GA 30075

The deadline for submissions is the 20th.

Understanding pH management and plant nutrition
Part 5: Choosing the "best" fertilizer

Bill Argo, Ph.D.
Blackmore Company, Tel: 800-874-8660, Int'l 734-483-8661, E-mail: bargo@blackmoreco.com
Originally printed in 2004 in the Journal of the International Phalaenopsis Alliance, Vol. 13 (4).

Over the last year, since the AOS article came out on MSU "Magic" fertilizer, I have been inundated with calls of people trying to get the fertilizer. Usually, I like to talk with them to get a little information so that I can recommend which of the fertilizers (there now are 4 formulas) will work best for their situation. In this last article of the series, I would like to answer several of the common questions that people are asking.

Q) My water alkalinity is 7.8, which fertilizer will work best?

A) Most often, when you hear that the alkalinity is 7.8, the person has actually measured the pH of the solution. Water pH and water alkalinity are not the same thing.

Water pH is a measure of the hydrogen ion concentration in the irrigation water, and will affect the solubility of chemicals and fertilizers in solution. However, in the range of water pH commonly measured in nature (between 5 and 8), there is only a minute amount of acid or base, not nearly enough to influence substrate pH.

In comparison, water alkalinity is a measure of the acid buffering capacity of the water. Because alkalinity is composed of bases (like bicarbonates, carbonates), the effect it has on substrate pH is similar to that of limestone. In addition, the concentration of base supplied by alkalinity commonly found in irrigation water is much higher than that supplied by pH alone. For these reasons, alkalinity (not pH) is the primary factor affecting substrate pH.

However, alkalinity can not be measured with a pH meter, and the pH of the solution will give you no idea how much alkalinity is in the water. In addition, the measurement of total alkalinity is not commonly done by municipal water companies or by water treatment companies. Instead, a water sample should be sent out to a commercial or university laboratory that specializes in testing for greenhouses or nurseries. The cost for these types of tests will range from $25 to over $100 per sample, so it pays to shop around.

The reason that knowing what the alkalinity concentration in the water is important is because it is the balance between the alkalinity of the water and the percent ammoniacal nitrogen in the fertilizer that will determine the ideal fertilizer for your location. See part 3 of this series for more information on fertilizers and how to balance the fertilizer with the alkalinity of the water.

Q) What else should I test for besides alkalinity?

A) Besides alkalinity, you want to know the electrical conductivity (EC) or total dissolved solids (TDS) which gives you an idea of the total salt concentration in the water. It is also good to know the exact concentration of two plant nutrients, calcium (Ca), magnesium (Mg), as well as the concentration of ions that may give you problems, boron (B), chloride (Cl), sodium (Na), sulfur (S or SO_4-S), and iron (Fe). Any laboratory that will test for alkalinity should also these for these ions.

The reason that knowing the concentration of calcium, magnesium, or sulfur is important is that you want to supplement or balance the concentrations of these nutrients in the water with those found in the fertilizer. In addition, you water to check the concentration of waste ions to see if the water is suitable for growing plants, or if it needs additional treatment (for example, RO purification).

Q) How do commercial growers apply fertilizer?

A) Commercial greenhouse growers will typically apply fertilizer one of two ways. The first is to apply the fertilizer based on the concentration of a specific nutrient, usually nitrogen. The formulas for calculating how much fertilizer to add to a given volume of water to get a specific nutrient concentration is found in Table 1.

The other way fertilizer is applied to a crop is based on the electrical conductivity (EC) of the fertilizer solution.

Q) What is the relationship between electrical conductivity (EC) and the fertilizer concentration?

A) Electrical conductivity is really a measure of how much or how little electrical current can move through water. Electrical current can not move through pure water. When a salt is dissolved in water, it can break apart into positively charged cations and negatively charged anions. For example sodium chloride (NaCl) dissolving in water will break apart into sodium cations (Na^+) and chloride anions (Cl^-). Because these cations and anions have an electrical

Table 1. The amount of fertilizer required to obtain specific concentrations of nitrogen in the fertilizer solution. To convert to grams, multiply the value by 28.

	Amount of fertilizer (in ounces) per 100 gallons to get the desired nitrogen concentration			Amount of fertilizer (in ounces) per 5 gallons to get the desired nitrogen concentration		
	100 ppm N	***200 ppm N***	***300 ppm N***	***100 ppm N***	***200 ppm N***	***300 ppm N***
30-10-10	4.4	8.9	13.3	0.2	0.4	0.7
21-7-7	6.4	12.7	19.1	0.3	0.6	1.0
21-5-20	6.4	12.7	19.1	0.3	0.6	1.0
20-20-20	6.7	13.3	20.0	0.3	0.7	1.0
20-10-20	6.7	13.3	20.0	0.3	0.7	1.0
19-4-23-2 Ca	7.0	14.0	21.1	0.3	0.7	1.1
17-5-17-3 Ca-1 Mg	7.8	15.7	23.5	0.4	0.8	1.2
15-5-15-5 Ca-2 Mg	8.9	17.8	26.7	0.4	0.9	1.3
15-3-20-3 Ca-1 Mg	8.9	17.8	26.7	0.4	0.9	1.3
14-4-14-5 Ca-2 Mg	9.5	19.1	28.6	0.5	0.9	1.4
13-2-13-6 Ca-3 Mg	10.3	20.5	30.8	0.5	1.0	1.5
13-3-15-8 Ca-2 Mg	10.3	20.5	30.8	0.5	1.0	1.5
10-30-20	13.3	26.7	40.0	0.7	1.3	2.0
9-45-15	14.8	29.6	44.5	0.7	1.5	2.2
6-30-30	22.2	44.5	66.7	1.1	2.2	3.3

To calculate the amount of fertilizer needed to get a specific nitrogen concentration

Step #1	Multiply the desired nitrogen concentration (in ppm N) by the gallons of fertilizer you want.
Step #2	Multiply the percent nitrogen in the formula by 75
Step #3	Divide the value from Step #1 by the value from Step #2.

Example: How much 20-10-20 do you need to add to 5 gallons to get a fertilizer solution with 100 ppm N

Step #1	100 x 5 = 500	You need to add 0.33 ounces (about 9 grams) of 20-10-20 added to 5 gallons of water to get a fertilizer solution with 100 ppm N.
Step #2	20 x 75= 1,500	
Step #3	500 ÷ 1,500 = 0.33	

For people who are only measuring out small quantities of fertilizer, 1 US teaspoon holds about 0.2 ounces (about 6 grams) of fertilizer. Below is the concentration of nitrogen (in ppm total nitrogen) obtained when mixing ¼, ½, 1, or 3 teaspoons into a gallon of water with different fertilizers.

	Amount of fertilizer added per gallon of solution			
	¼ teaspoon	***½ teaspoon***	***1 teaspoon***	***3 teaspoon***
30-10-10	120	240	475	1425
21-7-7	85	165	225	1000
21-5-20	85	165	225	1000
20-20-20	80	160	320	950
20-10-20	80	160	320	950
19-4-23-2 Ca	75	150	300	900
17-5-17-3 Ca-1 Mg	70	135	270	810
15-5-15-5 Ca-2 Mg	60	120	240	710
15-3-20-3 Ca-1 Mg	60	120	240	710
14-4-14-5 Ca-2 Mg	55	110	220	660
13-2-13-6 Ca-3 Mg	50	105	210	620
13-3-15-8 Ca-2 Mg	50	105	210	620
10-30-20	40	80	160	475
9-45-15	35	70	145	425
6-30-30	25	50	95	285

charge, they can allow an electrical current to move through the water. So, the greater the amount of salt dissolved in the water, the higher the electrical conductivity.

However, not all salts dissociate (break apart) the same when dissolved in water. Some salts, like sodium chloride will dissociate completely to form ions, while others, like magnesium sulfate (Epson salts or $MgSO_4$) will dissolve, but will not totally dissociate. When equal amounts of sodium chloride and magnesium sulfate are dissolved in water, the sodium chloride will have the higher EC. Some salts, like urea, will dissolve completely but don't form ions, and so their presence in water doesn't affect EC.

Fertilizers are nothing more than combination of salts, but because each formula is different, there is a unique relationship between the concentration you are applying with a specific fertilizer and the EC. For example, 20-10-20 is composed of ammonium nitrate, monoammonium phosphate, and potassium nitrate

Table 2. The relationship between electrical conductivity (EC) and the fertilizer concentration (in ppm total nitrogen) when dissolved in pure water. Values for EC are given in mS/cm[2].

Formula[1]	Fertilizer concentration in ppm total nitrogen					
	50	***100***	***150***	***200***	***300***	***400***
30-10-10	0.07	0.14	0.21	0.28	0.42	0.56
21-7-7	0.28	0.56	0.84	1.12	1.68	2.23
21-5-20	0.29	0.58	0.93	1.16	1.86	2.33
20-20-20	0.20	0.40	0.60	0.80	1.20	1.60
20-10-20	0.33	0.66	0.99	1.32	1.98	2.63
19-4-23-2 Ca	0.34	0.68	1.02	1.36	2.04	2.72
17-5-17-3 Ca-1 Mg	0.32	0.64	0.96	1.28	1.92	2.56
15-5-15-5 Ca-3 Mg	0.39	0.78	1.17	1.56	2.34	3.12
15-3-20-3 Ca-1 Mg	0.35	0.70	1.05	1.40	2.10	2.80
14-4-14-5 Ca-2 Mg	0.35	0.70	1.05	1.40	2.10	2.80
13-3-15-8 Ca-2 Mg	0.40	0.80	1.20	1.60	2.40	3.20
13-2-13-6 Ca-3 Mg	0.34	0.68	1.02	1.36	2.04	2.72
10-30-20	0.48	0.95	1.42	1.90	2.85	3.80
9-45-15	0.60	1.20	1.80	2.41	3.60	4.82

NOTE: There can be some slight differences between the values of the same formulation from different companies. You should always obtain a fertilizer chart from your manufacturer.

[1] N-P_2O_5-K_2O formula

[2]The terms conductivity, soluble salts, or electrical conductivity (EC) are all used to describe the amount of salt contained in a solution. There are also a variety of units used to measure EC including micromhos (µmho), millimhos (mmhos), microsiemens (µS), millisiemens (mS), or decisiemens. 1000 µmho/cm = 1000µS/cm = 1mmho/cm = 1mS/cm = 1dS/m.

Frequently, you are not using a pure water source without any conductivity. Therefore, you need to take the water into account when determining the relationship between EC and fertilizer concentration. Examples are given below.

Calculate ppm Nitrogen from a 20-10-20 fertilizer solution with a total EC of 1.8 mS/cm and an using irrigation water with an EC of 0.5 mS/cm.

EC of fertilizer solution	-	EC of water	=	EC of only the fertilizer
1.8 mS/cm	-	0.5 mS/cm	=	1.3 mS/cm

From the chart above, 20-10-20 with an EC of 1.3 mS/cm would give a concentration of about 200 ppm N.

To predict the EC of 20-10-20 at 200 ppm N using an irrigation water with an EC of 0.5 mS/cm.

EC of 20-10-20 at 200 ppm N	+	EC of water	=	EC of fertilizer solution
1.3 mS/cm	+	0.5 mS/cm	=	1.8 mS/cm

For growers that use proportioners or injectors, sometimes the EC of the fertilizer solution coming out of the hose is not what you expect. The problem can be caused by an incorrect dilution rate from the injector (either broken or not properly adjusted) or the fertilizer stock concentration is wrong.

To check the fertilizer concentration, take a small amount from the stock solution, dilute this in water to the target ratio, and check the EC. For example, in you think that your injectors is set at 1:100, then put 10 milliliters into 1 liter of water (this will also give a 1:100 dilution). If the EC of the solution is where is should be, then it is an injector problem. If the EC of the hand-diluted solution is off-target, then the stock concentration is not correct.

(along with a small amount of micronutrients, and dye). Dissolving 1 gram of 20-10-20 in 1 liter of pure water will give you a solution with a concentration of 200 ppm nitrogen and an EC of about 1.3 mS/cm. 20-20-20 is composed of monoammonium phosphate, potassium nitrate, and urea. Dissolving 1 gram of 20-20-20 in 1 liter of pure water will also give you a solution with a concentration of 200 ppm nitrogen but the EC will only be 0.8 mS/cm. 30-10-10 is also composed of monoammonium phosphate, potassium nitrate, and urea. Dissolving 1 gram of 30-10-10 in 1 liter of water will give you a solution with a concentration of 300 ppm nitrogen, but the EC will only be about 0.4 mS/cm.

Don't forget that the irrigation water also has an EC, which needs to be taken into account when determining the relationship between the EC and concentration of a fertilizer solution. For example, dissolving 1 gram per liter of 20-10-20 in pure water (no EC) will give a solution with an EC of 1.3 mS/cm. However, dissolving 1 gram of 20-10-20 in water with an EC of 0.5 mS/cm will give a solution with an EC of 1.8 mS/cm. See Table 2 for more information on the relationship between EC and fertilizer concentrations.

Table 3. Relationship between electrical conductivity (EC) of selected fertilizer dissolved in pure water at a constant concentration of 100 ppm total nitrogen and total dissolved solids (TDS) measurements. The exact value that you get will depend on the TDS conversion constant used by the meter.

Formula	EC value at 100 ppm N (mS/cm)	TDS conversion constants (ppm = 1 mS/cm)				
		420 ppm	***500 ppm***	***640 ppm***	***700 ppm***	***1000 ppm***
30-10-10	0.14	59 ppm	70 ppm	90 ppm	98 ppm	140 ppm
20-20-20	0.40	168 ppm	200 ppm	256 ppm	280 ppm	400 ppm
20-10-20	0.66	277 ppm	330 ppm	422 ppm	462 ppm	660 ppm
15-5-15	0.78	327 ppm	390 ppm	500 ppm	546 ppm	780 ppm
13-3-15	0.80	336 ppm	400 ppm	512 ppm	560 ppm	800 ppm

At a concentration 100 ppm total nitrogen from 20-10-20, the TDS measurement can range from 277 ppm to 660 ppm, depending on the constant used by the TDS meter. To calculate a TDS for nitrogen concentrations other than those presented above, multiply the corresponding EC from Table 1 by the constant for your meter. Examples are given below.

Calculate the expected TDS measurement of 20-10-20 at 100 ppm total nitrogen (in pure water) using a meter with a costant of 1000 ppm = 1 mS/cm.

EC of fertilizer solution at 100 ppm total nitrogen	x	Constant	=	TDS of the fertilizer
0.66 mS/cm	x	1000	=	660 ppm TDS

Predict the nitrogen concentration of 20-10-20 dissolved in pure water with a TDS measurement of 660 ppm

TDS measurement	÷	Constant	=	EC of fertilizer solution
660 ppm	÷	1000	=	0.66 mS/cm

An EC of 0.66 mS/cm corresponds to a total nitrogen concentration of 100 ppm N.

Irrigation water will also affect the TDS value. For example, a water with an EC of 0.5 mS/cm will show a TDS measurement of 500 ppm (if the constant used by the meter is 1000 ppm). At 100 ppm N from 20-10-20 (and using the same meter), the TDS measurement of the fertilizer solution would be:

TDS measurement of the fertilizer	+	TDS measurement of the water	=	TDS of the fertilizer solution
660 ppm	+	500 ppm	=	1160 ppm

Calculate the TDS supplied by only the fertilizer when the fertilizer solution (water + fertilizer) has a TDS of 1160 ppm, the water has a TDS of 500 ppm, and the constant used by the meter is 1000.

TDS measurement of the fertilizer solution	+	TDS measurement of the water	=	TDS of the fertilizer
1160 ppm	+	500 ppm	=	660 ppm

To determine the constant being used by your TDS meter, simply look at the measurable range of the meter for EC and TDS (most TDS meters are combination TDS and EC meters). For example, if the range of the meter for EC is 0 to 10 mS/cm and TDS is 0 to 10,000 ppm, then you know the constant being used is 1000 (1 mS/cm = 1000 ppm). Another way is to purchase a standard EC solution and measure the TDS of the solution. For example, a common standard EC solution used for calibrating meters has an EC of 1.41 mS/cm. A TDS meter using a constant of 1000 would measure 1410 ppm with a standard solution of 1.41 mS/cm.

Q) What is the difference between electrical conductivity (EC) and total dissolved solids (TDS)?

A) The measurement of EC and TDS are closely related. An EC meter will measure the electrical conductance of the fertilizer solution. A TDS meter will measure the EC of the fertilizer solution and then convert the measurement into parts per million (ppm) by multiplying the EC by a constant. In article 2 of this series, I said that the constant is usually 1 mS/cm = 1000 ppm salt. On further examination, I found five different constants being used by various meters ranging from 420 to 1000. See Table 3 for more information on the relationship between EC and TDS.

Q) How do I know how much of each nutrient I am applying?

A) Both EC and TDS measurements are generic measurements, they don't tell you any specifics about the fertilizer solution that you are applying. If you want to know the exact concentration of each of the nutrients that you are applying with the fertilizer, then you need to calculate that from the formula on the bag of fertilizer. See Table 4 for more information on the concentration of individual macronutrient supplied by different fertilizers.

In addition, the irrigation water can supply significant amounts of some nutrients. Unless you are using a pure water source (which contains little if any nutrients), then you should add the concentration of

Table 4. The concentration of specific macronutrients (in ppm) supplied by different fertilizers when applied at a total nitrogen concentration of 100 ppm N

	NH_4-N	Urea-N	NO_3-N	P	K	Ca	Mg	S
			Granular fertilizers					
30-10-10	7	82	11	14	28	0	0	0
21-7-7	43	57	0	14	28	0	0	48
21-5-20	31	9	60	10	79	0	0	0
20-20-20	20	53	28	43	83	0	0	0
20-10-20	40	0	60	22	83	0	0	0
19-4-23-2 Ca	30	0	72	9	100	11	0	0
17-5-17-3 Ca-1 Mg	25	0	75	13	83	18	6	0
15-5-15-5 Ca-2 Mg	8	14	79	14	83	33	13	0
15-3-20-3 Ca-1 Mg	16	0	84	9	111	20	7	0
14-4-14-5 Ca-2 Mg	14	0	86	12	83	36	14	0
13-2-13-6 Ca-3 Mg	6	0	94	7	83	46	23	0
13-3-15-8 Ca-2 Mg	5	0	96	10	96	62	15	0
10-30-20	44	0	56	129	166	0	0	0
9-45-15	100	0	0	215	138	0	0	0
6-30-30	45	0	55	215	415	0	0	0
			Liquid fertilizers					
10-5-5-2 Ca-0.5 Mg	37	0	63	22	42	20	5	0
7-9-5-2 Ca-0.5 Mg	37	0	63	55	59	29	7	1
7-7-7-2 Ca-0.5 Mg	30	0	70	43	83	29	7	1
3-12-6-2 Ca-0.5 Mg	23	0	77	172	166	67	17	3

To calculate the concentration of each nutrient in a fertilizer solution, divide the percentage of desired nutrient in the fertilizer formula by the percentage of total nitrogen in the formula, then multiply by the concentration of total nitrogen in the fertilizer solution. Examples are given below:

How much calcium will I get from 13-3-15 when applied at a concentration of 100 ppm total nitrogen?

% desired nutrient in formula	÷	% total nitrogen	x	Total nitrogen concentration (in ppm) in the fertilizer solution	=	Concentration of desired nutrient
8	÷	13	x	100	=	61.5

When you apply 100 ppm total nitrogen from 13-3-15, the fertilizer is supplying about 62 ppm calcium.

To calculate the values for phosphorus and potassium, and addition step is required. For phosphorus, the calculated value will be for P_2O_5. To calculate the actual concentration of phosphorus you are applying, multiply the P_2O_5 value by 0.43. For potassium, the calculated value will be for K_2O. To calculate the actual concentration of potassium you are applying, multiply the K_2O value by 0.83.

nutrients supplied by the water with those supplied by the fertilizer to get the total nutrient concentration applied to the plant.

Q) Do orchids require high phosphorus fertilizers?

A) Phosphorus is needed by the plant to store and transport chemical and light energy. Although there is no specific research, it appears that applying between 10 and 20 ppm phosphorus with every irrigation will supply enough phosphorus to a plant (any plant, not just orchids) for normal growth and flowering. Once this sufficient level is reached, then there is not any particular benefit to applying any more phosphorus. Thus in this case, there is no benefit to using a high phosphorus fertilizer.

When plants have a phosphorus deficiency, the older leaves tend to turn purple, and the plants show a marked loss of vigor. Unfortunately, with some plants, phosphorus deficiency is hard to see, and all you will notice is a lack of vigor with poor root growth and limited if any flowering. Because orchids are slow growing to begin with, you might not notice the problem at all. Under these circumstances, it is appropriate to apply a fertilizer that is high in phosphorus simply to get the plant growing again. However, because the plant has been stressed, you will likely see a reduction in blooming and growth when compared to plants that never had the deficiency to begin with.

A third possibility has to do with the over-application of nitrogen rather than the under-application of phosphorus. It is well know that over-applying nitrogen will cause plants to remain vegetative. For example, tomatoes, peppers, squash, new guinea impatiens, or azaleas will not produce fruit (or flowers) if too much nitrogen is applied. Rather, they will produce excess foliage growth. Reducing the nitrogen level in the soil reduces the vegetative growth, and the plants produce flowers or fruit.

Orchid fertilizers like 30-10-10 lend themselves to the over-application of nitrogen because they have a

Figure 1. How much phosphorus is necessary for flowering? Henry Mast Greenhouses from Grand Rapids, MI uses a fertilizer containing 12 ppm phosphorus applied with every watering and reports getting between 60% and 70% of their plants with double flower stalks.

lot of nitrogen per unit weight and they have a low EC or TDS measurement per ppm nitrogen. In comparison, a bloom formula like 6-30-30 has a low concentration of nitrogen per unit weight and a high EC or TDS measurement per ppm nitrogen. If you are using the same amount (or the same EC or TDS measurement) for both fertilizers, then you are over-applying nitrogen with the 30-10-10. When you switch to the 6-30-30, you are effectively reducing the nitrogen level, which in turn induces the plant to bloom.

The paradigm of using high phosphorus fertilizer to get plant to bloom has largely died out in the commercial greenhouse industry. Commercial greenhouses apply fertilizer based on the concentration of nitrogen or they will correct the EC they are applying based on the relationship between the EC and ppm total nitrogen for that specific fertilizer. By maintaining an equal nitrogen concentration and supplying a sufficient amount of phosphorus with both formulas, you probably wouldn't see much difference in growth or flowering between high nitrogen or high phosphorus formulas.

Q) What is the ideal orchid fertilizer?

A) First, the ideal fertilizer for any crop, not just orchids, is one that balances you water quality. Probably the most important aspect of this comes with the management of the substrate pH. Orchids appear to perform the best when the substrate pH is around 6.0 (similar to most other plants). However, since most substrates used for orchid production have little if any buffering, managing the balance between the alkalinity of your water and the acidity of your fertilizer is very important.

That means that the amount of acidic nitrogen should be balanced by the alkalinity of your irrigation water. If you are using a very pure water source, like rain water or reverse osmosis purified water, then your fertilizer should have no more than 10% of the total nitrogen in the ammoniacal or urea form, or you may be driving you substrate pH down to levels that may cause micronutrient toxicity problems. However, the reverse is also true. If you have a large amount of alkalinity in your water, then you should not be using fertilizers that are low in ammoniacal nitrogen or else the pH of your substrate will increase to unacceptable levels causing nutrient deficiencies.

In addition, an ideal fertilizer should supply a sufficient amount of each nutrient for growth. That means that the nutrients contained in the fertilizer should complement those supplied by the irrigation water. If the water does not contain a specific nutrient, like calcium or magnesium, then it needs to be supplied by the fertilizer. It also needs to be supplied at a concentration high enough that it influences plant growth. For example, some 20-10-20 fertilizer contain magnesium, but the amount supplied is so low that it really doesn't influence the nutrition of the plant.

Q) What is MSU "Magic" fertilizer?

A) There is nothing "magic" about the fertilizer being used by Jan Szyren at Michigan State University. Dr. John Biernbaum (from MSU), Larry Metcoff (from GreenCare fertilizers), and I designed two fertilizer formulas to be used with the two types of irrigation water found at MSU research and teaching greenhouses. The formula for pure water (13-3-15) was designed to be used with reverse osmosis purified water. Specifically, the 13-3-15 contains very low ammoniacal nitrogen (acidic nitrogen) to match the very low alkalinity of the RO water. In addition, the 13-3-15 supplies calcium and magnesium because these nutrients are not supplied by the RO water. The formula for well water (19-4-23) was designed with higher levels of ammoniacal nitrogen to compensate for the higher alkalinity levels of the well water. In addition, the formula contains a small amount of calcium and no magnesium because these two nutrients are found at high concentrations in the MSU well water. Both formulas were designed to be used at 125 ppm total nitrogen with every irrigation. At this nitrogen rate, both formulas also supplied about 12 ppm phosphorus.

It is important to note that these formulas were not designed with orchids in mind. In fact, they were not designed with any specific crop in mind. The reason that they have worked well for orchids is the same reason that they have worked well for a huge variety of plant species grown in the research and teaching greenhouses, the formulas complement their specific water qualities both in pH reaction and nutrition.

Notes on AOS Award Abbreviations by David Mellard

Photo © Danny Lentz

At the September meeting, you're likely to hear numerous abbreviations for AOS awards, such as CCM/AOS, which stands for Certificate of Cultural Merit from the American Orchid Society. Two AOS awards, a CCM and a CCE, are given for culture and thus recognize the skill of the grower rather than flower quality. A CCM (certificate of cultural merit) is given to a plant that scores between 80 and 89 points, while a CCE (certificate of cultural excellence) is given to a plant that scores above 90 points. To get a cultural award, the leaves and flowers have to be in good to excellent condition and the plant must have a high flower count for the species or hybrid. In many cases the scores given are based on previous CCM and CCE scores for that species or hybrid.

The AOS has three awards for flower quality: HCC, AM, and FCC. An HCC, or highly commended certificate, must score between 75 and 79 points, while an AM, or award of merit, must score between 80 and 89 points. The highest flower quality award is an FCC or first class certificate and must have a score of 90 points or better out of 100. The number, form, and color of the flower(s) are just a few of the characteristics that judges look for in scoring a plant for a flower quality award. Two other common AOS awards are CBR and CHM. These two awards are like being presented at a cotillion. They are first time awards given to plants that have not received other AOS awards and in a sense establish the plant in the AOS system. A CBR (certificate of botanical recognition) is given for rare and unusual species that have educational value and are being seen for the first time. A CHM (certificate of horticultural merit) is given to plants with characteristics (e.g., flower quality or foliage) that contribute to the horticultural aspects of orchidology. A CHM can be given more than once, for instance, to an unusual color form. Three other AOS awards are possible (award of distinction, AD; award of quality, AQ; and judges commendation, JC), but these are beyond the scope of this brief explanation.