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It's time to plan for the

2010

Stone Mountain, GA. USA

NAPP / IWGS Event

Water Feature Conference & Expo

February 28 - March 2, 2010

This is a chance for those in the pond business to meet with other pond professionals to learn about the future of technology and how it will aid your business and your customers' ponds.

2010

San Angelo, TX. USA

Waterlily Festival

September 17 - 19, 2010

This will be the waterlily event of the century. Over 200 varieties and species plants on display. Speakers to be announced later. Everyone who is anyone in the waterlily community will want to be there. Make plans to join us at *The International Waterlily Collection* for Lily Fest and the IWGS Waterlily Festival.

Visit ***www.iwgs.org***
For more information as it becomes available about these great opportunities.

Executive Director's Comments
"Nau Hear This"

by Larry Nau

Tim Jennings Photo

It's that time of year, renewal time for your IWGS membership. For the next month I will be mailing renewal forms and a reminder to our membership around the world. These letters will be sent by both conventional mail and e-mail. Then I wait, checking the IWGS mailbox everyday to see who has responded. My predecessors tell me this process may take until May as the last of the renewals finally arrive. Overall it's a slow, awkward process that can get confusing as the time drags on.

As each renewal arrives, I need to update the IWGS membership roster and confirm all the contact information is correct. I record the payment in the accounting program after I create a bill for the membership. Next the dues will be deposited in our checking account or processed on our credit card machine. I will double check to confirm if our member wants a paper copy of the Water Garden Journal and if they need any additional services. I will verify that they are on our "Let's Talk Water Gardening Yahoo Group" which is not always the easiest roster to check. Please let me know if you have changed e-mail addresses in the last year, as that will be a big help.

Repeating this several hundred times goes with the job and I truly hope those numbers grow in the future. What can you do to help? Kindly mail in your renewal as soon as possible or just go on to the IWGS website and do it now. It's much easier to do the renewals in groups at the same time. It is much simpler doing this work during our slow business season as well. As 2010 moves along, I have a number of other projects which will require my attention and energies. Having the majority of the IWGS memberships processed by January will clearly simplify my job and make my life a bit more manageable.

History has shown us the vast majority of renewals are done by traditional mail. You will soon receive your renewal package in the mail. Included in this envelope will be your renewal form, a reminder to register to join us at the NAPP Meeting and a keepsake bookmark highlighting our San Angelo Waterlily Festival in September. We will also include instructions, the order form and fact sheet for our first Collector's Aquatic Plant of the Year (CAPY) in 2010. Current members will receive member's only discount pricing for this spectacular waterlily, *Nymphaea* 'Ultra Violet'.

I will send out a membership reminder after 3 weeks in the form of an email to save on mailing costs. We will change the login and password information on the IWGS website on February 1. I will send out one last reminder in mid February for any outstanding memberships at that time.

It has been a pleasure to meet and assist many members already on behalf of the IWGS. I look forward to working with many more IWGS members in 2010. I look forward to meeting many of you in either Atlanta this February or San Angelo in September. I hope all of you enjoy the upcoming holiday season and have a prosperous 2010. You can give your Executive Director the best gift of all; renew your IWGS membership as soon as possible!

Thank you.

Larry

2010 IWGS New Waterlily Competition

by Mike Swize

The IWGS is looking for interested individuals and companies who would like to enter the 2010 New Waterlily Competition. Grow out of plants will be conducted in the Sarah P. Duke Gardens at Duke University in Durham, North Carolina, with judging to be held in August. Hardy entries must be received between March 1st and April 15th, 2010. Tropical entries must be received between March 15th and April 15th of 2010. Arrangements can be made to receive entries before this time by contacting Mike Swize. Also, if assistance is needed in shipping entries, contact Mike.

The competition is open to any hardy or tropical waterlily that has not been in the retail trade for more than three years and has not previously won the Best New Waterlily Competition. Awards will be given for best New Hardy Waterlily and Best New Tropical Waterlily. If any *Nymphaea* hybridizer or introducer would like to submit varieties to be grown for the competition please complete the ***entry form*** and, fax or email it in by February 28, 2010. Entry form is on the web at *http://www.iwgs.org/images/stories/waterlily_competition/entry%20form%202010.doc*

Competition Protocols will be available by February 2010.

Any questions concerning the competition can be directed to:

Mike Swize
1502 Katy Fort Bend County Rd
Katy, Texas 77493 USA
NewWaterlilyCompetition@gmail.com
281-850-2037 Fax 281-391-8626

Florida Aquatic Nurseries Photo

In Memoriam - Dr. Surrey W. L. Jacobs

by C. Barre Hellquist

Dr. Surrey W. L. Jacobs, noted Australian botanist, died November 26 at the age of 63. Surrey was employed by the Royal Botanic Gardens Sydney, for 38 years and last year was promoted to the level of Senior Principal Research Scientist. Over the years he has worked extensively on grasses, weeds, and water plants. He has published numerous journal articles dealing with Australian grasses and various aquatic plant genera of Australia including, *Aponogeton*, *Vallisneria*, and *Nymphaea*. He has co-authored "The Water Plants of New South Wales", "Waterplants in Australia" and the treatment of the Nymphaeaceae in the "Flora of Australia".

His extensive work on the waterlilies of Australia has led to a much greater understanding of a taxonomically difficult group. Surrey traveled extensively throughout the tropics conducting field studies and subsequent taxonomic studies of the family Nymphaeaceae. When Surrey started working on the Nymphaea of Australia, five native species in three subgenera were known. Today as the result of extensive studies over the past 17 years there have been seven new species described. Surrey also divided the subgenus Anecphya with the addition of the subgenus Confluentes. Shortly before his death, Surrey and Barre Hellquist completed a new manuscript naming five new genera of waterlilies in Australia, which upon publication, will bring the number of native waterlilies in Australia to 17. His expertise, wit, and friendship will be greatly missed by all who knew him.

Autumn Fades Into Winter In The UK

By Harry Hutchings

In previous years I have tried to keep tropical waterlilies flowering as long as possible. It was extremely costly on water and air heating and not very successful as daylight dropped to 10 hours a day or less. This year I let the glasshouse ponds follow the weather, with the exception of taking advantage of whatever sunshine there was with my air pump technique described in the last journal to help the water temperature.

It was interesting to see which of the tropical waterlilies flowered for longest as the days shortened and the water temperature dropped.

The first thing that I noticed is the number of flower buds forming did not coincide with them opening, but more astonishing to me was the color change in the flowers. *Nymphaea* 'Antares' went from the deep red of summer to a lighter red with an almost white center. *Nymphaea* 'Mrs. George C. Hitchcock' went from a striped pink and white to a very light cream.

Nymphaea 'Innocence' developed deep pink tips to the stamens. *Nymphaea* 'Pamela' moved from pale blue to an almost lilac color with heavy darker blue mottling in the pads. The purple color of *N.* 'Director George T. Moore' intensified. *Nymphaea* 'Allene' moved from a salmon color to pink with heavy mottling in the pads. *N.* 'Blue Beauty' moved towards lilac.

I expected, as all the books tell me, that the viviparous waterlilies would be the last to stop flowering. This was not the case for my conditions except for *N.* 'Innocence'.

Some of the first to stop flowering were *N.* 'Madame Ganna Walska', *N.* 'Miami Rose', *N.* Midnight', *N.* 'Midnight Serenade', *N.* 'Midnight Embers', *N.* 'Ostara', *N.* 'Elysian Fields', *N.* 'Antares', *N. caerulea*, *N. colorata*, *N. capensis* var. *zanzibariensis*, *N.* 'Green Smoke', *N.* 'Day Glow', *N.* 'Ambrosia', *N.* 'Laura Frase' and the stars of my pools, including *N.* 'Carnea', *N.* 'Leopardess', *N.* 'Red Flare', *N.* 'Blue Sapphire', *N.* 'Evelyn Randig', *N.* 'Manassas', and *N.* 'Excalibur'.

These were followed by *N.* 'Foxfire', *N.* 'Blue Beauty', *N.* 'Ruby', *N.* 'Blink', *N.* 'Aquarius', *N.* 'Stan Skinger', *N. nouchali* [*stellata*], *N.* 'Peach Blow', *N.* 'King of Siam', *N.* 'Star of Zanzibar', *N.* 'Mrs. George C. Hitchcock', my own hybrid *N.* 'Carmen' [*N.* 'Red Flare' x *N.* 'Antares'], *N.* 'Moon Shadow', and finally *N.* 'Pamela'

Nymphaea 'Rhonda Kay', *N.* 'Mrs. Ward' and *N.* 'Star of Siam got almost to the end. Water temperature was now around 14 °C [57 °F] and air temperature around 12 °C [53 °F].

The survivors at the point where I decided to wrap up for the year were *N.* 'Golden West', *N.* 'Allene', *N.* 'Innocence' and *N.* 'Director George T. Moore' which

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just out performed *N.* 'Star of Siam' by days.

I have seen many times people asking how low in temperature can tropical waterlilies go and still flower. Until the water and air temperature dropped below 18 °C [64 °F], most established plants were still flowering. At 15 °C [59 °F] most had stopped. A month before, the outdoor pond hardies had already stopped flowering. The tropical waterlilies in an unheated greenhouse had a much longer flowering season than the outdoor hardies.

All of the viviparous waterlilies are in the glasshouse aquarium along with my own hybrids that were hybridized during the year. These small plants will be kept at around 20 °C [68 °F] and flood lights will be used to extend light hours to 12 hours a day. As with last year, I expect about 75% will survive by being kept small in small pots with no fertilizer. The heat will be stepped up in April to 22 °C [72 °F].

I am harvesting the tubers. Several points are apparent. I think I will follow Rich Sacher's advice and put small slits in my pots that have no holes for next year. It is apparent that some plant roots do not go down deeply in the pots, and there is a putrid smell near the bottom. I will include peat in my soil mix for next year to try to avoid some of the corm rot, particularly the mother rhizome.

This year I tried to avoid the algae etc., so I did not do the recommended continuous fertilization. Despite this, I had many big flowers, the original dose of slow release and fish, bone and blood fertilizers were only supplemented once, after a month with slow release, high potash tabs. Without all the extra fertilizer only a few produced a number of tubers. I am presently floating a number of trimmed mother rhizomes in the hope that some more tubers might be produced.

The bulk of next years plants will come from the tubers, stored in damp sharp sand in snap-top food containers in my wine chillers at around 13 °C [55 °F]. The rest will be over-wintered in the insulated poly-tunnel, where there is a mixture of plants in their summer pots and others that are planted in smaller pots where the tuber is insufficient to store. They will be kept at 20 °C [68 °F] with the additional lighting from November through February. In March we have enough hours of daylight to discontinue the artificial light.

There are some mother tubers, like *N.* 'Green Smoke' that tend to rot when left in the glasshouse pond too long with a water temperature below 20 °C [68 °F]. I attempt to clean them up and store the large tuber in a mixture of sand and peat-moss. I'll take another one that is rotting and float it at an elevated temperature, with high light level to see if I can get it to sprout before it rots away. I can then detach the plantlet and transfer it to my aquariums. Sometimes it's just cheaper to trash it and buy another in the spring.

Have a good winter

Harry Hutchings BSc AMPS

IWGS European Coordinator

Cultivation of Lotus (*Nelumbo nucifera* and *Nelumbo lutea*) Advances in Soil and Fertility Management

By Warner Orozco-Obando, Ken Tilt and Bernice Fischman
The Auburn Lotus Research Project, Department of Horticulture, Auburn University. Alabama, USA

Lotus (*Nelumbo nucifera* and *Nelumbo lutea*) is a perennial water plant often grown as an ornamental. For centuries many organs of the plant have been used for their home-based medicinal properties, which are currently being scientifically verified and refined in pharmaceutical labs. Lotus produces rhizomes (underground stems/tubers), leaves, stems, seeds, flowers, and other plant parts that are edible. In some countries the highly appreciated lotus is well known and part of the daily lives of billions of people around the world. However, it only occupies a niche market in the U.S. There is an opportunity to expand this market if we learn how to efficiently manage production inputs and educate and market the wonders of this multi-purpose plant. As an ornamental, vegetable, or medicinal herb, lotus can be grown in environments not favored by other traditional agricultural crops.

In the Southeast U.S., there is an area referred to as the Black Belt Region due to its dark colored soils characterized by poor drainage and aeration. Although certain death to many plants, it is the "Briar Patch of Brer Rabbit" to lotus and the aquaculture industry. It is an environment with growing conditions particularly suited for commercial production of lotus (Yamaguchi, 1990).

Although little development has occurred on the American native *Nelumbo lutea*, thousands of years of breeding *Nelumbo nucifera* in Asian countries has produced hundreds of ornamental and edible cultivars with different sizes, flower forms, and colors. Asians have developed great production techniques that require a vast low paid labor pool. The U.S. is not so fortunate (or unfortunate) to have inexpensive labor. Our country requires increased technology, efficiency, and automation to be competitive.

To advance in these areas, it is important to understand the biology and physiology of the lotus crop. Basic agronomic practices must be reviewed, adapted, or developed. Soil fertility is one of the variables that can yield the greatest increase in production in the short run. Soils, light, water, temperature, and other factors affect the uptake of nutrition. Whenever changes are made to one factor, changes or adjustments may be necessary among the other variables. This article focuses on the current knowledge of fertility requirements of lotus, summarizes some of the most relevant variables among production aspects, and generates pertinent questions for further investigation.

Origin and Geographical Distribution of Lotus

Lotus (*Nelumbo*) belongs to the Nelumboleaceae family and has only two species: *lutea* and *nucifera*. The American species (*Nelumbo lutea*), known as Yellow lotus and Lotus lily, is native to the eastern and central portions of the U.S.. Some researchers mention the existence of native stands throughout the West Indian Archipelago, Tamaulipas, Mexico (Hernandez et al., 1991), and northern South America (Wang and Zhang, 2004). American lotus was once cultivated in the waters of the Tennessee and Cumberland Rivers by the aborigines who carried the species northward and eastward (Hall and Penfound, 1944). This native aquatic plant spreads 1-2 feet wide, has round leaves (30-60 cm in diameter) lifted up 1 to 4 feet above the water's surface and produces 5-10 inch (12-25 cm in diameter) creamy white to pale yellow flowers. Edible sweet, nut-like tasting seeds are located on a funnel-shaped seed pod

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with a flat top. Flowering occurs from June through September. Seed pods are harvested, dried, and used for winter bouquets (Tondera et al., 1987).

Nelumbo nucifera Gaertn is known by numerous names such as Sacred lotus, Asian lotus, Indian lotus, lotus root, Bhain (Pakistan), Renkon (Jap.), Bong sung ma (Vietnam), Padma (Bangladesh), Bhen, Padma, Pankaja, (Ind.); Baino (Philipp.); Bua luang (Thai.); Hasu-n-ne (Japan); Patma (Mal.); Tarate (Indon.) [Kay, 1987]. Its habitat spans a huge geographic area from Afghanistan to Vietnam (Hanson, 2007). The plant has been cultivated for over 2,000 years (Guo, 2009) and consumed throughout Asia, with all parts of the plant (seed, rhizome, leaf, stalk, petals, anthers, pericarps and fruit receptacles) used for food or for medicinal purposes (Tian et al., 2008; Ono et al, 2006). In Asia lotus is considered the sacred symbol of eternal life (Hanson, 2007). The considerable variation in flower color and shape has made lotus one of the most popular ornamental and cultivated plants in Asia (Masuda et al. 2006).

Growing Conditions and Cultivation

Growth and yield of lotus is influenced by diverse factors such as genotype, media, water depth, light, temperature, planting time, propagation methods, planting techniques, and fertilization (Tian et al., 2009a). Rhizomes enlarged from the previous year's growth are typically used for commercial cultivation (Masuda et al., 2006). This is considered the best and simplest method, ensuring a harvestable crop in one season.

Lotus is an emergent aquatic plant whose water requirements vary during different growing stages. After planting, water should be shallow and clear for full sunshine exposure to warm the water and soil to stimulate growth. When floating leaves appear, the water level can be gradually raised for easier maintenance. Once the standing leaves have emerged, the full depth of the water should be maintained for optimum growth (Zou et al., 1997). Syringing foliage with overhead sprinklers reduces transpiration and possible heat stress that can cause young leaf deformation. This is more of a problem in small containers where water temperatures fluctuate much more. Syringing also helps reduce the incidence of spider mites seen more frequently in greenhouses during times of drought conditions.

Soil Characteristics

Soil type is probably the most important factor in the development of *Nelumbo* (Meyer, 1930). For production in containers and ponds several substrates have been suggested; however, lotus prefers rich and fertile soil. Lake or pond bottoms containing large amounts of organic matter are the most suitable (Xuemin, 1987). Some commercial producers suggest the use of a heavy clay loam or formulated soil for the growth of aquatic plants. If the soil is compacted heavy clay, roots cannot penetrate and harvesting is difficult. On the other hand, sandy soils lack binding sites for nutrients and have been reported to produce rhizomes with an astringent flavor (Nguyen, 2001). Slocum and Rob-

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inson (1996) recommended the use of a soil so heavy that it would not float. This recommendation limits the use of most potting soil mixes found at garden centers. Optimal soil is a soft silt loam, free-form particulate matter (Nguyen and Hicks, 2004).

Good organic matter content (manure or well-rotted mulches) provides rich, readily available nutrients, buoyancy to texture, and prevents light penetration (Nguyen, 2001). Shen-Miller et al. (2002) germinated hundreds-of-years-old seed in a 3:1 soil mix of clay soil and greenhouse soil (sphagnum moss, washed sand, and sandy loam in equal proportions). In an evaluation of growth and establishment of *lutea* seedlings, Meyer (1930) noted that one month after planting more coin leaves were produced by the plants growing on loam soil than those growing in sand. Six weeks after planting, the differences were even greater. Tubers were found on the seedlings of both soils but were larger on those plants growing in loam.

Although lotus grows best in acidic soil of pH 4.6 (Shen-Miller et al., 2002), growth has not been affected by variation in water pH from 5.5–8.0. During a survey in Samaspur Lake, India, it was observed that lotus was growing luxuriantly despite an alkaline pH of 9.0-9.3 (Goel et al., 2001). Meyer (1930) compared plants growing in soil with a pH of 9.0 vs. a soil with a pH of 4.5. Plants growing in lower pH soils grew more rapidly but did not form any tubers. Lotus is a plant that has shown a tolerance for some levels of salinity in the water (Nguyen, 2001). Adequate electrical conductivity (EC) range is debatable. Hicks (2005) determined the significant effects of EC on total dry mass and organ dry mass production. In his study, an EC of 2.0 mS cm-1 allowed the plants to reach peak biomass accumulation. Higher EC (3.0) induced a reduction of biomass by 75 %. On the other hand, Tian (2008) observed EC readings greater than 1.0 mS cm-1 in container production to be detrimental to new tender growth.

Fertilization

Fertility can be simple or complicated. With a small amount of balanced fertilizer, you can keep a plant alive and it can look healthy but when you fine tune and cater to the specific needs of a crop, you can greatly increase productivity while being a responsible steward of the environment. Each plant species has its own special requirements that have to be

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discovered through research. Plants not only require about 16 nutritional elements, they also need these nutrients at the right level and in proper balance with the other nutrients at the right time. Current information on lotus nutrition is considered limited or inadequate in its scientific rigor (Hicks, 2005). In his dissertation, David Hicks (2005) noticed the lack of research on the tissue composition or nutrient supply levels for the crop. In addition, he warned that the lack of understanding on the critical concentrations for optimal growth and the rudimentary guidelines used in the commercial production of the plant could be detrimental.

Little is known about the effect of heavy metals and micronutrient toxicity on lotus. Chromium toxicity inhibits chlorophyll, reduces protein content and nitrate reductase activity (Vajpayee et al., 1999). Regarding copper, it has been reported that plants generally contain 2- 20 ppm (Mengel and Kirky, 1987). At its peak of growth, lotus was found to contain 6.7 – 17.4 ppm (Lung and Light, 1996). Chromium toxicity has been reported at levels of 50-200 ppm. Normal looking plants have been reported with high concentrations of Manganese (Table 2).

The correct amount of fertilizer is dictated by the maturity stage of the crop. Fertilization of young plants has to be carefully administered because they can be easily burned. It is recommended that the doses be split in 3-4 applications (Nguyen, 2001). If seedlings are held for longer than 1 year in their pots, controlled-release fertilizer can be used after new leaves emerge in the spring. Osmocote Exact® tablets with 3% water soluble magnesium oxide 15-9-9, for 8-9 months applied at a rate of 5g per liter have been used successfully (Sayre, 2004). Plants reaching maturity and rhizome formation require more potassium and less nitrogen (Nguyen, 2001). In the flowering season quick-acting phosphate fertilizer should be added every 7-10 days to promote flower bud differentiation. Phosphate and potash fertilizers are needed later to promote fruit ripening and to stimulate rhizome growth (Zou et al., 1997).

Soils for Field production

Being an aquatic plant, water management issues (acquisition, movement, storage, and economics) are primary considerations. Pond size and production capacity correlate directly with production success. Hicks and Haigh (2001) reported that 6.7 million gallons of water per acre (60 million liter) were required for production of lotus. The soil's capacity to retain water is critical. If the soil cannot retain water the use of liners should be considered. In the Black Belt region, soils are rich in expansive clay

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and can be compacted to form an impermeable barrier allowing the retention of water (Tilt. 2009. Personal communication). These soils are acid and are somewhat poorly drained. They are locally known as "flatwoods" or "post oak clays." The clayey soils contain a large percentage of montmorillonitic clays and they shrink and crack when dry and swell when wet (Auburn, 2009).

Fertility for Field Production

If the lotus field, lake, pond, or paddy is deficient in fertility, it should be supplemented with various organic matters such as an oil-press cake or composted and green manure (Xuemin, 1987). Although animal manure has been suggested as a useful addition to such soil mixes, Shen-Miller and colleagues (2002) do not agree. In their previous studies, manure proved fatal to the young seedlings. On the other hand, in India, growing media is enriched by incorporating well-decomposed cattle dung manure at a rate of 9.2 lbs/ yard2 (5 kg/m2), Neem (*Azadirachta indica*) cake at a rate of 3 ounces/ yard2 (100 g/m2), Di-ammonium phosphate (25 g/m2), and 0.7 ounces/ yard2 (25 g/m2) of Muriate of potash as a basal dose 15 days prior to the planting (Goel et al., 2001). Slocum and Robinson (1996) suggested that well rotted and composted cow manure can be used in the bottom half if mixed one part composted manure to two or three parts topsoil.

In China, farmers use different combinations to fertilize the fields. In some cases, fields are enriched by adding 18-24 tons/ac (45,000-60,000 kg/ha) of animal waste or combining 0.6 tons of bean manure plus 6 tons of animal waste/ac (1,500 kg + 15,000 kg/ha). Others use 528 lbs of special lotus formulated fertilizer + 330 lbs of NH4HCO3 /ac (600 kg lotus fertilizer + 375 kg NH4HCO3 /ha)[Wang and Zhang, 2004]. In a recent study at the Hubei Academy of Agricultural Sciences, Xiong and his colleagues (2009), reported the improvement on lotus yield and edible root quality by applying N,P, K and Zn. They reported the use of 450, 150, 450 and 22.5 kg/hm2 yielded 37,136 kg of roots/hm2 (16 tons/ac). In addition, their data suggest a high demand of potassium by root producing lotus. In Thailand, fields are plowed and left for 10 days for weeds to die and decompose; then 1 ton/0.4 ac (2.5 tons/ha) of manure is added (Woranuch et al., 2009). Chomchalow (2007) mentioned that once the lotus is established and producing new leaves, 16-20-0 or 15-15-15 fertilizer should be broadcast at 110 lbs/0.4 ac (125 kg/ha). In areas where water levels can not be managed, farmers wrap a teaspoon (4.2 grams) of granular fertilizer in a ball of clay. The fertilizer balls are air dried and buried around a clump of lotus. Each clump can be fertilized with 2-3 balls. Thai farmers apply another round of fertilization to plants that look ragged, dilapidated, with faded colors, or smaller flowers.

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Container Cultivation and Soils

Working with very large containers can be difficult and complicated (Hicks, 2005); however, their use is common and as cultivar knowledge develops, the appropriate containers are easier to find. Round containers are preferable because the tubers and runners can become cramped in the corners of square planters (Slocum and Robinson, 1996). Some commercial plant propagators recommend growing theplants in fabric pond pots or no-hole plastic containers to minimize maintenance (The Water Garden, 2006). Large lotuses perform at their best in large boxes, e.g., Aqualite pool [120x95x30 cm] or Super Tub [90x60x20] (Slocum and Robinson, 1996). At the National Botanical Research Institute in Lucknow, India, the lotus germplasm collection is grown in concrete tanks with a clay soil stratum up to 18 inches (45 cm) thick at the bottom of the tank (Goel et al., 2001). Seeds or seedlings can be planted in pots without holes which are 5.5- 7.0 inches (14-17 cm) in diameter (Wang and Zhang, 2004).

The effect of soil volume on container production of lotus has been under-reported. Tian and his colleagues (2009 b) evaluated the effects of soil volume on 3 cultivars of *N. nucifera* ('Karizma', 'Embolene', 'Garton's # 98') and the native species (*Nelumbo lutea*). Plants growing in containers filled ¼ full with soil produced the greatest plant height and underground fresh weight and a greater amount of emerging leaves. Plants growing in containers filled ½ to ¾ full produced the largest number of propagules. Flower number decreased as soil level increased.

Fertility for containerized plants

Researchers at Auburn University evaluated the effects of fertilization (Tian, et al., 2005) on three cultivars: 'Embolene', 'Garton's # 98' and 'Garton's # 1'. In this study, growth of the plants had a positive correlation with the amount of fertilizer applied. One tsp of 20-10-20 every 20 days was sufficient for adequate growth in a 15 gallon (53.5 L) container. Lotus plants responded favorably to increased fertilizer rates. Eight-gram applications increased root fresh weight, number of propagules, and expanded internodes. Zou and his colleagues (1997) reported that Chinese lotus growers use 5 g of fertilizer in small pots and 10 g for large pots. The fertilizer is wrapped in tough paper and inserted into the container 4-6 inches (10-15 cm) deep in the mud.

Opportunities in the U.S. Southeast and Further Research

Some of the poorest counties in the United States are located in Alabama. These areas are plagued by a high rate of unemployment, a large percentage of the population below the poverty line, and low per capita income. Though agriculture was once the base of the local economy many of today's farms are small, have limited resources, and have traditionally been denied access to lucrative markets.

Despite many socioeconomic challenges, the region has great potential for growth and economic development. The region is rich with natural resources and a vast labor pool and producers have potential markets close by(Atlanta, Birmingham, Montgomery, etc.) which can utilize products from local farms. In addition, Alabama supports a fairly well developed aquaculture industry with more than 10,000 hectares of fish farms owned by 250 producers worth $105 million in cash receipts to fish farmers (Crews and Chappell, 2006). According to Crews and Chappell (2006), the state has the land and water resourc-

Cultivation of Lotus (*Nelumbo nucifera* and *Nelumbo lutea*) Advances in Soil and Fertility Management

By Warner Orozco-Obando, Ken Tilt and Bernice Fischman
The Auburn Lotus Research Project, Department of Horticulture, Auburn University. Alabama, USA

es to support an industry ten times its current size. Small farmers who double-crop (fish/vegetables) can contribute significantly to this expansion (Orozco-Obando et al., 2009). Due to the small market in the U.S. at the current time, there is little competition but if demand increases, U.S. producers need to be able to compete in the global marketplace.

Fertility is just one segment of production that needs to continue to be investigated, especially since it offers quick and large responses to research. There has been some research to evaluate and establish a basic nutritional program for production of healthy, vigorous lotus plants growing in the field/pond and in containers (Table 1). However more research is needed to find their optimal, unique nutritional needs. In addition, research related to lotus as an edible crop is mandatory. Can nutrition be adjusted to increase antioxidants and levels of other vitamins important to health or medicinal qualities? How can starch storage in the rhizomes be maximized to make this a viable energy source alternative? Lotus has enormous potential as an ornamental crop, edible vegetable, and medicinal plant and offers lots of opportunities for niche business and creative research. For example, it has the potential of producing up to 16-18 tons of roots/ac (Orozco-Obando et al., 2008a). Lotus' large biomass production also offers the possibility of using the plant for the remediation of polluted waters (Orozco-Obando et al., 2008 b) and the roots can be used as an alternative feedstock for ethanol production (Orozco-Obando et al., 2007).

If we focus our energy on it, it will soon be offered in fine restaurants and grocery stores and we will begin to enjoy what the world has cherished for centuries.

Table 1:

Nutrient	Nutrient Concentration				
	Pond Growth			Container Grown	
	Leaf	Petiole		Leaf	Petiole
Nitrogen (%)	2.20	0.80		3.40	2.00
Phosphorus (%)	0.20	0.08		0.40	0.40
Potassium (%)	1.16	1.89		3.07	3.91
Calcium (%)	0.23	0.28		1.24	0.83
Magnesium (%)	0.31	0.23		0.90	0.67
Sulfur (%)	0.22	0.13		0.33	0.37
Chloride (%)	0.91	1.09		1.63	2.86
Iron (ppm)	35.30	22.40		110.10	75.60
Manganese (ppm)	1364.00	602.00		8380.00	2511.00
Sodium (%)	0.04	0.17		0.14	0.82
Aluminum (ppm)	10.00	19.00		92.00	204.00
Copper (ppm)	7.50	9.40		22.50	20.90
Zinc (ppm)	14.20	13.60		28.10	25.80
Boron	~~~	~~~		~~~	~~~
Silicon (%)	0.007	0.003		0.05	0.017

Range of nutrient content within soils, young leaves and petioles in healthy lotus plants grown in ponds and containers (Nguyen, 2001; Hicks, 2005)

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Table 2:

Cultivar	Soil level	Macronutrients (%)						Micronutrients (ppm)						
		N	Ca	K	Mg	P		Fe	Al	B	Zn	Cu	Na	Mn
Embolene	2-Jan	1.87	1.3	1.15	0.38	0.17		39.2	26.2	17.7	10.5	8.7	257	1580.2
	4-Mar	1.92	1.18	1.25	0.36	0.19		50.2	33.7	35.2*	14.1	8.5	312.4	1992.6*
98 Seed	2-Jan	1.5	1.41	0.75	0.39	0.13		30.5	24.7	15.7	17.3	5.9	233.3	1545.8
	4-Mar	1.49	1.33	0.71	0.39	0.13		34.5	27.8	25.6*	13.8	6.5	222.8	2014.1*

Nutrients in the young leaves of lotus sampled on day 70 after planting (Tian et al., 2009b).

*Significant (P <_ 0.05, T-TEST) Comparing soil treatments in the same column for the same cultivar.

References for this article are available online through this link

All photos in this article provided by Warner Orozco-Obando

Call for IWGS 2010 Hall of Fame Nominees

This is a call for our members to nominate persons of note who have made an impact in the world of Water Gardening. There are details on the ***Hall of Fame page on our website*** as to the criteria used in nominating a person. Please email the nominee of your choice along with their credentials to the ***Executive Director*** at ***execdirector@iwgs.org*** for consideration by the 2010 Hall of Fame Awards Committee which is chaired by the Vice President.

The International Waterlily and Water Gardening Society

Is Pleased To Offer Its First Collector's Aquatic Plant Of The Year

Nymphaea 'Ultra Violet'

This outstanding tropical day blooming waterlily has bright purple flowers with up to 70 petals which sit above red pads. The purple flower is accented by a bright yellow center.
Nymphaea 'Ultra Violet' was voted the **Best New Waterlily in 2008** in the IWGS New Waterlily Competition.
Hybridizer: Florida Aquatic Nurseries 2007
Parents: Seed - FAN 3706 x Pollen - FAN 5406 (Both are unnamed hybrids selected for breeding)
Flower Size: 20 cm. (8 in.) with 70+ petals
Leaf Size: 35 cm. x 33 cm. (14 in. x 13in.)
Plant Size: 180 cm – 240 cm (6 - 8 ft.)
Fragrance: Yes
Flowering: *Nymphaea* 'Ultra Violet' is free flowering.
It commonly opens at 8:00 am and closes at 5:00 pm.
It appears to be an active grower even in cooler conditions.
The IWGS wishes to thank Florida Aquatic Nurseries for its participation in this venture.
The cost is US $100 for 1 plant, US $ 250 for 3 plants and US $450 for 6 plants.

Email the ***Executive Director*** at ***execdirector@iwgs.org*** to order yours now.
Join with club members or friends to get the benefit of the lower price for multiple purchases.

San Angelo Lily Fest

By Tim Davis

Why should you travel to this small town in the middle of Texas. Conventional wisdom say that you should not try to grow water plants in an area that only gets 18 inches of rainfall a year and has high temperatures over 100 degrees. There is a simple answer to that question. The answer lies in the name and heart of Kenneth C. Landon, better known as Ken.

Ken started his love affair with the genus *Nymphaea* over 40 years ago and his passion is as strong today as it was when he started. He has gone into the wild jungles around the world to collect new or rare specimens. He has rediscovered waterlilies through extensive research of the original explorers to prove the existence of plants that everyone believed to be extinct. He has amassed the largest single collection of waterlilies in the world. The collection continues to grow through new discoveries, plants acquired through established friendships and his own hybridization work.

Ken has hybridized and named more than 50 waterlilies to date. He has tuber stock of more than 500 hybrids to be trialed that may be the next great thing or may be a genetic repeat. There is a science involved in achieving something new in a hybrid but there is also a large amount of chance. Ken knows as well as anyone how to play those odds for a successful new plant. You may wonder why Ken has not entered and won the new waterlily competition with such knowledge. The fact is that he does not care for personal accolades. He knows what he likes and that is what he concentrates his energies on.

The extinct waterlily described above that Ken rediscovered in Mexico is *Nymphaea flavovirens*. It is described as a star lily for the simple star shape of its flower petals. It is one of the tallest forms above the water of waterlily in the genus *Brachyceras*. It is not as showy as many other types but it is vigorous. When you see a dozen blooms a foot above the water in one spot you just have to stop and stare. Critics said that it was not pretty enough to grow. This just fueled Ken's passion to show them what he knew but they could not envision. He now has created hybrids in virtually every color of the spectrum. He has gone from green pads to mottled pads to those that have almost no green. He increased petal count, then doubled it and then tripled the petal count found in the *N. flavovirens* parent.

He wants to show the world what it does not understand. Without the preservation of the species plants which are more austere, we cannot create the next waterlily that captures the world's attention. Hybrids may come and go but without man, they will surely die. The species will survive as long as it does not have to fight against mankind. ***The International Waterlily Collection*** is the showcase of a life's work. The more important work is what goes on behind the scene. The preservation of not only species material but also rare and historically note worthy material by greats such as Pring, Slocum, Randig and Strawn is why Ken created The International Waterlily Repository.

So once again, why should you travel to this small town in Texas? To see the greatest display ever put together in one showing. We are at more than 200 different specimens and counting for this once in a lifetime display. One other thing I might mention. Did I tell you that Ken is a world class pyrotechnician who will be putting on a fireworks show for you as well? You do not want to miss this event.

The 1st International Conference on Lotus, Waterlily and Aquatic Plants 2010

by Dr. Niran Juntawong

Associate Professor Dr. Niran Juntawong is pleased to announce the 1st International Conference on Lotus, Waterlily and Aquatic Plants to be held at Kasetsart University at the Chalerm Phrakiat Sakon Nakorn Province Campus in Thailand. The meeting will take place October 20 - 22, 2010 with a cultural post tour October 23 - 24, 2010. This meeting is also the 8th National Conference on Research and Development of Lotus, Waterlily and Aquatic Plants in Thailand. Sakorn Nakorn Province is located in north eastern Thailand.

The conference goal is to strengthen the on-going research and to enhance sustainable production of lotus, waterlilies and aquatic plants. Topics will include an overview of lotus growing in Thailand and of lotus flower production in China. The latest trends in lotus seed and root production will also be presented. Various aspects of breeding, biotechnology, production, utilization, marketing and economics, extension and transfer of technology will be presented. There will also be a poster session, exhibition and a field trip as part of this conference. This meeting is a joint venture between various agencies in Thailand and China. Speakers will be from around the globe and the conference will be conducted in English.

Full paper submission must be sent to the secretariat office no later than July 31, 2010. The attendee registration deadline also due by July 31, 2010 and the fee is US $200 for overseas participants. MJ, The Majestic Hotel is the host hotel and the rate of US $20 per night is for a standard twin room.

Complete details may be found at ***http://kurecoil.project.ku.ac.th*** or by contacting:

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IWGS Web Site Members Only Page

The members page features exclusive society news, articles and online voting.
The current member log on is **waterlily** and the password is **tetragona**.
The current password will be deleted prior to the next issues release.
The new password information will be emailed to members prior to the next Journal. After logging in, the members only page allows you to select the current Journal and it will download in a PDF format for viewing. This Journal issue is available online in color for viewing, printing or saving.
A full year of printed Journals may be ordered for $25 through the ***Executive Director.***
We also have a new chat feature on that page as a test for members to interact in real time.

www.iwgs.org

Carlos Magdalena, Royal Botanic Gardens, Kew, Creates Magical Miniatures

Nymphaea carpentariae x *Nymphaea minuta*

All images by Carlos Magdalena, RBG, Kew, unless otherwise specified.

An image says more than a thousand words and I hope that the many pictures on this page are enough to describe the "look" of this hybrid. Traditionally, it has always been easier to come up with larger and larger hybrids, probably as a direct consequence of hybrid vigour. *Nymphaea nouchali* (so far, Australian *N. nouchali* . . .) and *Nymphaea minuta* seem to be the perfect parents for dwarf hybrids.

Species in the subgenus Brachyceras tend to be sparse bloomers and therefore, in displays, hybrids catch the eye of visitors more easily than natural-source plants. On the other end, species in the Anecphya group are proven to have the "wow" effect. Besides purity as species, they produce very large plants, with impressive blooms in good quantities. The downside is that they need big pots, lots of space, high constant temperatures and high levels of light.

In my experience, intersubgeneric crosses involving Anecphya and Brachyceras are not something very difficult to achieve and here you can see a new example. Multiple seedlings from a single pod were grown as the pollination led to many seeds being produced at once. It was so successful that I feared that it was going to be the result of a self-pollination of *N. carpentariae*. The idea vanished quickly: *N. carpentariae* never has produced a fruit if the flower was not hand-pollinated, and nearly all the seeds germinated straight away (*N. carpentariae* is reluctantly difficult to germinate). Furthermore, hastate leaves of the seedlings were smaller than usual, and when the first floating leaves grew it was evident that the hybridization had taken place.

So far all the plants have bloomed white or pink, generally on long flower stalks (all but one plant that opens the flowers on short stalks underwater . . .). As seen in the pictures, flowers are very small, (especially in the pink forms) and vary in size from 3 to 10 cm (1.6 to 4"). They seem to be reliable bloomers. Flowers, unlike the *N. carpentariae* parent, close at night but they seem to open earlier and close later

Carlos Magdalena, Royal Botanic Gardens, Kew, Creates Magical Miniatures

Nymphaea carpentariae x *Nymphaea minuta*

All images by Carlos Magdalena, RBG, Kew, unless otherwise specified.

than *N. minuta*. The general look is a tiny version of *N. carpentariae*. This enables the cross to flower in a "yogurt sized" pot for a while.

N. carpentariae *N. carpentariae x N. minuta* *N. minuta*

James Knock Photo

Andre Leu Photo

Kit Knotts Photo

N. carpentariae *N. carpentariae x N. minuta* *N. minuta*

Six plants in 11 cm pots (4.3 ") can be easily grown in one square metre (11 square feet) of pond surface, so they may be ideal for group planting. What about in an aquarium? The submersed flowering one, perhaps? The leaves don't seem to exceed 10 cm (4 ") and have a serrated edge that looks similar to those found in the night bloomer subgenus Lotos, but with the sprawling habit of subgenus Anecphya.

They haven't been tried yet in dark conditions or cool temperatures, but it is likely that they are more tolerant than Anecphya species. So far these seem to be sterile hybrids.

So what about Aussie *N. nouchali*? Does it cross with Aussie *Nymphaea* subgenus Anecphya? Well yes, or at least that is the only explanation for a batch of seedlings that is growing on (but not flowering yet!) at this time, *N. georginae* x *N. nouchali*. Other crosses in the pipeline? *N. georginae* x *N. minuta*, *N.immutabilis* x *N. minuta*, *N.gigantea* x *N. minuta*, *N.gigantea* x *N. nouchali* are already under way (seed pod, seed, or seedling stage), so this seems to be the beginning of the saga of pocket-sized Anecphya-like waterlilies.

New Hall of Fame Member - Sir Ghillean Prance

Article By James Allison, Larry Nau and Tim Davis
Photos By James Allison

World renown botanist Sir Ghillean Prance was presented with an award by the IWGS in recognition of his groundbreaking research on the Giant Amazon Waterlily. The presentation was made on Saturday, September 27th by the representative of the IWGS, Norman Bennett, on the grounds of Bennetts Water Gardens in Weymouth, United Kingdom.

Detail of the award that was presented.

Sir Ghillean arrived at the New York Botanical Gardens in 1963 as a postdoctoral research associate. Twenty five years later he departed as Senior Vice President for Science of the New York Botanical Gardens and Founding Director of the Garden's Institute of Economic Botany. During his 25 years at The New York Botanical Garden, he conducted prodigious plant exploration and research, mentored graduate students and developed new programs. He made extensive field observations and published his findings on many Amazon plants, including *Victoria amazonica*. In particular the relationship between the night blooming *V. amazonica* flower and the scarab beetle were discovered.

Sir Ghillean became the Director of Royal Botanical Gardens, Kew in 1988. Under his guidance, he created a new sense of purpose as the world's leading center for research into plants and their conservation. He also developed an elaborate fund raising system that serves to support and expand Kew. He was knighted in 1995. He was Director of Kew Gardens for the eleven years leading up to his retirement in 1999.

Sir Ghillean Prance on the left receives the award from Norman Bennett, a formerly inducted Hall of Fame Member.

In retirement he is the scientific director of the Eden Project, a recreation of the rainforest and other environments in Cornwall, England. He is constantly traveling, lecturing, and collecting and studying plants even in retirement.

Sir Ghillean has also devoted much time to the relationship between plants and humans. He has lived with at least sixteen different tribes in the Amazon to study this relationship. A book on his life experiences is entitled A Passion for Plants: From the Rainforests of Brazil to Kew Gardens. It was written in 1995 by Clive Langmead. Sir Ghillean is the author of 19 books and editor of a further 14 books. He has published over 400 papers of both scientific and general interest.

New Hall of Fame Member - Pairat Songpanich

Article By Tim Davis

Mr. Pairat Songpanich was inducted to the IWGS Hall of Fame in July at the symposium held in St. Charles, Illinois. He learned how to cross hardy waterlilies in Thailand under the guidance of Dr. Slearmlarp Wasuwat, an IWGS founding member and member of the IWGS Hall of Fame. Trials were run to perfect how to preserve the seed of hardy waterlilies. Techniques were developed to grow new seedlings in the tropics. Eventually these methods would lead Pairat to the intersubgeneric hybridization between *nymphaea* and *brachyceras*. Ultimately the century old goal of creating a hardy blue waterlily was realized in 2007 with the selection *Nymphaea* 'Siam Blue Hardy'. This noteworthy achievement surpassed all before him who had attempted to achieve this.

Larry Nau on the left and Pairat Songpanich on the right.

Mr. Pairat Songpanich's hybrids have received many awards in recent years.

Nymphaea 'Tan-khwan' was awarded IWGS Best New Hardy Waterlily in 2006. The following year, *Nymphaea* 'Miss Siam' received the same honor from the IWGS. At the IWGS Thai Symposium in 2007 Pairat's waterlily *Nymphaea* 'Tanpong' received the 1st reward trophy from her Royal Majesty. He also received the 2nd reward trophy for *Nymphaea* 'Rattana Ubol' and the 3rd reward trophy from her Royal Majesty for *Nymphaea* 'Miss Siam'. In 2007 *Nymphaea* 'Pink Ribbon' was voted number one in the online Waterlily Beauty Contest by members of Water Gardeners International (WGI). Pairat generously agreed that a portion of the proceeds from the sale of N. 'Pink Ribbon' will support breast cancer charities.

In December of 2008, Pairat Songpanich was honored with The Best Plant Breeders Award from The Plant Breeding and Multiplication Society of Thailand. In 2009 the Royal Botanic Gardens Kew requested 9 cultivars for a display in the gardens. Also in 2009, the Thailand Post Company Limited has honored Mr. Songpanich with 2 postage stamps which are illustrated with *Nymphaea* 'Tanpong' and *Nymphaea* 'Tan-khwan'.

Not only does Pairat excel in the art of growing and propagating waterlilies but he is also an award winning amateur photographer. Pairat has won 9 international photo awards and 54 photo awards within Thailand. Among his favorite subjects to photograph are orchids and as you might have guessed waterlilies. He continues to lecture, discuss and hybridize so the future is wide open for further achievements.

Pond Ice Sculptures

by Jennifer Zuri
Aquascape, Inc.

Keeping your pond running during the frozen months of winter will allow you to enjoy the beautiful ice sculptures that form in the stream and waterfall. Although it is beautiful, it is possible that the ice build-up can form dams that could divert your pond water out of the pond. Check on the waterfall and stream and monitor the water level periodically throughout the winter. If you see an ice dam forming or the water level dropping at a high rate, your pond might be losing water because of the frozen sculpture and it might be time to turn off the pump for the winter. If you decide to leave the pond running until warmer weather however, your main concern is to ensure there is enough water for the pump or pumps to operate properly.

Can a pond run throughout the entire winter?

During the winter months, the usual water supply options are not available. Outdoor water spigots and automatic water fill valves should be turned off to prevent pipes from freezing and cracking. Therefore, pond owners who run their systems during the winter will have to find an alternate water source to replenish their pond. Water can be supplied via a hose run from inside the house or by making multiple trips with a five-gallon bucket. Generally speaking, it is not uncommon to have to go out a few times a month during the winter to "top off" the pond.

Won't the waterfall freeze solid?

Pump size is important when determining a waterfall's ability to operate during the winter. A pump that provides at least 2,000 gallons per hour (gph) can be operated throughout the winter without a problem, as long as it runs continuously. Moving water will usually keep a hole open in the ice around the waterfalls and in front of the circulation system. However, repeated days in sub-zero temperatures may lead to excessive ice build-up and can cause the system to operate improperly. If the flow of water into the circulation system is unable to keep up with the pump because of ice build-up, it may be necessary to shut the system down. The system can be run again once the ice is melted and normal water flow is restored.

Will the filters and pipes crack?

Most good filters are constructed out of rotational-molded polyethylene, and are designed to bow and bend with the freezing and thawing effects of winter. The PVC flex pipe is reinforced and will also not crack unless water is left in the pipe over the winter and allowed to freeze. If you decide to keep the pump running all winter long, there will still be a constant flow of water traveling through the pipe, and the moving water will not freeze.

The bottom line

The bottom line for winterization is maintenance. Roughly 70 percent of pond owners in the colder climates decide to shut down their system because they don't enjoy tending to their water garden during the bitter months of the winter. The aesthetic rewards of the winter pond are absolutely worthwhile, so by all means; don't be afraid to keep the system running as long as possible. Shutting down a pond during winter is also an option. Just be sure you take precautionary measures to preserve pump, fish and plant life.

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Front cover photo
This lotus field is in the city of Liaocheng.
It is on the lower reaches of the Yellow River and at the meeting point of Hebei, Shandong and Henan Provinces in China. © Warner Orozco-Obando

Back cover photos
In ancient times Yueyang was called 'Baling or Yuezhou' and is a historic and cultural city with a long history of more than 2,500 years. Located at the northeast of Hunan Province, neighboring Jiangxi Province in the east and Hubei Province in the north, Yueyang was a hinterland of military importance during the past dynasties.
"Witches Hat Mountains" - Yunnan province, in southwestern China is an area 150 miles South of Sha Ping.
© Warner Orozco-Obando

All inside uncredited photos
© Tim Davis

Mission Statement—The International Waterlily & Water Gardening Society (IWGS) is a non-profit organization of multinational membership dedicated to the furtherance of all aspects of water gardens and their associated plants. As an organization we support and promote education, research, and conservation in these areas.

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Witches Hat Mountains - Yunnan province, in southwestern China

Yueyang - northeast area of Hunan province, China