

Nurseries should try out these products under their own conditions to ascertain which gives the best quality liners for potting on.

PROPAGATION OF MARGINAL AND AQUATIC PLANTS.

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Aquatics are a very specialised group of plants so first I will describe the natural conditions under which such plants grow. One word, WET. The degree of wetness will vary from moist soil or mud to several metres of fairly clear water.

It is obvious to anyone that there is a marked change in the vegetation at the edges of ponds and lakes. As the soil above the water table becomes shallower the moisture content increases and oxygen levels drop. The first indication is that the only trees that thrive are those that need lower levels of oxygen, e.g. willow, alder, etc. Such vegetation is called "carr" vegetation. The highly variable flora of drier land gives way to sedges, rushes kingcups, and water docks.

Some plants are adapted to grow with their roots rooted below the water. Above the water their aerial stems photosynthesise as normal terrestrial plants. These plants, sometimes half in and half out of the water, are called EMERGENT PLANTS.

As we move further away from the bank and, if the water becomes deeper, these plants cannot grow and we come to a zone of plants which are THE FLOATING-LEAVED PLANTS. They are rooted in the bottom but they send up stems and/or leaves (sometimes different types of leaves above and below the water) and these photosynthesise above and below the water.

Some of these plants hang in the water, preferring to drift about drawing nutrients directly from their watery surroundings. The floating leaved plants grow best in still waters.

In amongst these plants, and in the deeper parts of the water, we find another zone of SUBMERGED PLANTS. The submerged plants rely on the light penetrating the upper horizons of the water, and on the nutrients in the water for photosynthesis. Like the sea weeds they have little need of strong stems — the water buoys them up. One can find a degree of internal strengthening in species adapted to growth

in streams but generally they are very fragile and bits break off easily.

Natural propagation. The aquatic trade is not as well developed as the terrestrial trade, perhaps because it is a cold, wet and malodorous business at certain times. The range of plants is relatively small and some of them grow naturally at a rapid rate so production always satisfies demand in the more common plants. The season can be very short, especially in England. Aquatic plants soon outgrow their surroundings, and sometimes they do not keep well, so some reliance is put on supplies from established stock beds which may be the margins of lakes and ponds.

Natural propagation occurs through:

Seed dispersal: by wind and water (wind-blown seeds and floating fruits and seeds), also by burrs attached to fowl or mammals. The seeders always have a strong back up of vegetative propagation.

Spores. A few aquatics are spore bearing, e.g. *Equisteum*, but for trade purposes vegetative propagation is quite fast enough.

Vegetative propagation. The emergent plants generally spread by rhizomes often making mats. Pieces of these break off, float away, and new colonies are started.

Floating Leaved Plants. Certain water lilies spontaneously produce buds or "eyes", as they are known in the trade. These branch off or break off, float away and make new plants. the production of eyes is spasmodic; it is not quite as simple as getting axillary buds to grow. They are more like latent buds. By trimming back hard and planting in shallow water some lilies may be induced to produce more eyes. One *Nymphaea*, "Colonel Welch" will produce a yellow flower and this, on dying, may produce young plantlets viviparously. It is an exception.

Submerged Plants. These all rely heavily on vegetative propagation. Pieces break off during growth and these equivalents of stem cuttings float away and form roots. No need for a mist bench. Some plants produce "hiburnacula." These bud-like structures hold stored food material. At the end of the growing season they break off and fall to the bottom ready to grow out in the following spring, e.g. Hornwort; Water soldier; Water milfoil.

All of the underwater growth responses are more tied to temperature than anything else. One can control the temperature of a body of water by controlling its volume also the flow of new water through it. Water depth can give winter protection,

but too much and you have a cold sink which takes a long time to warm up. Aquatic nurseries are best situated where there is natural, clean water in copious supply. In summer the evaporation from water surfaces and associated crop cover is enormous.

I will now deal with some of the plants in more detail but I have only time to skim over and under the surface. The ornamental garden trade and the ecological and fish management trades overlap to a degree but they do have specialist requirements depending on many environmental factors.

Acorus calamus (Sweet flag). Superficially this looks like a flag iris but instead of the showy yellow flower on top. *Acorus* pushes a small tail-like inflorescence out of the side of its leaf stems. The variegated form is ornamental and propagates readily from offshoots which arise from the fast growing rhizome.

Alisma plantago-aquatica. (Water plantain). This rapidly spreading plant has fresh green foliage. The tuberous rhizome throws up shoots from the axillary buds which all the stems bear. After flowering, between June and October, the plant produces copious amounts of seed.

Aponogeton distachyon (Water hawthorn). This South African plant will grow and flower almost all summer. It is a true aquatic and highly fragrant. It may be propagated from seed or pieces of rooted plant. Water fowl enjoy eating this plant.

Calla palustris (Bog Arum). Like all of the aroids, this plant produces fleshy seeds. The spadix should be gathered before the seeds float away, then the seeds are separated and sown in wet pans. It can be propagated from rooted pieces of the fleshy rhizome.

Caltha palustris (Marsh marigold). When ditches and wet meadows were common this plant abounded. It spreads by seed but may be induced to root from its soft stems in the growing season. The double-yellow and double-white forms must be propagated vegetatively, as they are sterile.

Carex (Sedge). These grass-like plants may have triangular stems which are interesting. Some are tall (e.g. *Carex longus*) in appearance like a 5 ft umbrella plant, whilst one is very ornamental and no more than 2 ft tall — *Carex* 'Bowles Golden'. If left alone too long the tussocks or clumps become very tight and it is not possible to easily extract plants from the centre. When they are extracted they have few roots. Seed from the yellow forms shows some variation.

Glyceria maxima (*Glyceria aquatica* 'Variegata'). This highly ornamental plant is the perfect nurseryman's plant, though fishermen may grow to curse it. It grows quickly and pieces

detach with pleasant ease from the loose mat which densely covers the shallow water areas. Most of the other emergent mat-formers strongly resist lifting.

Iris kaempferi is close to *I. laevigata* but it has a prominent mid-rib. It will not stand in water all winter but the colour forms are varied due to centuries of work by the Japanese.

Iris laevigata. The type with blue flowers comes readily from seed; this is better than waiting for extensions from the rhizome. This useful, fully hardy emergent plant has numerous forms, some of which are very choice and scarce. *Iris l.* 'Lilacina'; *I.l. alba* 'Snowdrift'; *I.l.* 'Colchesteri' (Syn. *monstrosa*) *Iris laevigata* 'Variegata'. There are colour forms with purplish and reddish flowers. All these special forms have to be propagated vegetatively.

Iris pseudacorus (Common flag iris). This is common enough not to need specialist intensive propagation techniques. A good stock bed will easily meet demand. It needs moist ground. It has various forms, the best of which is the slower growing *Iris p.* 'Variegata'. The paler yellow, *Iris p.* 'Bastardi' will perhaps interest the collector.

Lysichiton americanum is the yellow skunk cabbage, and *Lysichiton camscatense* is the white-flowered Old World species. In a garden I once cared for there is a specimen (perhaps the first) of the hybrid and I have always called this, *Lysichiton* 'Brave New World'. This hybrid has hybrid vigour and a large whitish-yellow spath. *L.americanum* seeds freely in situ, and *L. camscatense* will produce plants if seed is collected late in the year and sown in wet pans away from rodents.

Menyanthes trifoliata (Bog bean). The leaves look like young broad bean (*Vicia faba*) leaves, hence the name. The white-frilled flowers add interest to the margins and shallower water. Propagate by divisions.

Orontium aquaticum (Golden club) is another aroid having similar seed characteristics. The pencil-thin spadix rises above healthy, bland green foliage. It is useful in that it will grow in 18" of water.

Peltandra virginica is a good plant for the bank. It has healthy leaves and a fresh green, lush appearance. There is a relatively uncommon form with an orange streak down the back of the midrib on the obverse of the leaf. Propagation is by division.

Phragmites communis (Common reed). This is a true grass so it will propagate sexually from wind-blown or collected seed. Once established it hardly needs this, for it not only has underground underwater rootstocks producing side shoots, but

fascinating decumbent shoots which reach out across the surface for up to fifteen feet.

Pontederia aquatica is a useful emergent plant producing ornamental foliage and varying shades of blue flowers depending on cultivar. The type can be propagated from seed, sown green in wet trays, or by division. The white form is more scarce, less vigorous, and so far as I know does not come true from seed.

Sagittaria sagittifolia (Arrow head). A wild plant and a desirable ornamental emergent plant. Put it in an aquarium or deep water and it will produce strap-like leaves. In shallow water it presents bright white flowers above the arrow shaped leaves. Runners are formed under the mud. Once detached they will form new plants. This vegetative method is the only way to propagate the double form.

Scirpus albescens and *Scirpus zebrinus*. Both are garden forms of common wild plants. The former is five feet tall, the latter 2 to 3 ft. Each has its own distinctive green and white variegation and architectural value in the water garden. *Scirpus albescens* is more of an emergent species. Propagation solely by division.

Sparganium erectum (Bur reed) produces seeds and offshoots. The former float and attach themselves to animals.

Stratiotes aloides (Water soldier). This strange plant spends its life rising up and down in the water. It looks like an aquatic aloe with a prickly rosette of leaves. From the apical buds in the rosette, long pendulous shoots are formed and these themselves develop plantlets not unlike the stoloniferous appendages on strawberry plants. The plantlets have leaves and aquatic roots. They part from the mother plant and drift on in their own way. They may also form winter buds which develop the following spring. They do flower, male and female being on different plants. Males are reputed to be rare in Britain. A group of these in a pond or tank, with a foot of water over them for winter protection, will double their numbers in a year.

Typha latifolia. This is a valuable ecological plant for consolidating lake edges. The wind-blown seeds will only germinate after exposure to critical day and night temperatures and, like willow seed, it must be fresh and sown immediately onto a wet surface. It is generally propagated from the shoots arising from the rhizomes. These can be very brittle and, if some people are to be believed, quite tasty.

Nymphaea (Water lily). One could write a book on nymphaeas alone, but briefly the nymphaeas sold in the trade

today are species such as *N. tetragona*, a small plant readily raised from seed, *Nymphaea alba* usually from divisions, *Nymphaea odorata* from divisions, with a wealth of hybrids and colour forms.

The hybrids are derived from complex intercrossings between *N. alba*; *N. tetragona*, *N. odorata*, *N. mexicana*, *N. tuberosa*, and possibly others. All the best work has been done by M. Latour Marliac, a Frenchman. Between 1877 and 1913 he raised most of the best plants found in the trade today. There have been others who have contributed to the store of beautiful plants we have today. The prime interest has been in France, United States, Germany, Great Britain, Sweden, Switzerland and Australia.

The hybrids can only be propagated vegetatively by growing on the little offsets which I mentioned earlier, or dividing the rhizomes. There have been attempts at meristem culture but, so far, the difficulties are insurmountable.

R. DOOL: How do you get rid of duckweed in ponds, besides manually?

G. BURGESS: It can be killed with Paraquat, though its use will be determined by whether fish are present. If you can remove the fish, then you can spray with Paraquat.

R. DOOL: If you had a lily problem could you use Casoron G?

G. BURGESS: You can use Roundup on lilies sprayed from a boat. Casoron G is better for submerged water weeds.

VOICE: How long before the fish can be put back?

G. BURGESS: It depends on the volume of water, but if draining and refilling, it will be the standard wait for the water to recover again.

D. GILCHRIST: Is there a special formulation of Casoron G for water weeds?

G. BURGESS: Yes, a powder formulation but it is expensive. In addition, you have to check with the water authority that your water is not connected in any way to the domestic supplies. There are very few herbicides which are classed as safe for use in water.