

Cultivation Guidelines Bromeliad









Introduction

This growing manual describes in short the growing of Bromeliads. Of course this concise handbook is not all-embracing and the cultivation is subject to new insights and techniques. For more detailed information about the possibilities of this cultivation you can contact Anthura B.V. For all your growth related questions the consultants of Bureau IMAC Bleiswijk B.V. are pleased to help you.

In case you are not familiar with the products of Anthura B.V. and the services of Bureau IMAC Bleiswijk B.V., please consult the enclosed introduction of both companies.

Introduction Bromeliads

'Bromeliad' is in fact a collective name for a group of plants belonging to the *Bromeliaceae*. Examples of well-known genera are *Guzmania*, *Vriesea*, *Tillandsia*, *Aechmea*, *Neoregelia* and *Nidularium*. The various genera can be sub-classified in terms of their leaf margins, inflorescences, and seed types. *Guzmania*, the best-known genus of the Bromeliads, has green leaves and a star-shaped flower in a variety of colours. *Vriesea* has a sword-like (feather-shaped) inflorescence; the leaves are either variegated or green. *Tillandsia* often exhibits a pink inflorescence, with blue-violet flowers. *Aechmea* has silvery leaves with a pink inflorescence. *Neoregelia* has red bracts, and the flowers remain within the cup-shaped leaf rosette. *Nidularium* has a yellow inflorescence.

Family: Bromeliaceae			
Subfamily	Genus	Leaf margin	Seed type
Tillandsioideae	Guzmania Tilandsia Vriesea	Smooth	Plumous
Bromelioideae	Aechmea Pineapple Neoregelia Nidularium Bromelia	Fully dentate	Naked
Pitcairnioideae	Pitcairnea Dyhia Hechtia Puya	Dentated Base	Appendaged

In nature Bromeliads grow in tropical rainforests, and consequently they flourish at temperatures between 20-22°C and a relative humidit y of 70%. Bromeliads also require shaded conditions. Bromeliads are able to absorb nutrients through the roots, the cup, and the leaves (via trichomes). The roots also serve to anchor the plant.

Plant material

The plant material is supplied in the form of plants that have been pricked out either once or twice during cultivation. Plants that have been pricked out twice are cultivated by the plant supplier for a longer period of time, and consequently are larger.











Young plants 1x pricked out

Young plants 2x pricked out

The initial size of the plants used for cultivation depends on the pot diameter, the plant density subsequent to potting up, and the required duration of cultivation. The collection of side shoots from plants that have already flowered is not an option; these shoots are very irregular, possess less vigour and are of a lower quality. Moreover it is not possible to guarantee that side shoots are free of disease.

On arrival the young plants must be unpacked and allowed to acclimatize under the cultivation conditions. The plants can be potted up once they have become acclimatized. When potting up the plants it is important to ensure that they are vertical, located in the centre of the pot, and planted at the correct height. The growing point of plants that are planted too deeply are susceptible to disease, whilst plants that are not planted deeply enough will lack sufficient anchorage and consequently be unstable. It is also important to ensure that the growing point is not squeezed when the plant is potted up, since this could otherwise result in the deformation of the foliage or permanent injury to the growing point (resulting in the death of the plant).

In general, once the plants have been potted up they will be subdivided into two grades, i.e. plants that have a healthy appearance and are of the correct size, and the smaller plants. Small plants often require a slightly longer cultivation period; small plants that are separated at the beginning of the cultivation and kept together will exhibit improved growth because of increased control, and the absence of competition from larger plants.



Using a potting machine



Correct planting depth







The cultivation plan

On reception the plant material may, depending on the type of plant material, the climate, etc., be too small for immediate potting up into the final pot (larger than 10 cm). In such instances it is preferable to pot up the plants in cell-liner trays or a smaller pot size (7-9 cm).

It is preferable to set the pots next to each other once the plants have been potted up, since the micro-climate – and consequently the growth – will benefit from as brief as possible a delay before the plants regain contact with each other. The plants must be provided with more space once the pots and/or the soil are no longer visible. The following table contains an example of a spacing scheme, in this instance for *Guzmania*. In general the plants will need to be put out by an additional 30%, so as to ensure that the leaves regain contact with each other within a period of a few weeks. Depending on the species, the cultivation period and the quantity of light it will be necessary to put out the plants by an additional 30%. Not putting out the plants for too long will result in the poor development of the flowers, and in smaller plants with smaller leaves. Premature or excessive spacing of the plants will be detrimental to the micro-climate, and consequently to the growth.

Example of spacing distances and weeks for the Guzmania group:				
	Operation	Plants per m ²	Weeks	
Pot size 7-9 cm	Potting up	110 75	20-22 18	
	Increase in space	110 - >50 75 - >40	18-20 18-20	
Pot size 11-13 cm	Potting up 7-9 cm Potting up 11-13 cm Increase in space	75-110 40-50 20-25	20 20-22 18-20	

Bureau IMAC Bleiswijk B.V. can provide advice about the preparation of a cultivation plan.

The total cultivation time is 37-45 weeks in 7-9 cm pots and 50-70 weeks for 11-13 cm pots.

The substrate

When selecting the substrate it is important to ensure for the presence of coarse particles for the drainage and fine particles (not dust) for the retention and distribution of the water and the nutrients. In general, preference is given to a substrate containing 60-70% coarse particles and 30-40% fine particles. The coarse particles can be comprised of materials such as Irish peat, bark, or coarse peat. The fine particles can be comprised of perlite, peat litter, or fine bark. Ultimately the substrate will need to consist of 50% solids, 25% water, and 25% air. The substrate may not contain an excessive amount of dust, since this will otherwise result in the compacting of the substrate at the base of the pot. In view of the relative long cultivation period it is also important to ensure that the substrate does not break down excessively rapidly. In addition to the substrate used in the pot, the drainage of the pot is also of importance.







Subsequent to watering, water may not remain in the lower region of the pot for an excessive period of time. In general pots of a size of between 9-15 cm are used; 9-cm pots are used for compact plants with a rapid development of the flowers, whilst 15-cm pots are more suitable for the somewhat larger species and plants requiring a longer cultivation period prior to becoming ready to flower.

Bromeliads are grown both on the ground and in tables/containers. The choice of the cultivation method will depend on the rate of turnover, the automation of the operation, and the required working height. It is important to ensure that the plants are provided with appropriate drainage, and that water can be supplied to the cup of the plants.

The irrigation system

In view of the Bromeliad's ability to absorb nutrients through the cell tissue of the cup it is important to ensure that they are watered from above using either sprinkler lines or spray booms. The water must be free of chemical and visible contamination; moreover the water may not contain an amount of elements such as sodium and chlorine in excess of 50 mg/l, and may not contain an excessive amount of bicarbonate. In the absence of supplies of good-quality water it will be necessary to make use of reverse-osmosis water.

The quantity of water required by the plants depends on the climate, the substrate, and the age of the crop. The irrigation system must be capable of supplying between 5-12 litres of water per m². Sufficient water has been given once all the cups overflow.

Fertilizers

Bromeliad cultivation can employ either compound fertilizers, a system with separate mixing tanks for the fertilizers, or compound fertilisers using a Dosatron[®]. General advice based on the use of mixing tanks for the fertilizer is enclosed with these guidelines. The needs may vary from variety to variety; Bureau IMAC Bleiswijk B.V. can be requested to provide customised advice for the relevant variety.

Caution should be exercised with the use of the elements phosphate, boron, zinc, and copper. Higher concentrations readily result in tip-burn, retardation of growth, and die-back. It is also important to bear in mind that some pesticides can contain copper and zinc. When using a basic fertilizer on a peat substrate it is important to ensure that the mix does not contain an excessive amount of Dolokal (< 2-3 kg/m³). In addition, 0.5 PG mix (12-14-24) per m³ is more than adequate. This should result in a pH of the substrate of about 5.5, and an EC of 0.5 mS/cm.

The EC of the nutrient solution should lie within the range between 0.8 and 1.0 mS/cm; a subsequent rinse with a lower EC is required. *Tillandsia* and *Vriesea* exhibit the greatest vulnerability to excessive levels of nutrient salts. The pH may fluctuate between 5.2 and 6.2. In view of their low needs for CO_2 Bromeliads do not need supplementary CO_2 .







System: Mixing tank; 1,000 litre tanks

Water supply: 100% rainwater

A - solution, a concentration of 100 times

Nitrate of lime	Ca(NO ₃) ₂ 19.0% Ca, 15.5% N	0,0 kg.
Ammonium Nitrate (liquid)	$\rm NH_4 NO_3~18\%~N~(9.0\%~NO3$ and 9.0% $\rm NH_4)$	9,0 kg.
Nitric acid 38%	HNO_3 8.4% N, 6.0 mol H_3O^+ per kg	0,0 ltr.
Potassium nitrate	KNO ₃ 38.2% K, 13.0% N	14,8 kg.
Iron chelate 3%	(DTPA)	0,0 kg.

B - solution, a concentration of 100 times

Phosphoric acid 59%	H_3PO_4 26.8% P, 8.6 mol H_3O^+ per kg	0,0 ltr.
Potassium nitrate	KNO ₃ 38.2% K, 13.0% N	17,3 kg.
Potassium dihydrate phosphate	KH ₂ PO ₄ 28.2% K, 22.3 % P	4,0 kg.
Potassium sulphate	K ₂ SO ₄ 44.8% K, 17.0 % S	0,0 kg.
Epsom salt	MgSO ₄ 9.9% Mg, 13.0 S	2,5 kg.
Manganese sulphate	MnSO ₄ 32.5 % Mn	0,0 g.
Borax	Na ₂ B ₄ O ₇ 11.3% B	0,0 g.
Zinc sulphate	ZnSO ₄ 22.7% Zn	0,0 g.
Copper sulphate	CuSO ₄ 25.5% Cu	0,0 g.
Sodium molybdate	Na ₂ MoO ₄ 39.6% Mo	0,0 g.

The climate

Temperature

Bromeliads are subtropical plants, and consequently temperatures lower than 14° and above 35°C should be avoided. For an appropriate growth e ndeavours should be made to maintain an average temperature of 18-20°C.

Relative humidity

An excessively low relative humidity will retard the rate of photosynthesis, whilst an excessively high relative humidity will increase the risk of problems with moulds. However it is important that more moisture is present at higher light intensities. Countries with a climate possesing a high relative humidity may make use of higher daytime temperatures and light intensities. Endeavours should be made to maintain the relative humidity in the range between 60 and 80%. In situations in which the relative humidity is too low – and certainly in combination with higher temperatures – it is in important to install systems that will increase the relative humidity, such as systems that do not wet the crop (for example, high-pressure humidification in the upper regions of the glasshouse, sprinkler lines under the pots, path/fan systems, etc.)







Light intensity

Excessive light intensities will often result in pale foliage and flowers, whilst it is also possible that the foliage will acquire a red tint (depending on the species) and become burnt. Inadequate light intensities result in straggly and poor quality plants. At a maximum of 1400 Watt/m² on sunny days a shading percentage of 80% will be required, which can be achieved by the use of chalking and/or screens. The following light intensities at the level of the plants are recommended for the species shown below:

Aechmea		30,000	lux
Guzmania	18,000 -	22,000	lux
Neoregelia		25,000	lux
Tillandsia	25,000 -	30,000	lux
Vriesea	18,000 -	20,000	lux



Too much light exposed to Vriesea

For cultivation in tropical countries a screening net offering 80% shading is required. Preference is given to the use of two nets, i.e. a fixed net providing 60% shading and a second movable net offering 50% shading. The movable net can be closed during sunny periods and at the middle of the day, thereby avoiding peaks in the light intensity.

The use of plastic screens is recommended when Bromeliads are grown in regions with a great deal of rain, since this will result in a drier crop and a reduced incidence of disease (bacteria and moulds). An additional benefit offered in these conditions is the reduced degree of the leaching of nutrients from the substrate; as a result the nutrient concentration in the pots and the cups will remain optimal, in turn ensuring for a more rapid growth and the elimination of the risk of the plants suffering from deficiencies of nutrients. So as to provide for a constant temperature and to ensure a good circulation of the air it is recommended that the gutter height should be between 3-4 metres.

For the purposes of subsequent thorough analyses of any cultivation problems that may occur it is important that suitable records be made of the most important climatic parameters, such as the light intensity, temperature, and relative humidity. These measurements should be made using a climate computer or hand-held meters; records should be kept of the minimum and maximum daily values.







Gases

The ageing hormone ethylene is used to ensure that Bromeliads flower simultaneously and in accordance with the scheduling. This flowering treatment can commence once the plants have grown sufficient foliage. Gassing is usually effected using acetylene (C_2H_2), which is dissolved in water and then poured into the cups. An appropriate concentration is achieved by bubbling acetylene gas at a pressure of 0.5 bar through 100 litres of water for at least 30 minutes. The ideal temperature of the water is about 20°C, since water at this temperature contains sufficient gas for the treatment whilst not being excessively cold for the plant. This treatment is most likely to be successful when carried out in the morning at high light intensities, since the plant will then be able to absorb the gas throughout the entire day; moreover the temperature is lower in the morning, resulting in a reduced evaporation of the gas during the first hours of the treatments will suffice at adequate light intensities; otherwise two to three treatments will readily be required if the treatment is to succeed.



Bubbling Acetylene gas in a tank



A mixing system for acetylene gas

The number of treatments also depends on the species; when in doubt an additional treatment should be given to prevent partial flower induction. If flower induction is to be achieved then it is important that level of nutrients available to the plants is low prior to the flowering treatment. Consequently it is important that the fertilization is halted in good time, and that the fertilization is then recommenced so as to restore the colour to the crop. A treatment with Ethrel is necessary for *Tillandsia* and optional for the green-leaved *Vriesea*. However more damage may be caused by the use of Ethrel if it is employed without due caution.



Bottle with acetylene gas



Filling of the cups











Partial flower induction

Partial flower induction

Diseases and pests

The most significant diseases afflicting Bromeliads are moulds, mites, and thrips.

Exsorhillium

Neoregelia is susceptible to the mould *Exsorhillium*; diseased plants exhibit brown spots which spread to the base and ultimately result in the death of the plant. Measures to retard mould growth such as good hygiene, a reduced relative humidity and an anti-fungal treatment are required to prevent further loss.

<u>Mites</u>

The pineapple mite and the straw mite are the most harmful species of mites infesting Bromeliads. These microscopic mites live in the cup, causing deformation of the flowers and discolouration of the foliage. The red spider mite can also infest Bromeliads; these mites live on the foliage, and cause a silvery discolouration.

Sciaridae (fungus gnats)

Large numbers of sciarid larvae attack the root tips; large numbers of larvae of these fungus gnats are particularly likely to be found in the last plants of big lots. The preventive deployment of the *Hypoaspis* predatory mite (100-150/m²) is often sufficient to prevent infestation.

You can contact Bureau IMAC Bleiswijk B.V. for adequate pest-control measures. Caution should be exercised with respect to phytotoxicity; not all chemical agents can be used on Bromeliads without causing damage. Any new pesticide agent should be tested on a few plants prior to large-scale use. Moreover the concentrations stated on the packaging are often too low – and, on occasion, too high. Always contact Bureau IMAC Bleiswijk B.V. if there is any cause for doubt. It is also necessary to take account of the slow response of the plants when making an assessment of the effectiveness of a treatment.







Sale

The plants are ready for sale once the flowers have developed to a sufficient extent. With *Achmea* this point has arrived when a bud has opened above the edge of the cup, whilst with *Guzmania* and *Vriesea* the flower needs to have acquired its colour. When the plant is made ready for sale any damaged leaves are removed, the water is emptied from the cup, and the plant is wrapped in a sleeve. It is important that the temperature does not fall below 18°C during transport.



Guzmania ready for sale

Tillandsia ready for sale

We hope that these brief cultivation guidelines will have given you an insight into the cultivation of Bromeliads. Although the cultivation of Bromeliads is a specialized operation, it is certainly feasible provided that a number of conditions are met. Growers who fulfil these conditions will be rewarded with a beautiful plant that can readily be kept in a good condition, and which deserves an excellent place in the market. You are welcome to contact us should you have any additional questions, or require a further explanation of any issues.

Anthura B.V. and Bureau IMAC Bleiswijk B.V. cannot accept any liability whatsoever for any damage that may be caused to the crop by following the advice in these guidelines. Moreover in view of the fact that many factors are both outside of our influence and our control we are unable to guarantee specific results.







Introduction Anthura B.V.

Anthura B.V. is the world market leader for planting material of Anthurium for pot plant and cut flower culture with greenhouses covering 14 hectares. Besides Anthurium we specialise in the breeding, selection and propagation of Phalaenopsis for pot plant and cut flower culture. Bromeliad completes our current product assortment, and we are happy to offer growers abroad planting material from Corn. Bak B.V. From a growers perspective all of these products are compatible and in many countries are cultivated next to each other. At the establishments in the Netherlands (Bleiswijk) are 180 workers employed and at the establishment in Germany (Borken-Burlo) are 55 workers employed.

It is important that before you begin planting you are thoroughly acquainted with the various husbandry methods we recommend here. This will enable you to make a good start and allow your crop to realise its full potentials. Additional information can be sought through our visiting representatives and agents as well as from the independent consultant agency Bureau IMAC Bleiswijk B.V. Alternatively you can contact the Anthura Sales department.

Phone.:	+31 10 529 1919
Fax:	+31 10 529 1929
E-mail:	info@anthura.nl
Internet:	www.anthura.nl
	Phone.: Fax: E-mail: Internet:

Introduction Bureau IMAC Bleiswijk B.V.

IMAC consultants are well educated individuals equipped with a great deal of practical experience gathered at home and abroad and dedicated to your success and ultimately to our own. Consequently there is a great deal of information exchange between our respective organisations upon which growers may call.

Because of our small-scaled mode of operation and a good consultative structure within our walls we keep each other well informed about the developments in the various cultures. Owing to the unique co-operation with Anthura a broad exchange of knowledge takes place between both companies without affecting the independence of IMAC. The activities of IMAC are not limited to the Netherlands only. Many foreign growers make use of the services of our consultation agency. Because of this international character the IMAC consultant is able more than anybody else to get the most out of your cultivation under your specific circumstances.

Activities of IMAC services world-wide include: advice on cultivation and management, support of study groups, fertilisation analysis and advice, studies in the fields of plant disease, business economics, plant evaluation and pot plant planning.

For more information, without obligation, you can contact the consultants at Bureau IMAC Bleiswijk B.V.

Bureau IMAC Bleiswijk B.V.	Phone:	+31 10 521 90 94
Anthuriumweg 12	Fax:	+31 10 521 82 30
2665 KV BLEISWIJK	E-mail:	info@imac-bleiswijk.nl