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RESEARCHES ON THE EFFECT OF THE MAIN ELEMENTS AND CERTAIN NUTRITIVE MIXINGS IN THE DEVELOPPING AND PREVENTION OF THE SHORTAGE TO SOME ORNAMENTAL PLANTS

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The present paper is focused on species and hybrids of leaf decorative plants of Begoniaceae family: Begonia boweri, Begonia rex- cultorum, Begonia masoniana, Begonia x diadema.

The name of the Begonia genera came since 1690 by French botanist Ch. Plumier (1646-1704) dedicated to Michel Begon (1638-1710) French Antilles intendent.

The first publication which describe in 1651 a Begonia species „Nova Plantarum Animalium et Mexicanorum Historia" by Francisco Hernandez a Spanish naturalist from Toledo presented a plant discovered before 1577 and later called Begonia gracilis H.B.K.

In 1690, Ch. Plumier discovered 6 species among them: Begonia plumieri, Begonia rotundifolia and then the research intensified. These discoveries were the source of important profits for the horticulture by subsequent hybridation that followed.

One of the first hybrids of Begonia was obtained in England in 1847, called Begonia x ricinifolia, having as genitors Begonia heracleifolia and Begonia barkeri; another hybrid from that time is Begonia x erythrophylla in the Berlin Botanic Garden resulting from Begonia hydrocotyfolia with Begonia manicata. The genitors of these two hybrids originated from Mexic.

There are known several classifications of the Begonia genus: J.F. Klotzch's from 1855, A. de Candolle`s from 1864 Chevalier`s who group them as follows:

- Beganias with tubers and bulbs – have an underground tuber, sometimes small bulbs between root and stem or near the leaf for instance: Begonia bogneri, Begonia dregei, Begonia boliviensis, Begonia socotrana, etc.
- Begonias with rhizomes – have as main reproduction organs the rhizomes, the foliage is highly ornamental by true and shiny colors ex: Begonia boweri, B. deliciosa, B. diadema, B. decora, B. imperialis, etc.
- Begonias with bamboo stems – include species with stems length between 0.6-4-5m, resembling the bamboo stems, with prominent nodes and bent blooms ex: Begonia albo-picta, B. coralina, Begonia lubbresii, etc.
- Begonias with thick stems – which have tall stems, thick, with long internodes less or no branching ex: Begonia dichotoma, B. ulmifolia, B. vitifolia, etc.
- Bush begonias – this group is heterogeneous as look, the species differ as aspect, high, shape of the leaves and flowers, blooming time ex: Begonia foliosa, B. luxurians, B. venosa, etc.
- Semperflorens begonias and its hybrids – includes the begonias which grow on mountains, important for gardens ex: Begonia x semperflorens – cultorum.
- Climbing and repent begonias – have stems which grow horizontally or vertically and adventive roots used to climb on a support ex: Begonia convolvulacea, B. scandens, B. polygonoides, etc.

The Begonia genus includes cca. 1,000 species and represents cca. 99% of the Begoniaceae family due to the selections there was reached over 10,000 hybrids and cultivars. The leaves are generally oblique oriented, altern, entire or lobated with several forms and bb number and the petiole varying in size with two stipples. The flowers are unisexuated, zygomorphous, located in axilar blooms, the fruit is a winged capsule, the seeds are numerous, small, exalbuminated.

The begonias are tropical and subtropical plants located in Central and South America, Asia and in some islands from Pacific yet they lack in Australia as spontaneous plants.

Their heat needs are 20-25°C in air and 18-20°C in soil, minimum 14°C during the night. They prefer the light places but not shinny with relatively high moisture (80-85%) well aerated. The soil has to be loosen but not wet, rich in humus, well drained, pH= 6-6.5. The soil components can be leaves soil, fibrous peat, fern soil, rotted manure and sand.

The flower and leaves decorative begonias which can cultivated in apartments are: Begonia masoniana, Begonia rex, Begonia x lucernae. Begonia tamaya is one of the hybrids created in the last years with stems resembling the bamboo ones, pink flowers grouped in bent racemes, actually sold in millions of units.

For the decoration of green spaces is used Begonia semperflorens with simple flowers green leaves, simple flowers and green-dark red leaves, double flowers and green, reddish or striped leaves.

There are begonia species which are used as medicinal plants in the origin countries for tea and syrup for certain affections (gut ulcer, kidney or fever).

The begonia crop has increased in our country. Profira Vidrascu (2002) has researched the begonia crop reproduction and recommend the vegetative reproduction by mature leaves with petiole or the half cutting of the leaves and then smaller portions till 2-4 cm, keeping a portion of the main nerve.

Michael Shaw (1991) has researched the fertilization of Begonia rex-cultorum cv. Mikado using the Osmocote 19-6-12 fertilizer.

Claude Ferry (2004) recommends a nutritive ground of 60% peat, 30% leaves soil and 10% sand plus a slow releasing fertilizer of 16-11-11 type, the appropriate pH being 6-6.5.

The researches in our country are scarce and worldwide are not systematic; the optimal fertilization formulas differ from author to author and from species to species.

The goal of the experiments was the knowing of the reproduction methods and of technological steps in order to observe the effect of the main nutritive elements and nutritive mixings in the plant development and prevention of shortage with decorative begonias by leaf.

The proposed objectives are the following:

- Aspects on the Begonia plants physiology
- The establishing of the rooting ground for the leaf reproduction for some species and hybrids. In order to achieve this objective, there was made leaves and fragments of leaves which were researched on several nutritive mixings.
- The establishing of the nutritive bed for young and mature plants with the researched species and hybrids. The young plants resulted from the vegetative reproduction trial, right after the planting in vessels and the mature plants reached the blooming stage.
- The establishing of the nutrition regime with the mature plants by applying foliar and radicular fertilization. For this purpose there were

used the following foliar fertilizers F411, F141 and F231 and to the soil there was used Kristalon.

The biological material consisted in species and hybrids of Begonia genus:

- Begonia boweri Ziesenh. Origin Mexico
- Begonia masoniana Irmsch. Origin China
- Begonia rex-cultorum L.H. Bailey
- Begonia x diadema Hort.

The researches have been carried out in the greenhouse of the Botanic Garden Al. Buia of the University of Craiova, in the compartment Tropical and subtropical plants which has the needed facilities.

The average temperatures into the greenhouse were between 12-26°C and the relative moisture of the air recorded high values.

There have been made recordings and determinations in the greenhouse and in laboratory about the morphological characters of the plants: the length, diameter, and bulk of the roots, the length of the stems and the surface of the leaves. The determinations were made to young plant and mature plants for each species and hybrid, the intensity of the photosynthesis, respiration and transpiration, the content in assimilation pigments and chlorophyll.

The determination of the degree of supplying with nutritive elements and the analysis of the vegetal material after the applying the fertilizers was made at the Laboratory for Pedological and Agrochemical studies in Craiova.

MAIN RESULTS

The determinations on the young plants physiology have emphasized that the Begonia leaves recorded small variations on the intensity of photosynthesis, respiration and transpiration between the two stages (young and adult plants) but high between species and hybrids.

For each species of Begonia the presence of a certain design is specific.

As regard the assimilation pigment content, both a and b chlorophyll recorded higher values with the second stage.

Among the species, the assimilation pigment content ranged between 0.635-0.647 mg/dm^2 with Begonia masoniana, followed by Begonia boweri having 0.734-0.754 mg/dm^2, the highest content in a and b chlorophyll being recorded with Begonia diadema, of 0.884 – 0.864 mg/dm^2.

The total content of chlorophyll recorded high increase from species to species, from 0.997 – 1.011 mg/dm^2 with Begonia masoniana followed by

Begonia diadema having 1.022 – 1.045 mg/dm^2, the highest chlorophyll content being recorded by Begonia rex, of 1.073 – 1.102 mg/dm^2.

In order to research the vegetative reproduction there were established two trials using for rooting entire leaves and fragments of leaves and nutritive mixings of different compositions.

An interesting aspect of the reproductive experiment was the number the plantlets which can be obtained from a single leaf.

With Begonia boweri, the best results were given by the V_4 ground mix consisting of leaves soil + red peat 1:3, when obtained 5 plantlets from a single leaf followed by the V_2 consisting of laves earth + perlit 1:1 when obtained 3 plantlets per leaf, the lowest results were obtained with the V_5 mix ground consisting of leaves earth + alluvium 1:1.

Researching Begonia rex with the V_4 ground mix there were obtained 24 plantlets per leaf followed by V_3 and V_1 with 19 and 13 plantlets, on the V_5 ground mix resulting only 6 plantlets per leaf.

With Begonia masoniana the best results were given by the V_5 ground mix consisting of leaves earth + alluvium 1:1 when obtained 12 plantlets from a leaf.

Begonia diadema recorded similar effect to the V_3, V_4 and V_5 ground mixings when obtained 8 plantlets from a leaf.

With the reproduction from fragments of leaves there were used 2 cm^2 leaf fragments on the 5 ground mixings.

Begonia boweri gave the same results on all ground mixings, of one plantlet.

Begonia masoniana was more sensitive to this kind of vegetative reproduction with V_1 and V_2 there were obtained two plantlets and with V_3 only one.

Begonia diadema gave 2 plantlets with V_3 and one plantlet with V_2 and V_4. Begonia rex has formed two plantlets with V_3 and V_4 and a plantlet on V_1.

In order to establish the nutritive bed for young and mature plants of Begonia we have researched 10 types of mixings using natural components and natural components of mineral origin thermically treated and untreated in different proportions.

In order to evaluate the nutritive bed we count the leaves due to their importance in decorating.

With Begonia masoniana the best results in formatting the leaves were given by the black peat variants V_3 and V_4, the number of leaves being 50 – 75% higher than control (V_1).

With Begonia diadema the best results in this regard were given by V_2 and Begonia boweri and Begonia rex to V_3.

As mature plants, Begonia masoniana, B. boweri and B rex give the highest number of leaves on V_2 mix yet B. diadema on V_1.

Another objective of the researching was preventing the nutrient shortage by foliar spraying and soil fertilizers.

We have used foliar fertilizers of F411, F141 and F231 types during 3 months every 2 weeks in the following concentrations: 0.05% and 0.10%.

After the applying of the foliar fertilizations there were taken samples of leaves for chemical analyses envisaging the main nutritive elements supplying.

As regard the total nitrogen content the all species in unfertilized conditions show shortage in this element. By applying fertilizers the total nitrogen content increase with all species the highest content being recorded with the F411 type.

The total phosphorus content is lower with the unfertilized variants. By applying fertilizers the total phosphorus content increases along with the increasing of the concentration being very significant in comparison with the unfertilized control, the total phosphorus content being normal and high.

The potash content reaches normal values only when applying F231, 0.1%, the other applyings determining no completion of the potassium needs.

In order to prevent the nutrient shortage, we have also used a soil fertilizer named Kristalon. There were followed the usage instructions being applied 6 treatments every one week, with 0.5% and 1.0% concentrations. The chemical analyses of the leaves after these treatments have emphasized the following aspects: the nitrogen shortage no longer exists after fertilizer applyings, the nitrogen content of the leaves increases along with the increasing of the concentrations nevertheless in lower values in comparison with normal standards. The phosphorus content records a very significant increase in comparison with the unfertilized control and by applying 0.5 and 1.0% concentrations of Kristalon, the average phosphorus content almost doubles.

The potash content doesn't reach the normal value yet its content increases along with the increasing of the fertilizer concentration.

An extremely interesting situation is with microelements when, along with the increasing of the Kristalon concentration from 0.5 to 1.0% the Ca and Mg content of leaves decrease but without shortage recording.

Besides the upward conclusions, we can mention the following:

- Regarding the vegetative reproduction, the best results were given by Begonia rex with the nutritive mix consisting of leaves earth + red peat 1:3.
- The young Begonia plants gave the best results with the nutritive mix consisting of: black peat, leaves earth and sand and the adult plants gave the best results with red peat, fern earth and sand.
- After the applying the foliar fertilizers it can be noticed that along with the increasing of the concentration from 0.05% to 0.10% the content of the main macronutrients increases, nevertheless the potassium content do not increase with all species and hybrids of Begonia which were researched. The situation is similar with the Kristalon product applying.

RECOMMENDATIONS

In order to obtain a good rooting of the Begonia rex plantlets from leaves we recommend the perlit + red peat 3:1 nutritive mix, with Begonia masoniana the nutritive mix consisting of leaves earth + alluvium 1:1, with Begonia diadema, the nutritive mixings consisting of leaves earth + red peat 1:1 or earth + red peat 3:1 or leaves earth + alluvium 1:1 and with Begonia boweri, the nutritive mix consisting of leaves earth + red peat 1:3.

The nutritive mix recommended for the young plants culture in function of the species is: black peat, leaves earth and sand for Begonia masoniana, Begonia boweri and Begonia rex and red peat, leaves earth and sand for Begonia diadema.

For the adult plants, we recommend the nutritive mix consisting of red peat, fern earth and sand for Begonia masoniana, Begonia boweri and Begonia rex and red peat, leaves earth, fern earth and sand for Begonia diadema. In order to ensure a suitable nutrition, for the prevention of nutrition shortage with the species and hybrids of Begonia which have been studied, among the researched fertilizers we recommend the foliar fertilization with F411 in 0.1% concentration or a combination of F411 and F141 in 0.05% concentration.

As radicular fertilization we recommend the Kristalon product in 1% concentration.

In order to avoid nutritive disequilibrium e.g. the Ca and Mg nutrients shortage because of the ionic antagonism it is recommendable the improving of the nitric and amoniacal ratio of the soil applied fertilizers by an supplement of potassium nitrate or calcium nitrate in order to reach an 1:1 ratio between NO_3^-/NH_4^+.

CONTENT