

Rehabilitation and welfare of wildlife under human care

-PLANT NURSERY-

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Plant nurseries are physical places dedicated to producing, growing and maintaining plants for various purposes: ornamental, trade, consumption and conservation of plant species, among others.

We shall focus on nurseries whose production is destined to animals under human care, setting out the importance of fresh and natural forage for wild animals with different feeding strategies, and in the rehabilitation of specimens which we seek to reintroduce to their natural habitat.

Any zoological or related institution that intends to maintain animal species whose natural feeding diet includes plants should consider it essential to have its own in-house plant nursery to provide fresh and quality forage in accordance with the needs of each of the species or individual animals throughout the year.

Herbivorous animals present morphological adaptations of their gastrointestinal tract (GI tract) depending on the types of plants they consume.

Hence, among the species, ruminant and non-ruminant, we can identify two large groups: "grazers" - roughage eaters and "browsers" - leaf eaters, and there is a third smaller group of the intermediate type.

These large groups have different requirements and feeding strategies that must be considered when feeding, so as to prevent causing digestive disorders that could endanger the health of these animals in our care.

At the GI tract level, some of the most important differences are: the ruminant species grazers (cows, buffaloes, sheep, oryx, etc.) have a larger rumen, with a slow fermentation rate and a high rate of fibre retention; while the browser species (giraffe, moose, gerenuk, dik dik, greater kudu, bongo, etc.) have a smaller rumen, with a rapid fermentation rate, faster particle passage rate and, therefore, less fibre digestion.

From a behavioural perspective, grazers eat fewer times a day than browsers, the former are much more general in their choice of food and the latter are more selective and sensitive to abrupt changes in feeding.

At first glance, according to the type of natural food they consume, it seems that browser species would require diets with lower levels of fibre and higher levels of proteins than grazers, and would also be more tolerant to forages with high levels of soluble carbohydrates (sugars and starch).

The bibliography and experience suggest, however, that under controlled conditions browsers are prone to metabolic disorders associated with ingestion of high levels of sugars and proteins and insufficient amounts of fibre; such as acidosis, laminitis, ruminitis, ketosis, etc.

Alfalfa or Lucerne (*Medicago sativa*) bales, the forage that is most used in zoos, depending on their quality have a high concentration of proteins and calcium that exceeds the needs of most of these species. In addition, usually it is not consumed in the amounts that are necessary to achieve the level of fibre required to maintain a healthy GI track. The production of volatile fatty acids, in the case of ruminants, and the production of glucose, in the case of non-ruminants, is modified by this insufficiency of fibre, affecting the pH of the gastric medium.

On the other hand, due to the secondary plant compounds (tannins, alkaloids, phenolic groups, etc.) a high percentage of the proteins in the natural diet of browsers is not available to the animal, which would indicate that the protein requirement is less than assumed.

All these factors, would explain why browsers kept in zoos on diets based on concentrate feeds and alfalfa (lucerne) bales generally consume low percentages of fibre, high percentages of quickly fermentable carbohydrates and excessive proteins, which can result in the metabolic disorders mentioned above.

In the case of ruminants, the use of pellets, reduces rumination and, therefore, the production of saliva that acts as a buffer substance (rumen modulator), lowering the rumen pH and predisposing the animal to ruminitis.

Besides, the leafy greens, green grocer products can be used only to a certain extent because their chemical composition does not offer the same nutrients contained in the leaves of trees and shrubs.

It follows that there is a need to have, for these species with specific foraging habits, a plant nursery that produces quality food to balance their diet and achieve good GI tract functioning.

From among the produce that can be obtained easily from a plant nursery, we will focus on productions which, based on our own experience, we consider most relevant:

- Pastures: pastures commonly referred to as "grass" are varieties of forage plant species produced with the intention of increasing an identified forage for animal consumption. They are usually laid out in plots of land, the size of which will depend on the needs and/or the possibilities of the relevant institution. They can range from a few square metres to several hectares.

Species should be chosen that will meet the demand all year round (winter pastures, summer pastures). The end of summer and early autumn is the ideal season for planting winter pastures, and mid-spring for summer pastures. Varieties of leguminous plants and grass plants can be planted. The wide variety of forage species includes the most rustic, (megathermal or C4 tropical climate plants) such as maize, sorghum and sugar cane, of high

fibre content and low digestibility; temperate climate grasses (C3), such as rye grass, fescue, timothy, and species with higher percentages of protein (leguminous), such as alfalfa (lucerne), clovers, vetches.

A good option is to combine grasses and leguminous varieties to benefit from the fibre and energy content of the former and the protein of the latter.

- **Forest Branches:** a slightly larger physical space is required for this type of production in order to allow transplanting of the varieties as required. As every plant must become a woody tree before its produce can be used, this production must be planned in advance, before the need arises, and rapid growth varieties should be sought, with high regrowth capacity in order to withstand cuts on a daily basis. The varieties usually used are: willows, poplars, blackberries, acacias, ficus, hibiscus. This forage, indispensable for browsers, is often unavailable during autumn and winter as most of the species used are deciduous. For that time of the year, the purchase of plants from commercial nurseries should be considered, which then need to be kept sheltered from the cold (ideally in a greenhouse) and a plant replacement system must be put in place between the animal enclosure and the greenhouse.

Until an in-house woodland is established that can be harvested on a daily basis, it is possible to resort to cutting branches from trees in nearby parks or woodlands, checking always that they are not toxic.

- **Hydroponics:** This production without substrate enables us to obtain high quality forage that can be used to complement pastures when there are shortages, as large volumes are produced in small areas and sheltered from the weather. Caution should be taken with this type of production with respect to humidity and temperature conditions, to prevent the proliferation of fungus on the forage that is produced.

Both grasses and leguminous seeds can be used and this method can be very useful to improve the nutritional profile of seeds, such as sunflower seeds for Psittacidae and to offer shoots to the species that include this food in their natural feeding.

Examples of hydroponics productions are: vicia, rye grass, millet, oats, sunflower.

- **Forage crops in pots:** this type of production is ideal to offer live plant material to species with specific nutritional needs, such as the capybara (*Hydrochoerus hydrochaeris*) with its requirement for vitamin C.

This nutrient oxidizes rapidly once the grass is harvested, therefore, depending on how long it takes the capybara to consume it, the intake of this vitamin may not be sufficient which can result in a condition called "scurvy" due mainly to lack of this nutrient which the species is unable to self-synthesize and, therefore, needs to be ingested on a daily basis. By having live forage in plant pots we can ensure that the capybara gets its required vitamin C intake.

Once the forage is consumed, caretakers remove the pots and return them to the nursery to be reseeded.

Here, again, the variety to be sown shall depend on the specific needs of each institution.

- Aquatic plants: It is a little more complex to set up production of aquatic forage, as pools or tanks are required and, if possible, they should be sheltered to prevent the plants being in direct contact with the frost. These pools can preserve and multiply aquatic plants as part of the diet of a particular species or as part of enclosure environments or animal enrichment.

Regardless of the production system that is chosen, in every case the first step shall be to prepare an annual plan of the tasks that need to be carried out in the nursery in order to accomplish the goals set. Some of the actions to be taken and main tasks to be carried out in a nursery are as follows:

- Cutting and management of pastures (preparation of seedbeds, planting, fertilizing, watering, weeding, harvesting).
- Management of forest species (watering, fertilization, pruning, preparation of stakes, replanting, cutting branches).
- Production of hydroponics. Preparation and crop management.
- Production of grasses in plant pots.
- Maintenance of plants, pruning, weeding, watering, planting of new species.
- Maintenance of aquatic plants pools.
- Maintenance of the greenhouse.
- Weighing the harvest, production records.

The annual plan for the plant nursery production should be prepared jointly by the nutritionist or person in charge of the animal diets together with the person in charge of the nursery who must know about plant production.

Personnel in charge of the nursery will carry out the tasks that are listed above, and delivery of the plant nursery produce shall always be following instructions of the nutritionist or the person in charge of animal nutrition.

It is most important to have all the tools necessary for each of the tasks that needs to be carried out: soil preparation, planting, harvesting, watering, pruning, weighing, elements for the correct delivery of the forage (buckets, pans, canvas bags), etc.

To ensure that the productions are effective and of quality, the seeds used must be duly identified and labelled (with traceability of origin). The seed bags must be kept sheltered from light and dampness and protected from pests.

Personnel in charge of both the nursery and the animals should be trained to identify weeds and toxic plants, because if herbicides are to be avoided, weeds will certainly appear intertwined with the pastures and some may be toxic for the animals.

One of the most important aspects of having an in-house plant nursery is its contribution to the rehabilitation of wildlife. Not only from a nutritional perspective, but also because it allows the animal to develop its natural behaviour, typical of its species and this, in many cases, is of vital importance, as for example for carayas, deer, roe deer and capybaras.

The animals in the process of rehabilitation should have access to this type of natural food as an essential part of their adjustment to feeding as they will have to when they are returned to their natural habitat.

Experience has shown us that the animals react positively to this provision of natural forage, which they consume and use as protection or shelter.

In zoological institutions, the in-house production of forage crops that may often be very difficult to find with external suppliers is a fundamental tool that can make a decisive difference in the welfare of the animals in their care and also in the successful reintroduction of animals to their natural habitat.