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Mini Review

# Integral Agroforestal plot with *Sapindus saponaria* associated with aromatic and medicinal species to conserve the ecosystems

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## Abstract

The propagation and processing of *Sapindus saponaria*, (Boliche) and *Caesalpinea spinosa* (Tara) will make it possible to manage ecosystems sustainably, obtaining biological soap and natural dyes and contribute to the fight against climate change, since plant cover is increased and to the capture of CO2, reducing the pressure of greenhouse gases, increasing the production of oxygen and at the same time generating industry for the production of biodegradable cleaning and beauty products.

The incorporation of *Caesalpinea spinosa* (Tara) interspersed with *S. saponaria* allowed the contribution of its fruits to the productivity of the plot, since from its fruits we obtain tannins for tanning, natural dye, and gums for the food industry. Continuing with the practice of agroforestry, aromatic and medicinal species such as *Aloe vera* (Sábila), *Chrysopogon zizanioides* (Vetiver), and *Cymbopogon citratus* (Lemongrass) were placed between the two tree species.

By means of Soxhlet extraction with ethanol, the soap and the dyes that were used as ingredients of the biological shampoo were obtained. Using a homemade steam distiller, the extraction of essential oils from the aromatic and medicinal species was achieved.

The project began under Resolution N° 0448-2009-R-UNE, which authorized the reforestation of the Universidad Nacional de Educación Enrique Guzman y Valle (UNE) and surrounding areas with native plant species. The strategy used was that of the Biology and Ecology students acting as godmothers and godfathers of the trees considered in the project.



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## Introduction

The human activity of burning fossil fuels and cutting down trees, among other harmful to the environment, is causing what has been defined as global warming and it is necessary to take drastic actions in the face of this terrible situation and therefore, it is necessary to return to the planet the two billion hectares that we have deforested [1]. On the other hand, man in his eagerness to modernize his life has abandoned the natural way of life and is using cleaning and beauty products based on synthetic chemicals such as Sodium or Potassium Lauryl Sulfate, which increase the contamination of water sources. And the soil, in addition to using these substances in our bodies that are causing diseases that deteriorate our quality of life. This creates a situation where the school and other academic training institutes are not developing the principles of Environmental Education and man has also abandoned the principles of organic agriculture and by different means the use of insecticides, pesticides, herbicides, and others is encouraged. poisons that are deteriorating the quality of soils by eliminating the natural microbial flora whose function is the degradation of organic matter and the health of producers and consumers, since in the market we are consuming products that have been produced with the application of these poisons.

The conservation of the planet is everyone's task and in particular, it is important to instill in students the principles of environmental education in such a way that the new generations are respectful of the ecological balance and do not destroy our ecosystems. For this, our students played the role of godmothers and godfathers of selected trees and had to plant and care for a tree during an academic cycle. These trees, in addition to increasing the green area to capture CO2, were potential suppliers of inputs to establish a venture. In particular, the propagation of *Sapindus saponaria*, from the Sapindaceae family that is known as Choloque or Boliche or Cheko and as Tingana in the Amazon, was stimulated and its fruit has 30% natural and biodegradable biological soap that is chemically known as saponin and also it has natural dyes and has medicinal and antifungal activity [2-5]. The species *Caesalpinea spinosa*, from the Fabaceae family, better known as Tara, was also propagated to obtain tannins and gum, as well as natural dyes [6,7]. Then, between the spaces between the trees, aromatic and medicinal plants were cultivated, such as *Aloe vera* (Sábila), which belongs to the Liliaceae family and is a species of so-called succulents, that is, it contains a large amount of juice loaded with extraordinary properties is what makes it the undisputed queen of medicinal plants. It has a cocktail of active molecules that interact synergistically and are essential for the prevention and cure of numerous diseases and ailments [8-11]; *Chrysopogon zizanioides* (Vetiver), a grass that has proven to be ideal for soil and water conservation, soil moisture and other uses such as bioremediation, bioengineering, fodder, agroforestry, medicinal, crafts, energy, etc. [12,13] and *Cymbopogon citratus*, a herbaceous, perennial, aromatic and robust plant that is propagated by cuttings and belongs to the Gramineae family, whose leaves are very aromatic and elongated like ribbons, rough, light green in color that sprout from the ground forming dense bushes and their essential oils are recognized as insect and microorganism repellents, in addition to their medicinal use and in the food industry [14-16].

By developing this project, we have returned a green plant area capable of fixing $CO_2$ for photosynthesis, providing oxygen to the atmosphere. At the same time, each one of the plants incorporated in the design of the integral agroforestry plot is potentially a generator of inputs that serve so that the students can generate their own enterprises. For example, from the Boliche fruit, we obtain biodegradable biological soap, better known as saponins, and natural dyes that constitute inputs for the cleaning and beauty industry. From Tara, we obtained tannins, gums, and dyes for the tanning industry, food industry, and textiles. From Vetiver we obtained essential oils for perfumery and plant pest control. From Aloe, we obtain the gel as an input for the food industry and the cleaning and beauty industry. From the aromatic ones, we extract essential oils to provide the aroma of cleaning and beauty products.

## Materials and methods

The seedlings of the species considered in the project were obtained in the nursery of the Center for Research in Andean and Native Plants of the Enrique Guzmán y Valle National University of Education.

The *Sapindus saponaria* trees were planted at a distance between 6 and 8 meters between each tree in such a way that the treetops do not intersect, taking into account that this species reaches a height of 8 to 10 meters, depending on the availability of water [17].

The *Caesalpinea spinosa* (Tara) plants, whose height reaches between 3 and 5 meters, were planted in the space between two *Sapindus saponaria* in such a way that they did not interfere with the fronds of the latter species.

Between each tree of *Sapindus saponaria* and *Caesalpinea spinosa*, the selected aromatic and medicinal species were propagated, such as *Aloe vera* (Sábila), *Chrysopogon zizanioides* (Vetiver) and *Cymbopogon citratus*.

The strategy to recover a species like *Sapindus saponaria*, whose fruits were used to extract bio detergents, consisted of making students responsible for planting and caring for the trees, who alternatively enrolled in Biology and Ecology courses, ensuring planting and maintenance. of the trees for at least two academic cycles, that is, 8 months. During that time, participation, institutional identification, and ecological or environmental culture were worked on. Each student was the godmother or godfather of at least one tree (Figures 1-3).

## Results

The agroforestry plot has 234 trees, of which 156 correspond to *Sapindus saponaria* with about 10% of them producing the fruits from which saponins are obtained, 64 to *Caesalpinea spinosa,* and 14 to *Eucalyptus citriodora*. In addition, specimens of *Aloe vera* (Sábila), *Chrysopogon zizanioides* (Vetiver) and *Cymbopogon citratus* grow among the mentioned trees.



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**Figure 1:** Students of the Geography specialty planting the species of the integral agroforestry plot.


**Figure 2:** Boliche tree (*Sapindus saponaria*) with the sign indicating the information of the godfather: Arnold Gutierrez Paqui, from the Physics specialty (F1) of the year 2011. It indicates that the plant is Bowling from the Sapindaceae Family.

From the processing of the parts of the propagated species, saponins and essential oils have been obtained, with which shampoo has been elaborated with the characteristic of being totally organic, biological, and biodegradable (Figures 4,5).

Most commercial shampoos include the synthetic detergent sodium lauryl sulfate in the formula and many users consider that its presence in the shampoo formula causes problems with hair loss, which is why we have replaced sodium lauryl sulfate with saponins from *Sapindus saponaria*, a biological and biodegradable soap. Then we have included the extract of some species such as *Rosmarinus officinalis* (Rosemary), an herbaceous plant that is mentioned as preventing alopecia and essential oil was extracted from *Eucalyptus citriodora*.

In the 14 years of the project, discounting the two years of the COVID-19 pandemic, there are 24 promotions with an estimated 520 students of Biology and Ecology subjects who have acted as godfathers and godmothers of trees have received training in environmental education and sustainable development.

## Discussion

The work carried out planting the selected species for the integral agroforestry plot has allowed the students to identify with their goddaughters and some of them even return to the plot to provide maintenance for their goddaughters.

From the products of the participating species, a shampoo and liquid soap has been achieved that is marketed in the university community and the patent process is about to begin. The characteristic of these cleaning products is being totally organic and using saponins and the species considered in the Integral agroforestry plot. Likewise, there are essential oils of *Eucalyptus citriodora*, *Chrysopogon zizanioides* (Vetiver), and *Cymbopogon citratus*. These results have generated the expectation in some students to generate their ventures from this experience.

Support has been obtained from the company Peru Nutricare SAC and from the Association for Agroecological and Regional Development -ADAER for the donation of the irrigation system so that the water supply is constant and the species are not subjected to a situation of water stress.

A fact to take into account is that according to Rentería [3], Sapindus saponaria begins to bear fruit after 8 to 10 years, however, in our plot, we have achieved it in 5 and 6 years.

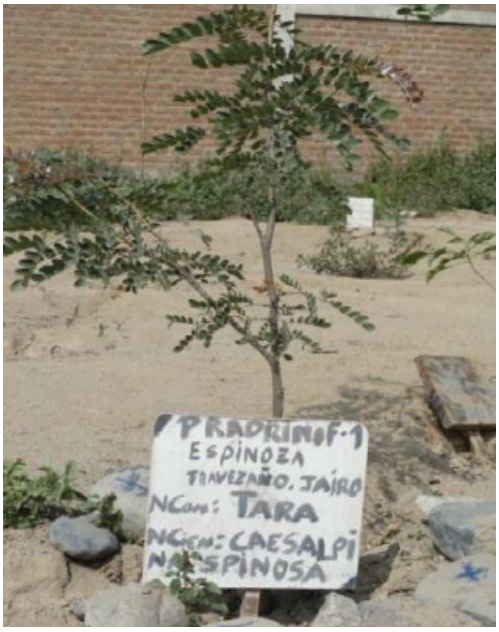


**Figure 3:** Caesalpinea spinosa (Tara) plant with the sign indicating the godfather's details. The godfather is the student: Jairo Espinoza Travezaño, majoring in Physics (F1). Indicates the common name and scientific name of Tara.

**Figure 4:** Shampoo based on biological soap (saponins).



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**Figure 5:** The *Sapindus saponaria* tree reaches an approximate height of 7 meters in full production of fruits, some of which are spread on the ground. At the foot of the tree is one of the water reservoirs, from which drip irrigation is carried out. The *Caesalpinea spinosa* trees reached a height of approximately 3 meters.

## Conclusion

It has been demonstrated and validated that it is feasible to implement the integral agroforestry plot for the development of ecosystems and practice some aspects of the circular economy. The integral agroforestry plot implemented in this project has *Sapindus saponaria* as its main species, which produces a biodegradable soap known as saponin. Sapindus saponaria is known in English as wing leaf soapberry or western soapberry and in Spanish, as Boliche, cheque, or jaboncillo, and many other local names, it is an alternative to reduce the pressure of greenhouse gases such as CO2 and contributes to the fight against climate change, at the same time it is an alternative for the development of ventures such as the production of beauty and cleaning products such as shampoo and soap, with the advantage that these detergents are completely biodegradable. Enterprises such as the production of essential oils can also be generated, by considering aromatic and medicinal species in the agroforestry plot. Finally, as a pedagogical strategy, the principles of environmental education based on organic agriculture are encouraged and practiced by students within the framework of sustainable development.

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## References

1. Hoff P. The Treesolution. 5th Edition. Groasis. Holanda. 2009; 137.

2. Abreu OA. Medicinal potential of the genus Sapindus L. (Sapindaceae) and the species Sapindus saponaria L. Rev Cubana Plant Med. 2005; 10(3-4). http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1028-47962005000300009&lng=es&tlng=es.

3. Renteria JL. Management plan for the eradication of Sapindus saponaria L. (Sapindaceae), an invasive species with limited distribution on Santiago Island, Galapagos. Version 1.0. Charles Darwin Foundation, Galapagos, Ecuador. 2007.

4. Tsuzuki JK, Svidzinski TI, Shinobu CS, Silva LF, Rodrigues-Filho E, Cortez DA, Ferreira IC. Antifungal activity of the extracts and saponins from Sapindus saponaria L. An Acad Bras Cienc. 2007 Dec;79(4):577-83. doi: 10.1590/s0001-37652007000400002. PMID: 18066429.

5. Tomás Ch, Huamán J, Aguirre R, Barrera M. Extraction and Classification of Saponin from Sapindus saponaria L., "Boliche". Rev Per Chem Chemical Engineer. 2010; 13:36-39.

6. De la Cruz P. Comprehensive and rational use of the tara Caesalpinia spinosa - Caesalpinia tinctoria. Magazine of the Research Institute of the Faculty of Geological, Mining, Metallurgical and Geographic Engineering. 2004; 7(14):64-73.

7. Dostert N, Roque J, Brokamp G, Cano A, La Torre MI, Weigend M. Factsheet: Botanical data of Tara. Project: Development of botanical monographs (factsheets) for five Peruvian crops. First edition. Perúbiodiverso Project – PBD. 2009; 10.

8. Foster K, Khan D, Daniels I. Aloe vera: Medical Marvel or Mumbo Jumbo?. The Internet Journal of Herbal and Plant Medicine. 2010; 2(1):1-4.



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9. Sahu PK, Giri DD, Singh R, Pandey P, Gupta S, Shrivastava AK, Kumar A, Pandey KD. Therapeutic and Medicinal Uses of Aloe vera: A Review. Pharmacology & Pharmacy. 2013; 4:599-610.

10. Shelton RM. Aloe vera. Its chemical and therapeutic properties. Int J Dermatol. 1991 Oct;30(10):679-83. doi: 10.1111/j.1365-4362.1991.tb02607.x. PMID: 1823544.

11. Surjushe A, Vasani R, Saple DG. Aloe vera: a short review. Indian J Dermatol. 2008;53(4):163-6. doi: 10.4103/0019-5154.44785. PMID: 19882025; PMCID: PMC2763764.

12. Filgueiras TS. Chrysopogon. 2003; 46: 159–161. In Zuloaga FO, Morrone ON, Davidse G, Filgueiras TS, Peterson PM, Soreng RJ, Judziewicz EJ. (eds.) Catalogue of New World Grasses (Poaceae): III. Subfamilies Panicoideae, Aristidoideae, Arundinoideae, and Danthonioideae, Contr. U.S. Natl. Herb. Smithsonian Institution, Washington, D.C.

13. Alegre J. Manual on the use and management of vetiver grass (Chrosopogon zizanioides). Pan American Health Organization. Ministry of Housing, Construction and Sanitation. Lime. 2007; 37.

14. Onawunmi GO, Yisak WA, Ogunlana EO. Antibacterial constituents in the essential oil of Cymbopogon citratus (DC.) Stapf. J Ethnopharmacol. 1984 Dec;12(3):279-86. doi: 10.1016/0378-8741(84)90057-6. PMID: 6442749.

15. Barbosa LC, Pereira UA, Martinazzo AP, Maltha CR, Teixeira RR, Melo Ede C. Evaluation of the chemical composition of Brazilian commercial Cymbopogon citratus (D.C.) stapf samples. Molecules. 2008 Aug 27;13(8):1864-74. doi: 10.3390/molecules13081864. PMID: 18794790; PMCID: PMC6244952.

16. Olivero-Verbel J, Nerio LS, Stashenko EE. Bioactivity against Tribolium castaneum Herbst (Coleoptera: Tenebrionidae) of Cymbopogon citratus and Eucalyptus citriodora essential oils grown in Colombia. Pest Manag Sci. 2010 Jun;66(6):664-8. doi: 10.1002/ps.1927. PMID: 20205230.

17. Wagner WL, Herbst DR, Sohmer SH. Manual of the flowering plants of Hawaii. Bishop Museum Special Publication 83. Honolulu: University of Hawaii Press and Bishop Museum Press. 1990; 2: 1229.





**Citation:** Jhoncon J, Poma S, Trinidad N, Zeballos Y, Quiroz G (2023) Integral Agroforestal plot with *Sapindus saponaria* associated with aromatic and medicinal species to conserve the ecosystems, Nigeria. Glob J Ecol 8(2): 081-085. DOI: https://dx.doi.org/10.17352/gje.000086