



INSPIRATIONAL CASES |  FINALIST 2022 |  COLOMBIA

#ENVIRONMENT

Students use rice husk to produce sustainable building material

The project combines traditional knowledge with scientific methodology to solve waste accumulation and offer an economic alternative to the rural community.

TEACHER

Dario Vergara Perez

COMMUNITY/CITY

La Mojana

STEM AREAS

Science and Engineering

STUDENTS

Dainer Bravo
Ema Arroyo
Julio Rodelo
Maria Escobar

SCHOOL

Institución Educativa San Marcos

OTHER AREAS OF KNOWLEDGE INVOLVED

Environmental Education

PROJECT NAME

Utilization of rice husks

In La Mojana region, Colombian Caribbean, 12% of the rice consumed in the country is produced and each year this production generates around 17 thousand tons of rice husk. When disposed improperly, this waste can contaminate bodies of water or the air when incinerated outdoors. How can we reduce the environmental pollution caused by this production chain? A team of four students found the answer using it for making a rural construction material.

The innovation titled “Aprovechamiento de la cáscara de arroz” (“Using Rice Husk”, in English) was a finalist in Solve for Tomorrow in Colombia 2022. The group created a prototype that transformed rice husk into a sustainable artisanal construction material (known as bareque or bahareque). The students were between 15 and 17 years old and were in 10th and 11th grade at the time of their participation.

The [mediator teacher](#), Dario Vergara, explains that La Mojana has a culture considered “amphibious” because the farmers live from fishing during the rainy season and in the summer they grow rice and yuca (manioc). He teaches Physics and Natural Sciences at the San Marcos Educational Institution and is involved in the school initiative called “AgroAnfibia”, which brings

together several teachers and students from various generations to develop projects related to the local reality.



This group then thought of taking advantage of rice husks while preserving the architectural culture, opting to make a new formula for bareques, traditionally made with sticks or reeds along with mud. The students went to investigate the preference for bareques and consulted the population that lives in this area, to share their knowledge and experience. “We asked why brick houses are not built in this area and they told us that when there are floods, brick is not as flexible as bareques,” recalls the educator.

According to residents, the handmade material also provides a more balanced thermal sensation inside the house, compared to the variation in cold or hot outside. It is also a more economical and affordable option for the area, where access to roads is difficult; therefore, it is expensive to bring bricks. Using rice husks has another advantage: a house surrounded by this material repels mosquitoes, which are so present in the region because it is surrounded by swamps, and marshy areas covered in silt.

The students looked for natural and easy-to-obtain materials. They mixed rice husk with a plant considered a pest, the water hyacinth. Additionally, they added cattle manure and sand. They made several types of combinations with these materials and placed them on a palm leaf, forming small squares of less than 1m², which were then dried and left outdoors for testing.



Eureka Moment!

By chance, it was the rainy season and when the prototype got wet, they realized that the formula was still not exact. “We discovered that when it rained the mixture was not as consistent with white sand, so we spoke to a man with experience in this native housing creation process and he advised us to change the type of sand for the silt, which is like mud,” said the teacher. In addition, they concluded that it was better to grind the rice husk more because it had to be well kneaded and smooth so as not to deteriorate with the rain. After further tests, they saw that the water hyacinth was not necessary, because without this material the result was the same. After two weeks of various tests, only the finishing touch was missing: using vinegar to eliminate the smell of manure. Ready!



“It is important to show students that it is possible to progress with the tools available in the community and to value traditional knowledge”,

believe Vergara.

The total cost was only 15 thousand Colombian pesos per m² (over 4 US dollars), including the labor of the person who plastered the house. The rice husk was donated by millers that the students already knew.

In addition to manual processes, the team used Arduino to automate some processes, such as measuring the humidity and temperature of the mixtures.

The project developed students' soft skills

Besides the result of the prototype, Vergara mentions that the production of the video was an important exercise to combat shyness and improve [communication](#). He also believes that the experience of defending their project in front of an audience was important for the students to be able to reach university because there they learned to work under pressure. Another challenge they learned to overcome was finding the necessary material and for that the support of the families was fundamental. During each stage, they got involved, helped show the way, and supported the students, the teacher emphasized.

He also notes that each student had other personal benefits. “One of them has a shop in his house where he sells rice and he tells me that he liked learning more about the rice chain.

Another student learned a lot from preparing the pitch and that skill helped her in other academic events,” he exemplifies.

The attitude of the other students at the school has also changed. “Before, it was difficult to find students to work on research. After we had this result, the call for applications the following year suddenly brought 30 candidates,” he says proudly. Now, the project to use rice husks continues to develop, with a new group of students.



Explaining!

Bareque is also known as bahareque or bajareque. It is characteristic of the Americas, especially in Caribbean communities in Colombia and Venezuela, since the most remote times. Currently, it is considered a “bio architecture” because it is the most ecological option for civil construction and a more economical alternative to reduce the housing deficit in Latin America.




Focus on practice!

Check out the teacher’s guide on how to use rice husks to make craft material for civil construction.




Empathy

 The team observed a problem with the main agricultural production in their region: rice. Every year, around 17 thousand tons of rice husk are generated. Disposed of improperly, the waste ends up in bodies of water or incinerated in the open air.




Definition

 The students decided to take advantage of rice husks while preserving architectural culture, opting to create a new formula for bareques; a local construction generally made with sticks or reeds together with mud. The population living in the region was consulted throughout the project to share their knowledge and experience.




Ideation

 The group looked for natural and easy-to-obtain materials. They made a mixture of rice husk with a plant considered a pest, the water hyacinth, known as water hyacinth in other countries. Additionally, they added cattle manure and sand.




Prototype

 They made several types of combinations with these materials and placed them on a palm leaf, forming small squares of less than 1m², which were then dried and left outdoors for testing. In addition to manual processes, the team used Arduino to automate some processes, such as measuring the humidity and temperature of the mixtures.



Testing

 In two weeks of testing, they produced several ideas for improvement to arrive at the final formula. They replaced the white sand with clay, crushed the shell more to get a better grip, and eliminated the water scum from the composition. The total cost was just over 4 US dollars, proving to be an economic and ecological option for local housing.