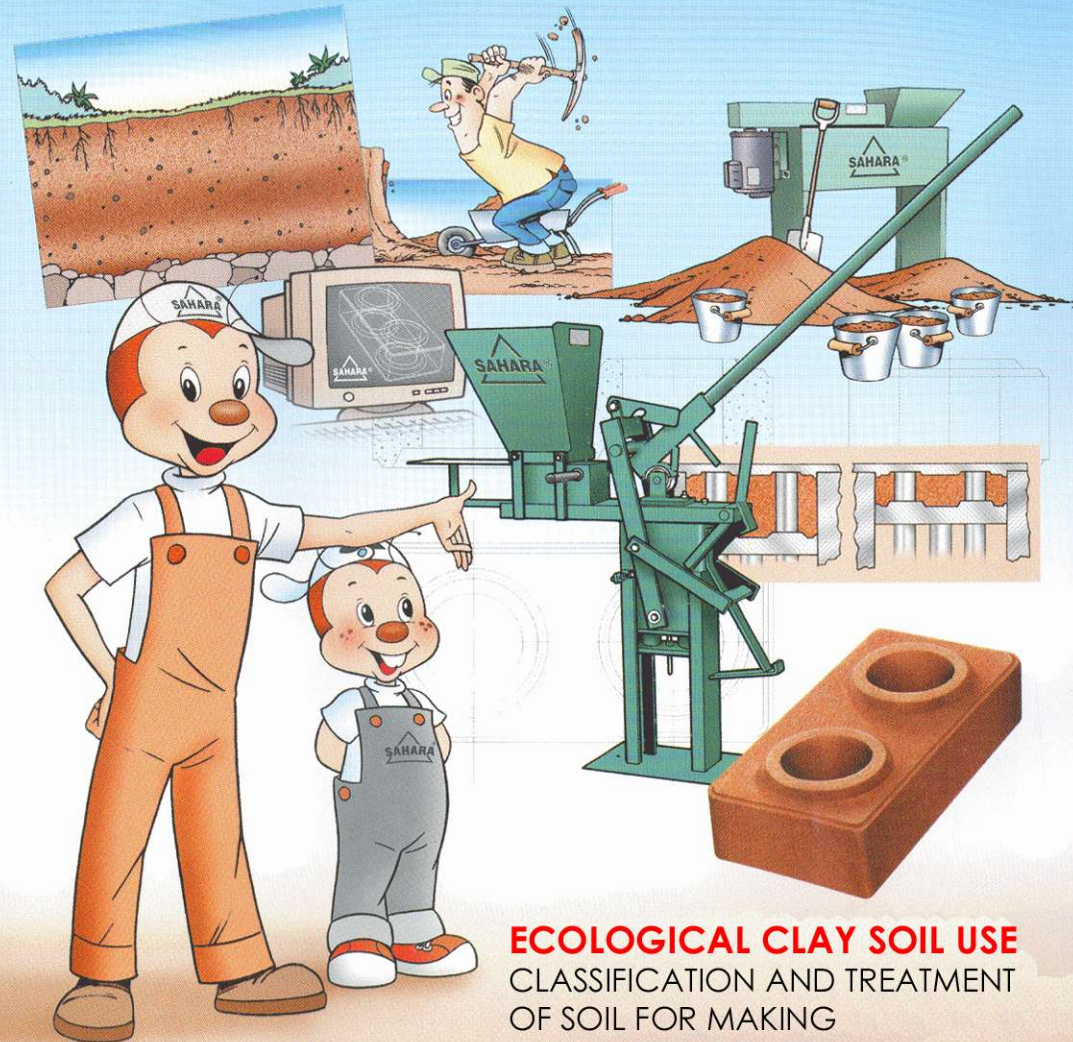


Brick & Brikito

SOIL - CEMENT

IN THE FABRICATION OF THE MODULAR BRICK



ECOLOGICAL CLAY SOIL USE
CLASSIFICATION AND TREATMENT
OF SOIL FOR MAKING
THE MODULAR BRICK

SOIL & LIFE

Shelter and food are basic elements for our survival, but without the soil we would not be able to have them.

In order to have good vegetables we need an adequate soil. Sometimes we need to correct this soil through correcting its characteristic.

Regarding the soil for the modular brick production it is the same. The correct selection, treatment and preparation of this soil, will determine the quality of the modular brick produced.

Having this concept as a main aim, Sahara has developed, through studies and research, precise techniques in order to have a correct classification for the soil and ways of correcting it if necessary.

Through a mixture of adequate soil with dosed amounts of water and cement we can achieve a good soil-cement raw matter which is essential for the good performance on the ecological pottery.

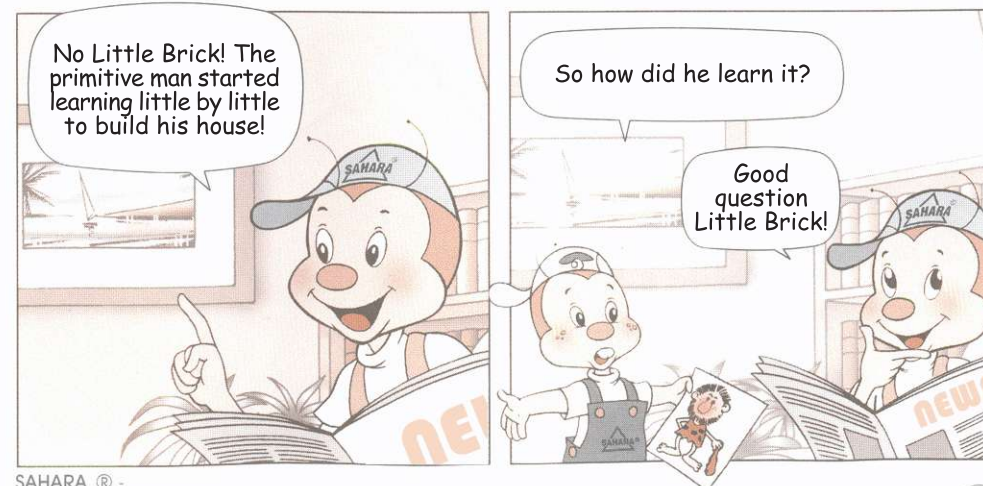
Soil-cement as abundant raw matter and low cost is a promising source of income. Also, it's part of an ideal compatible with nature's balance conservation and can provide low costing housing.

Informations contained in this manual are also provided by SAHARA through free courses to those whom are interested.

Brick & Briko

IN

THE SOIL-CEMENT In the Fabrication of the modular brick



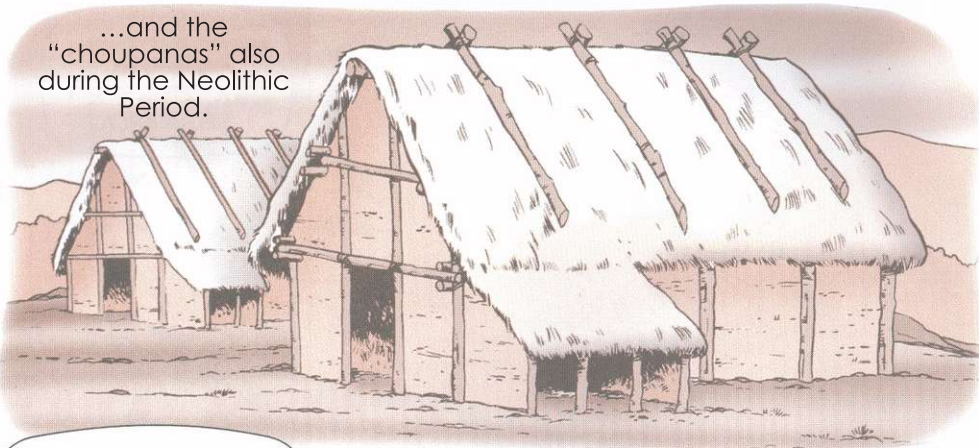


Building techniques varied according to culture, climate, and soil of the region.

...Like the mud houses in Norway during the Neolithic Period...



...and the "choupanas" also during the Neolithic Period.



And so, through times, men improved the technique, building houses and buildings more sophisticated.



Mexico



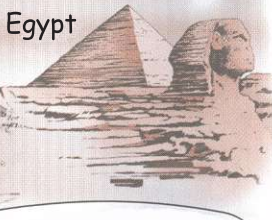
Greece



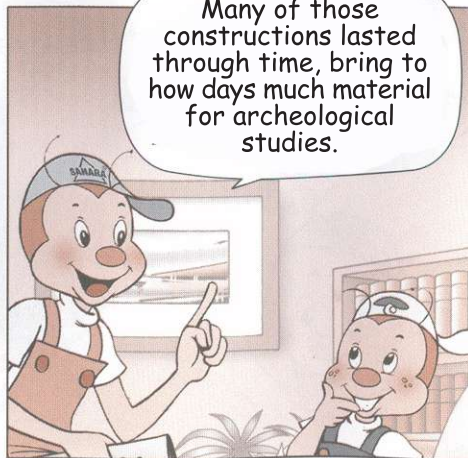
China



Egypt



Many of those constructions lasted through time, bring to how days much material for archeological studies.



Today there are several construction techniques.



Amongst them we point out the **Modular Building System** developed by **SAHARA** enterprise.

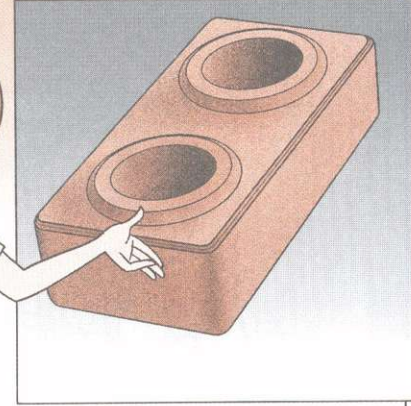


Why Uncle Brick?

Because the **modular building system** is faster, more economic and has many other advantages.



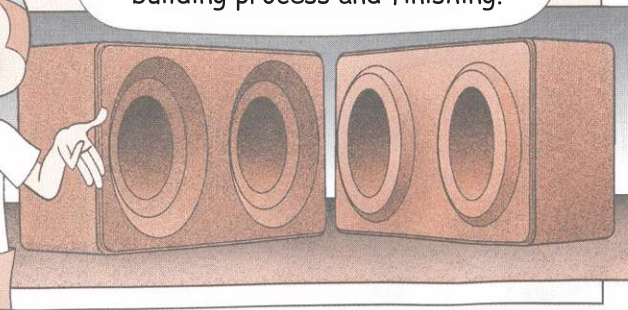
The modular building system was created from the **modular brick** or **ecologic brick**.



What is a modular and ecologic?

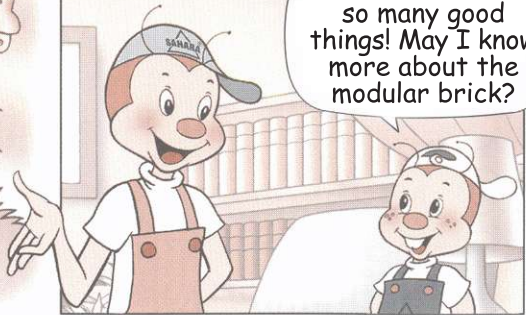


Modular because its measurements are standard and in proportioned allowing the fitting of the bricks between themselves facilitating the building process and finishing.





It's called ecologic because in its production it doesn't produce pollution from burning and doesn't require wood.



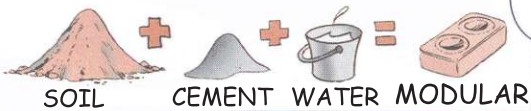
Wow Uncle Brick, so many good things! May I know more about the modular brick?

Of course! That's why SAHARA developed this manual that presents the **Ecologic Brick**, its characteristics, qualities and the **Modular Building System**.



Good!!

Yes Little Brick! But it's not any soil that can be used.



But Uncle Brick! Is the ecologic brick made only with soil, cement and water?



Besides, there are techniques and "normas" that have to be respected in order to achieve a good quality product according to the standards demanded by official entities.



And to make a good modular brick we have to choose first of all good raw material.

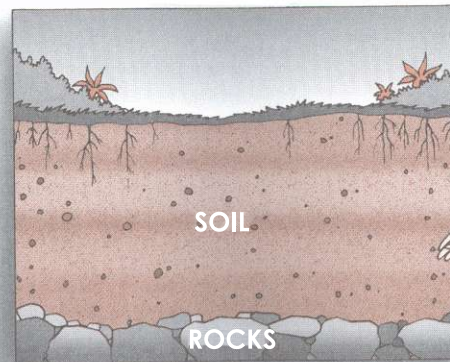


Let's go to the lab and there I'll be show you.

And how is the ecologic brick made?



In the lab...



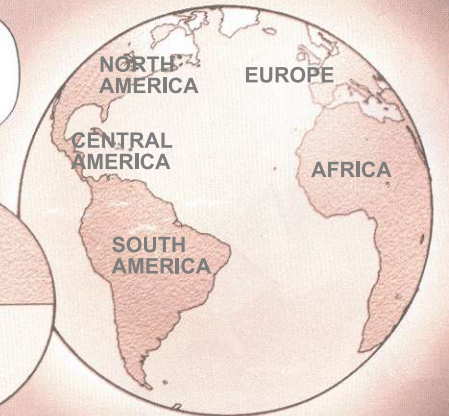
Before anything else we should know that soil is the top part of Earth's crust and is a result of rocks weathering.



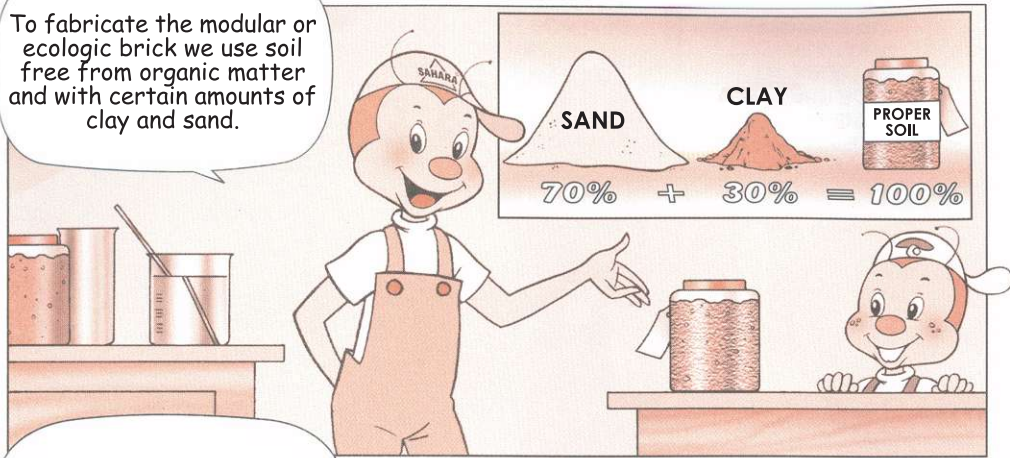
Around 75% of Earth crust's soil is fit for building, therefore we have abundant raw material and readily available at the construction site.



75%

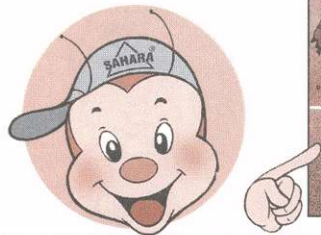
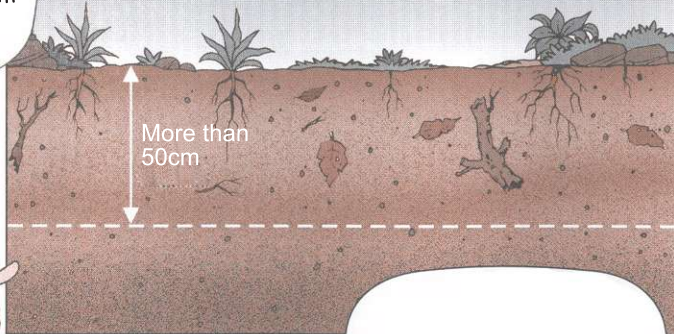


To fabricate the modular or ecologic brick we use soil free from organic matter and with certain amounts of clay and sand.

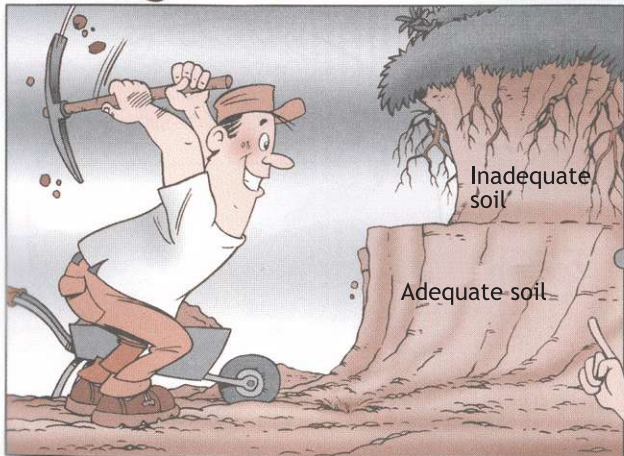


It is recommended to dig the soil from a horizon 50cm lower than ground level. However we always have to make sure that it's free from organic matter.

ORGANIC MATTER IN THE SOIL
Organic matter is all the material that goes through decomposition like leaves, roots, dead plants, etc.






Soil with organic matter alters the cement hydration and soil's stability as raw matter which compromises the quality of the modular brick.



Let's see the soil quality according to its color.

SOIL QUALITY

	Red or yellow	} Good quality
	Sandy	} Excellent quality
	Black	} Bad quality



So is any soil free from organic matter suitable for making the modular brick?

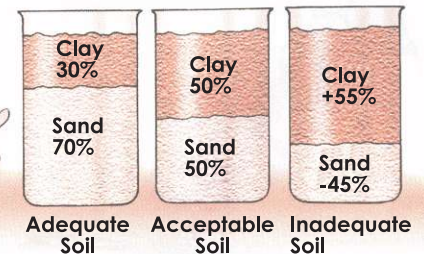
No! Besides the soil being free of organic matter, we have to evaluate the amounts of sand and clay in it.



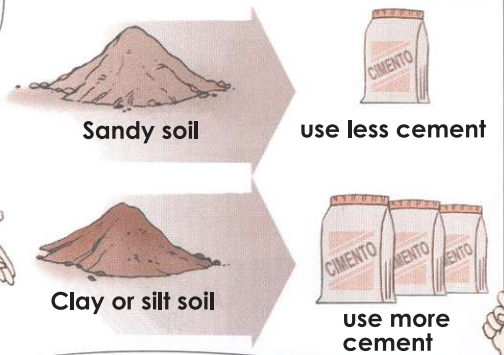
Which ones are the right amounts of sand and clay?

Let's see in this chart...

SOIL'S PERCENTAGES FOR SAND AND CLAY



A sandy soil requires less amount of cement than a clay or silt soil.



So what is the purpose of the clay?

Clay is needed because when moisturizing and pressing the soil-cement mixture, the clay gives the binding quality enough for getting the bricks out of the molds and handling them.

That's why if the soil is very sandy we have to add clay.

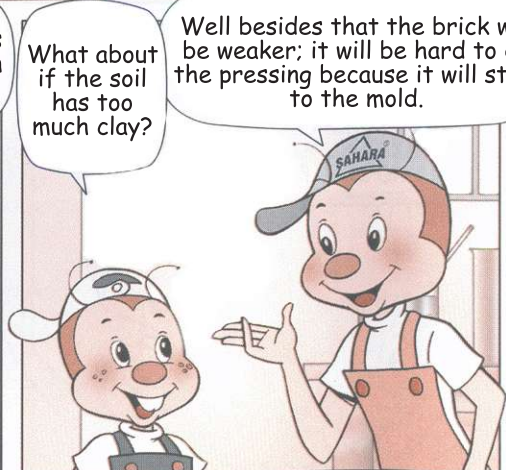
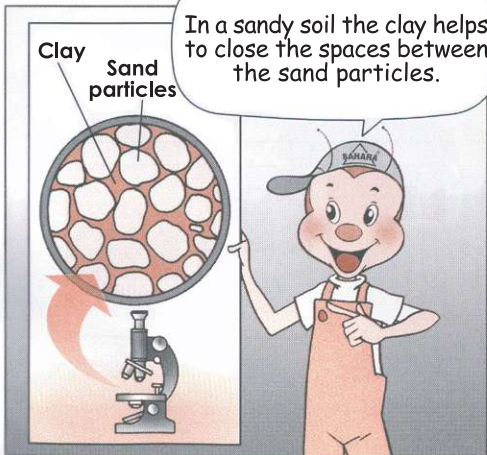


Clay Sand particles

In a sandy soil the clay helps to close the spaces between the sand particles.

What about if the soil has too much clay?

Well besides that the brick will be weaker; it will be hard to do the pressing because it will stick to the mold.

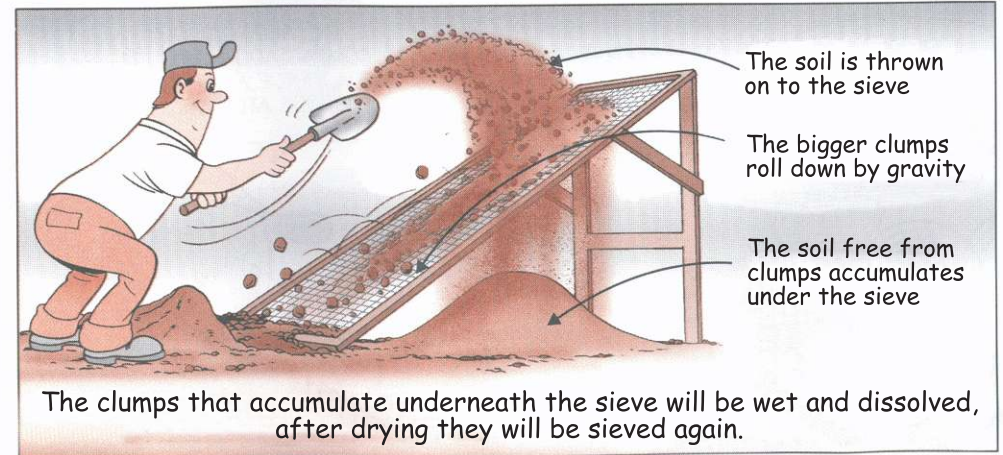
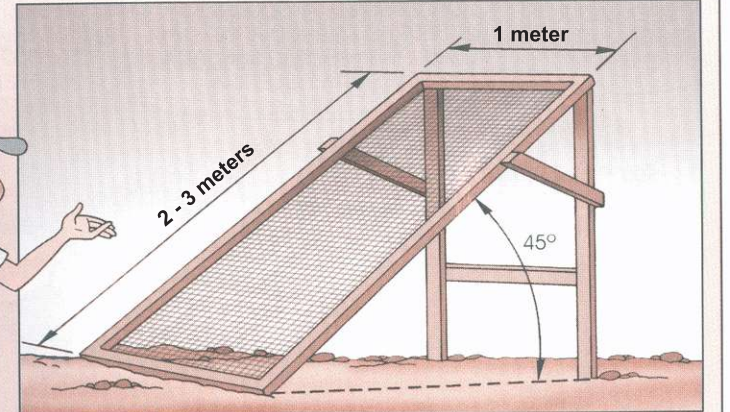


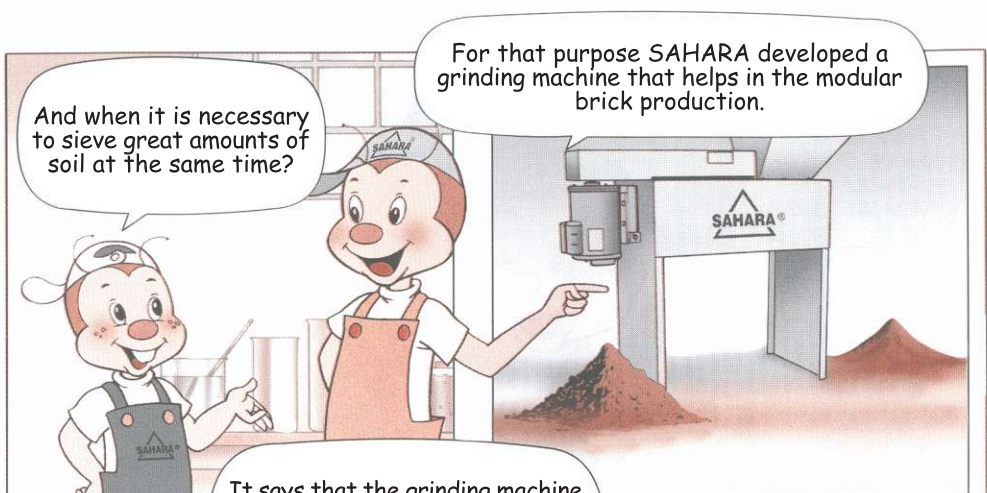
That is done during the soil preparation. We have to grind the clumps or sieve them through a mesh of 4 to 6 millimeters.

How do you remove the clumps that come in the soil?



To sieve the soil we can use this type of sieve with these measurements.





And when it is necessary to sieve great amounts of soil at the same time?

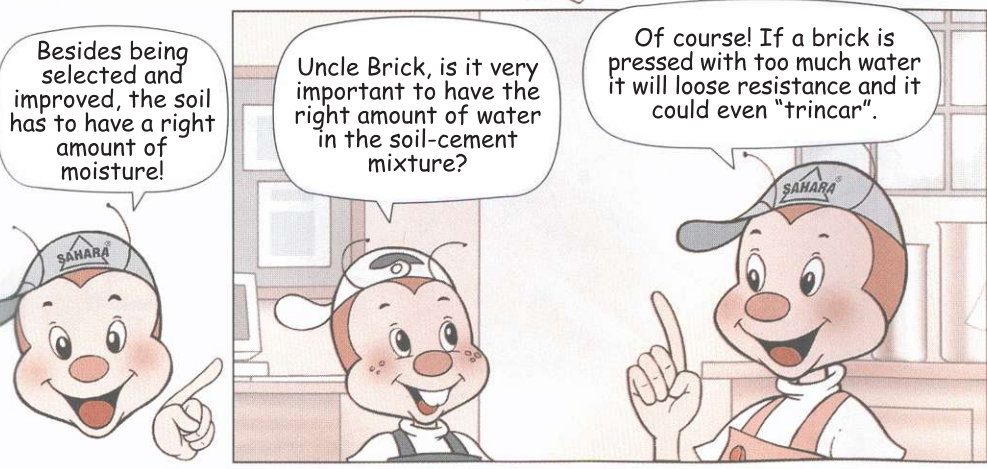
For that purpose SAHARA developed a grinding machine that helps in the modular brick production.

It says that the grinding machine works with blades at high rotation speed in order to explode the soil clumps, but if stones are hit by the blades they will be thrown out quite violently.

What does this sign says Uncle Brick?

Even when using the machines with a soil stone free, we have to use safety equipment to avoid any possibility of accident.

ATTENTION
Soil with stones cannot go through the grinding machine



Besides being selected and improved, the soil has to have a right amount of moisture!

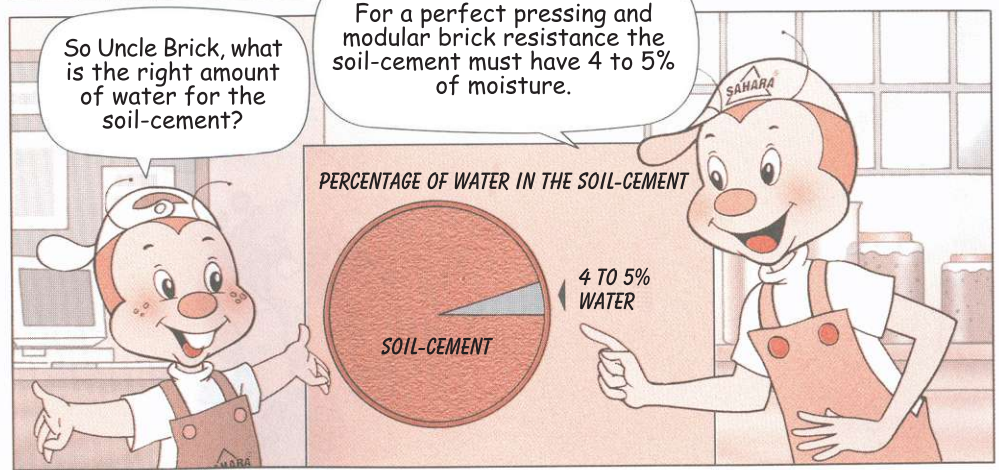
Uncle Brick, is it very important to have the right amount of water in the soil-cement mixture?

Of course! If a brick is pressed with too much water it will loose resistance and it could even "trincar".



What about if there is too little water?

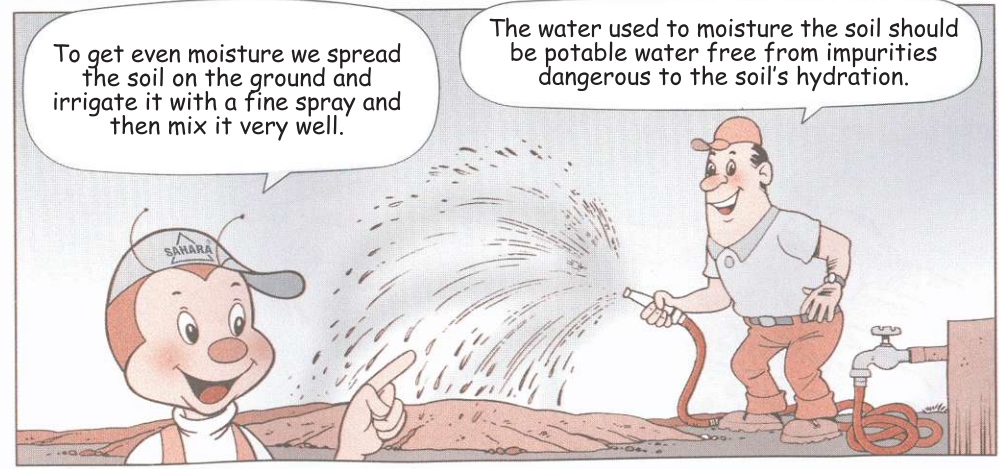
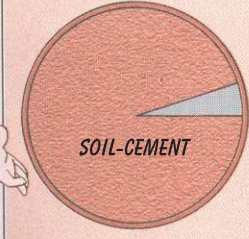
Then pressing become difficult and resistance will also be lost.



So Uncle Brick, what is the right amount of water for the soil-cement?

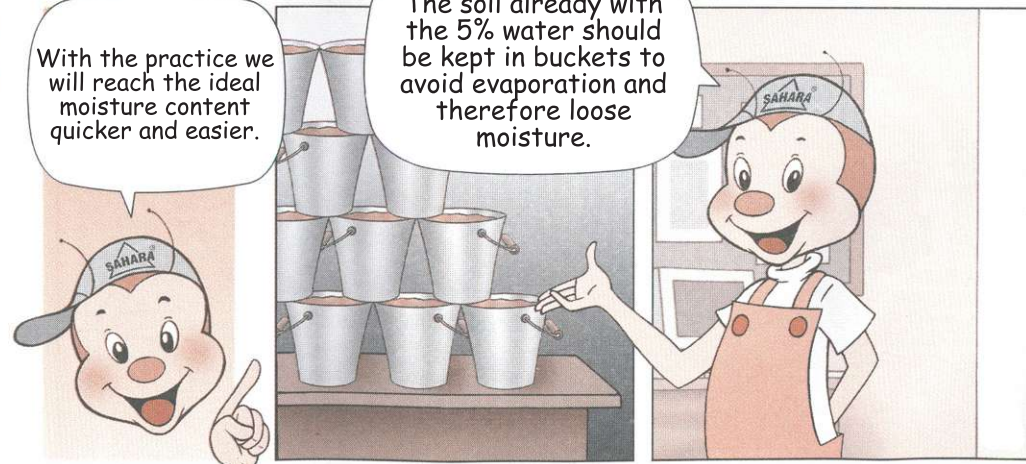
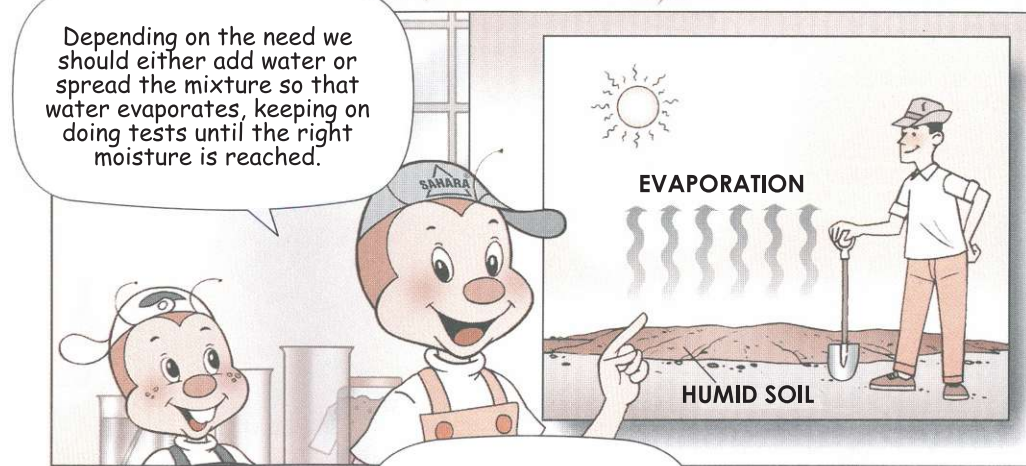
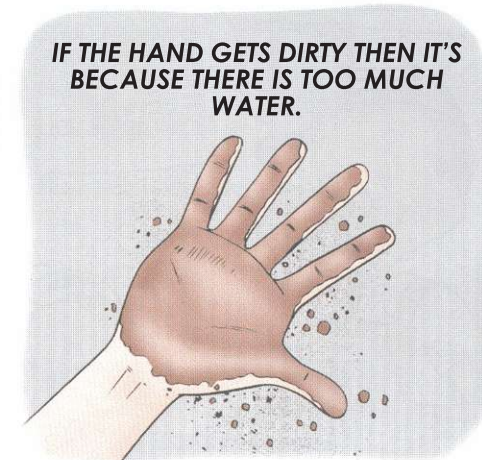
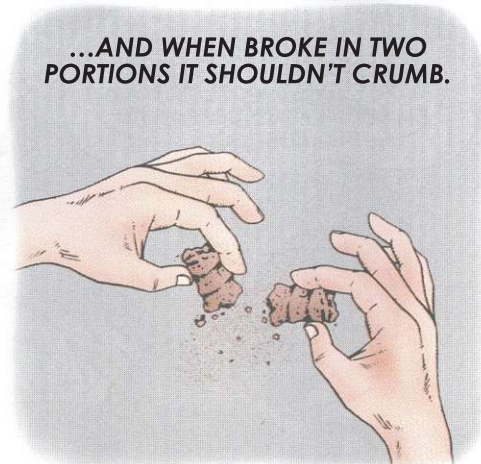
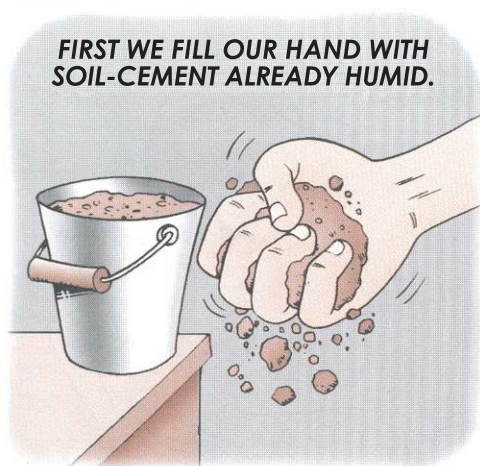
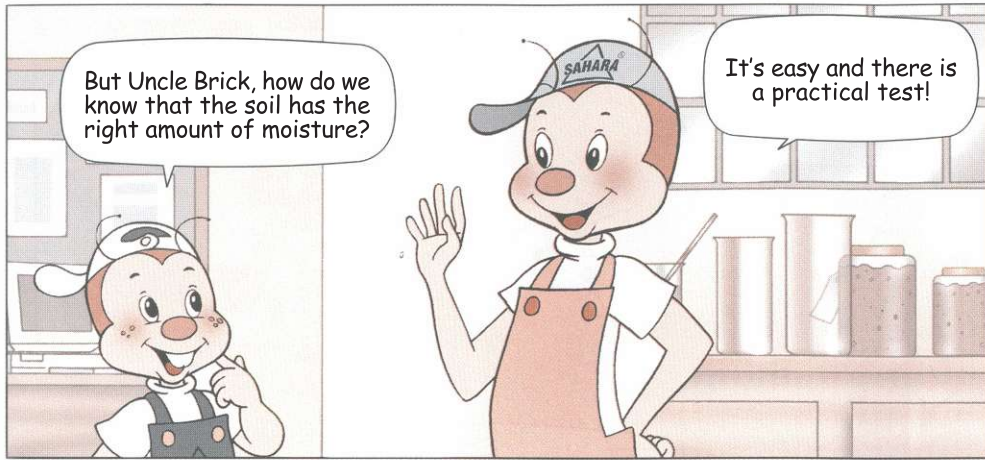
For a perfect pressing and modular brick resistance the soil-cement must have 4 to 5% of moisture.

PERCENTAGE OF WATER IN THE SOIL-CEMENT



To get even moisture we spread the soil on the ground and irrigate it with a fine spray and then mix it very well.

The water used to moisture the soil should be potable water free from impurities dangerous to the soil's hydration.



And now that the soil is moist and with the right amounts of sand and clay we just have to make the soil-cement mix.

30% CLAY
70% SAND
4 - 5% WATER

Depending on the type of soil that we are going to use, the amounts might vary from 7 to 10 buckets of soil to 1 bucket of cement. That is why we advise a soil analysis before this operation.

7 TO 10 BUCKETS OF SOIL + **1 BUCKET OF CEMENT** + **4 - 5% WATER** = **MODULAR BRICK**

It is important that the soil is passed twice through the grinding machine together with the cement. It is through this operation that we will have a homogeneous mix.

SOIL-CEMENT PRE-MIXED

SOIL-CEMENT GRINDED & MIXED

ATTENTION !
The soil-cement may not be mixed with a concrete mixer.

ATTENTION

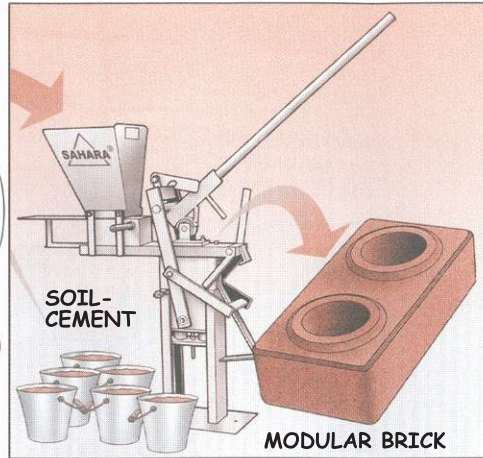
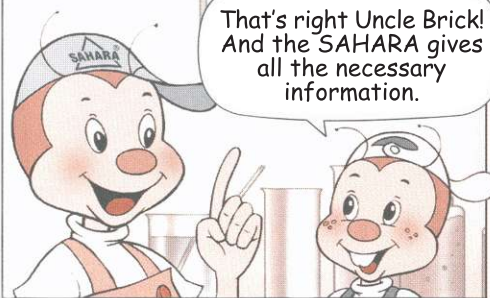
THE SOIL-CEMENT MIXTURE MUST BE PREPARED FOR MAXIMUM PRODUCTION OF ONE HOUR, BECAUSE AFTER THAT TIME THE MODULAR BRICK'S QUALITY WILL BE COMPROMISED.

Good! We already have the soil-cement ready to be pressed.

In this operation we also have to have certain care. Before starting we have to be well informed about the operational and care instructions of the pressing machine.

By following all the instructions we will be sure of having a good production and an excellent product.

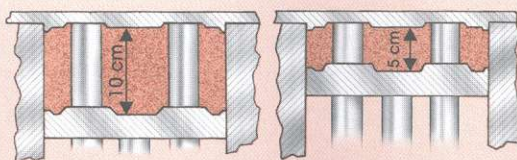
That's right Uncle Brick! And the SAHARA gives all the necessary information.



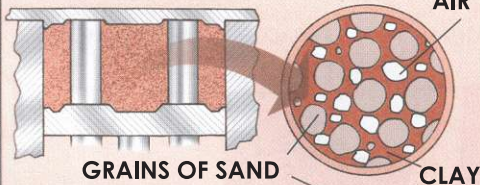
Let's learn a bit more about the pressing process.

Let's now see an example the different between the pressing chambers before and after the pressing is done.

BEFORE PRESSING **AFTER PRESSING**



The proportions vary according to the brick measurements or the type of soil to be pressed.

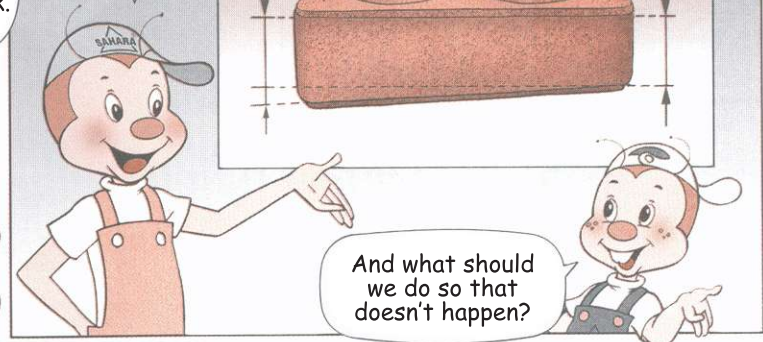


The pressing is made up to 6 tons of pressure closing up the pores and expelling the air from brick's interior.



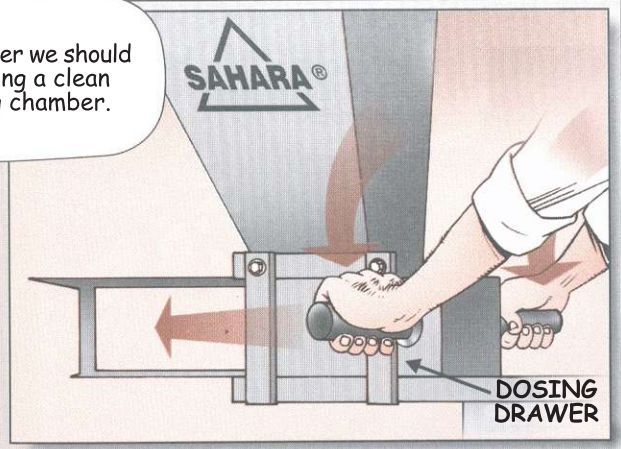
During the pressing operation we have to be very careful so that we won't get a conic brick.

This mean so that one side is not higher than the other.

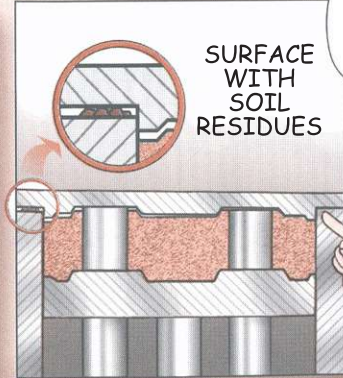
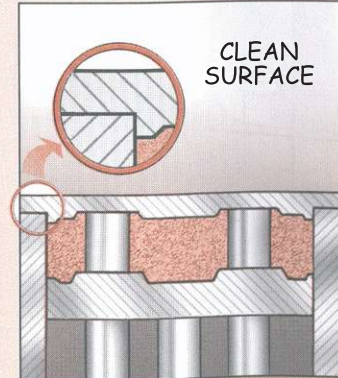


And what should we do so that doesn't happen?

When opening the dosing drawer we should press it down, always keeping a clean surface under the pressing chamber.

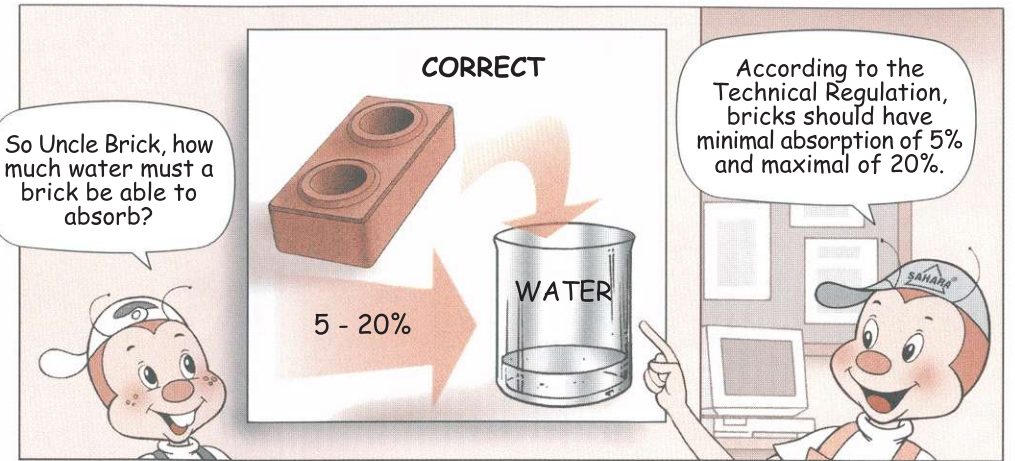
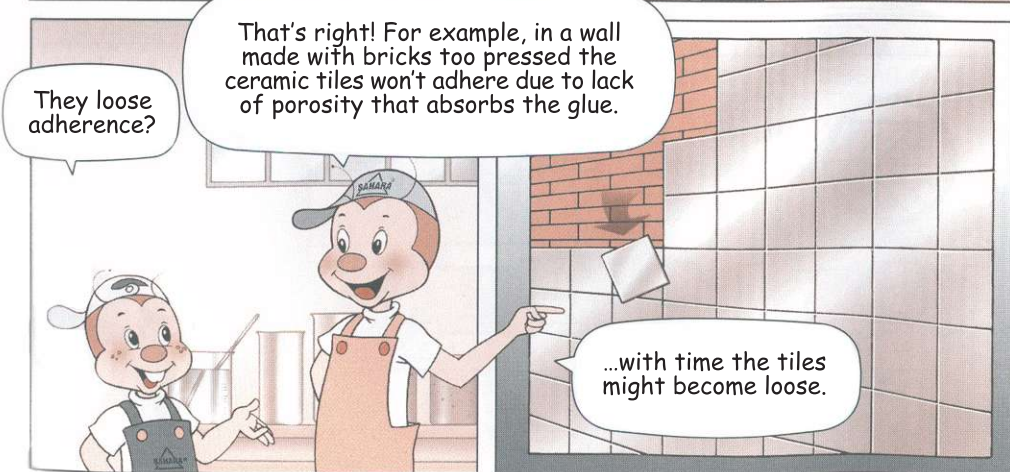
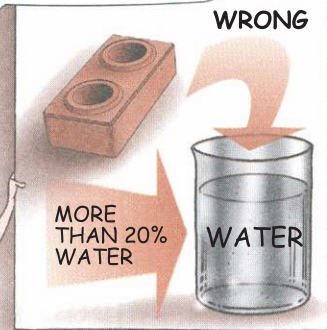
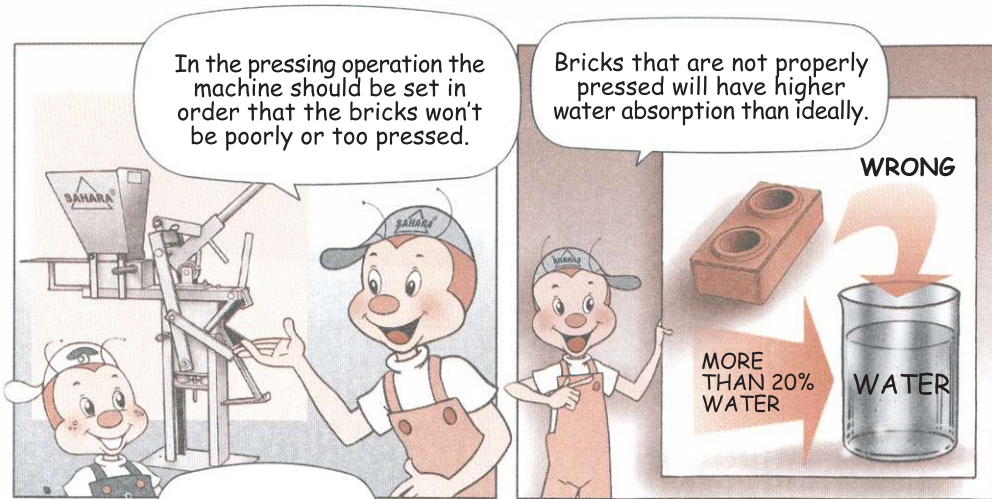


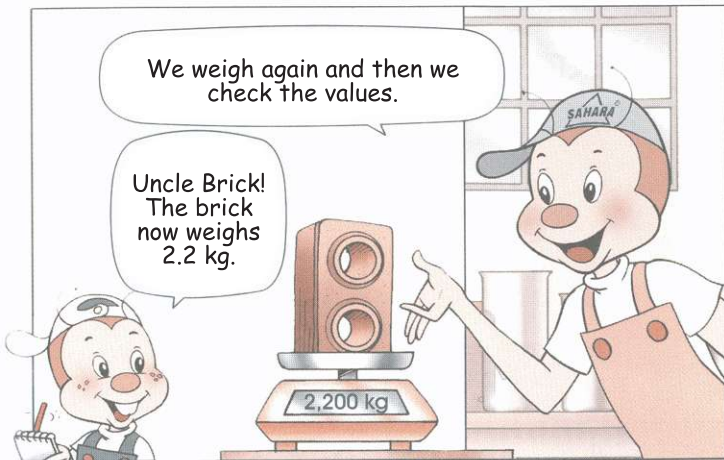
RIGHT



Here we can see how the lack of cleaning can alter the brick measurements.





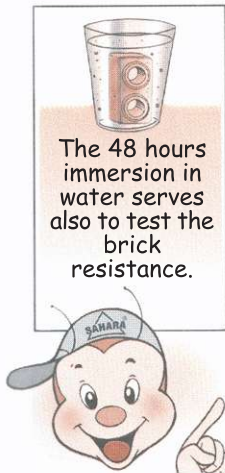


We weigh again and then we check the values.

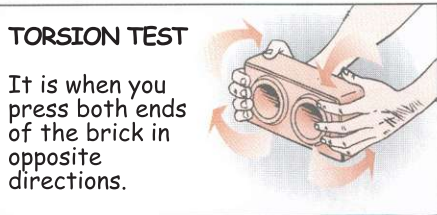
Uncle Brick!
The brick now weighs 2.2 kg.



Great! Before the brick weighed 2 kg and now weighs 2.2 kg. So it absorbed 10% of water.

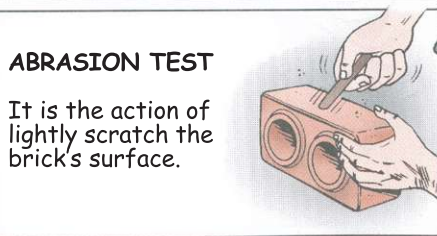


The 48 hours immersion in water serves also to test the brick resistance.



TORSION TEST

It is when you press both ends of the brick in opposite directions.

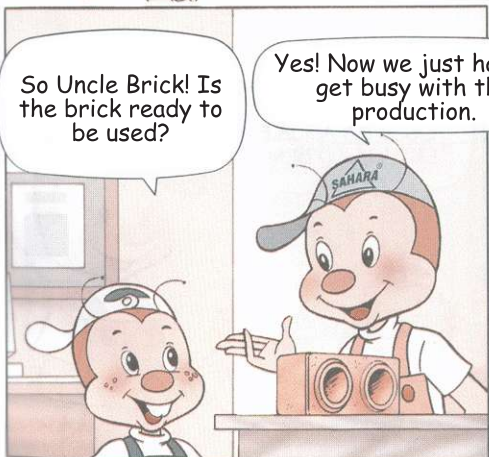


ABRASION TEST

It is the action of lightly scratch the brick's surface.



If in the abrasion test the particles are hard to come loose than the product's quality is approved.



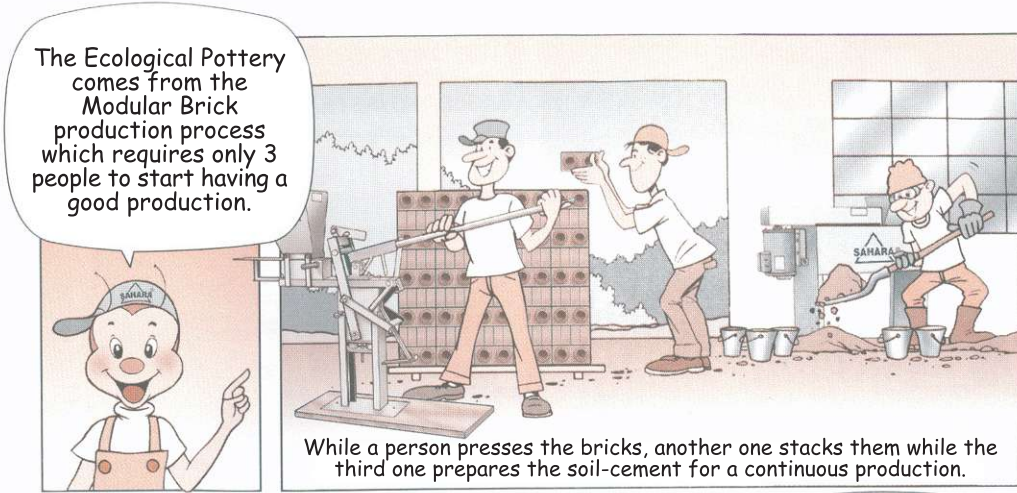
So Uncle Brick! Is the brick ready to be used?

Yes! Now we just have to get busy with the production.



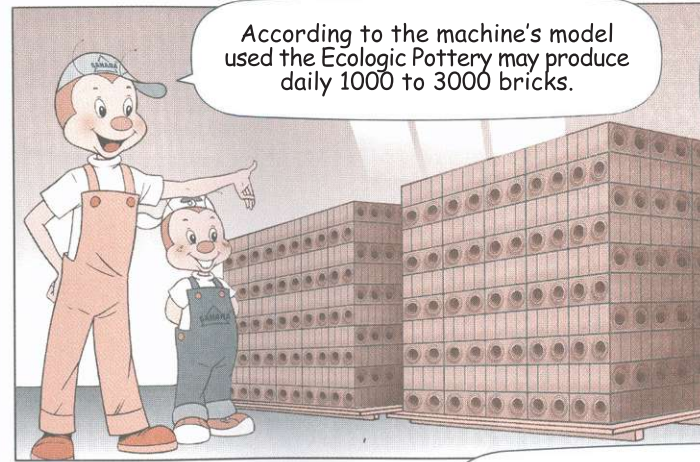
Talking about that, let's see how a **ECOLOGICAL POTTERY** works.

GREAT!



The Ecological Pottery comes from the Modular Brick production process which requires only 3 people to start having a good production.

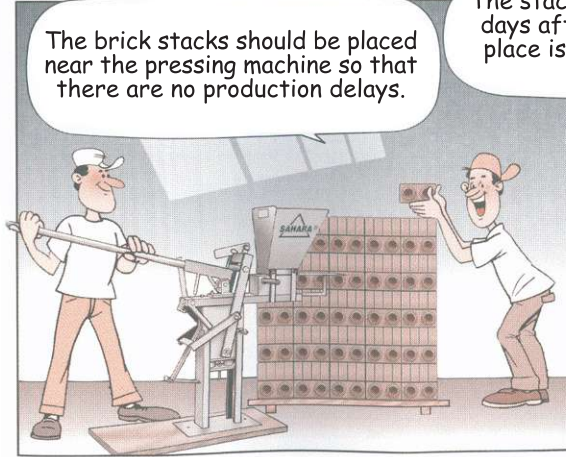
While a person presses the bricks, another one stacks them while the third one prepares the soil-cement for a continuous production.



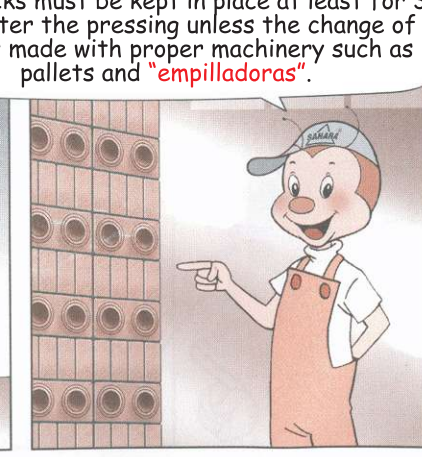
According to the machine's model used the Ecologic Pottery may produce daily 1000 to 3000 bricks.



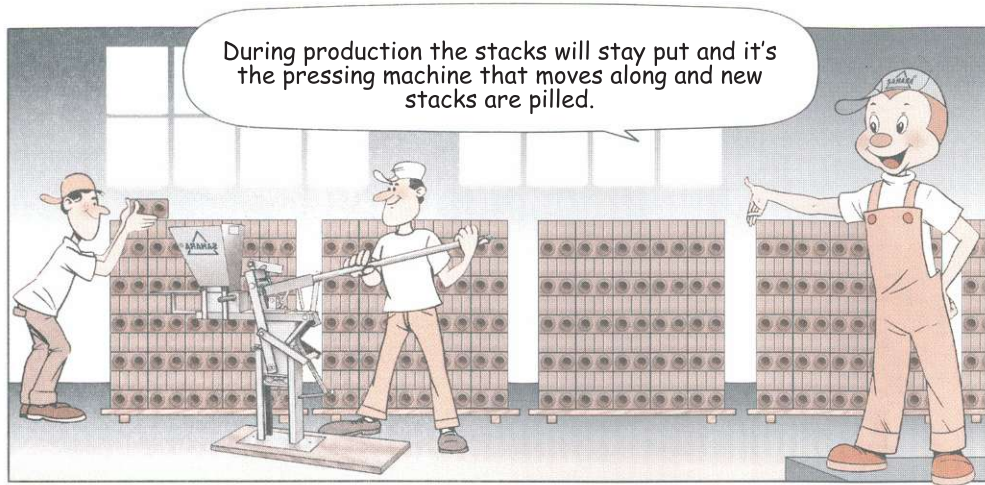
But during the production we have to take certain cares to guarantee the quality of the modular or ecologic brick.



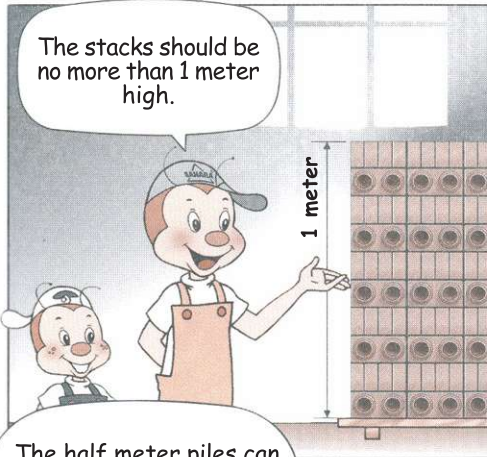
The brick stacks should be placed near the pressing machine so that there are no production delays.



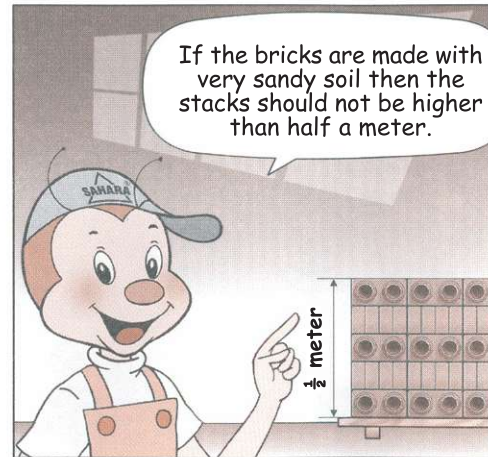
The stacks must be kept in place at least for 3 days after the pressing unless the change of place is made with proper machinery such as pallets and "empilladoras".



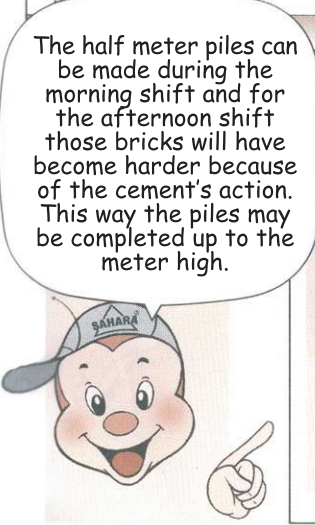
During production the stacks will stay put and it's the pressing machine that moves along and new stacks are piled.



The stacks should be no more than 1 meter high.

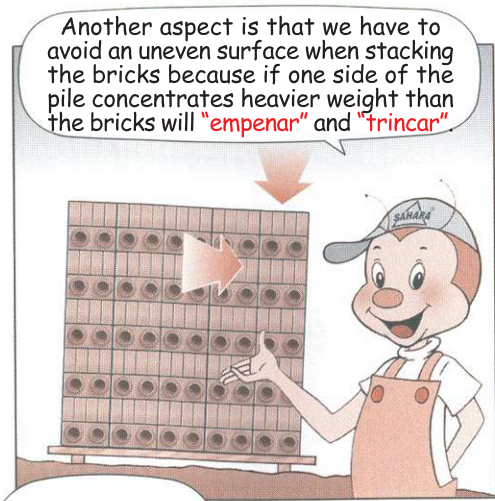
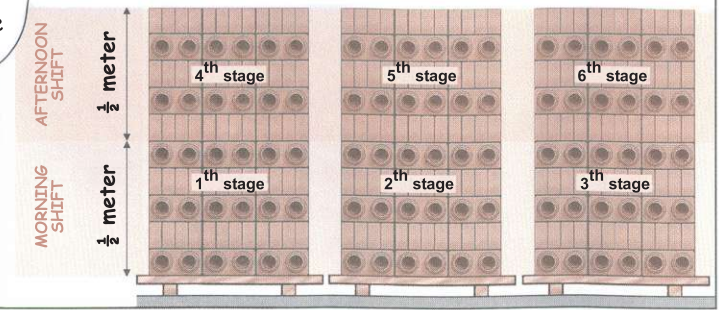


If the bricks are made with very sandy soil then the stacks should not be higher than half a meter.



The half meter piles can be made during the morning shift and for the afternoon shift those bricks will have become harder because of the cement's action. This way the piles may be completed up to the meter high.

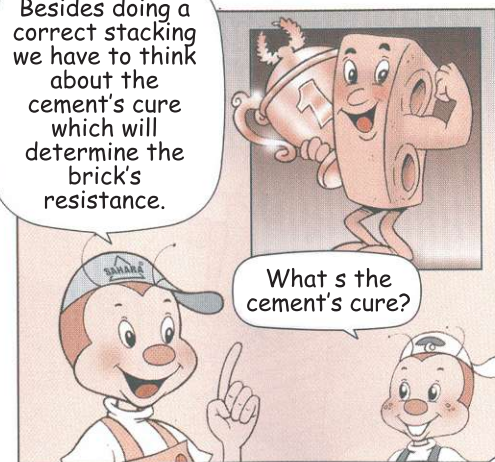
The half meter piles can be made during the morning shift and for the afternoon shift those bricks will have become harder because of the cement's action. This way the piles may be completed up to the meter high.



Another aspect is that we have to avoid an uneven surface when stacking the bricks because if one side of the pile concentrates heavier weight than the bricks will "empenar" and "trincar".

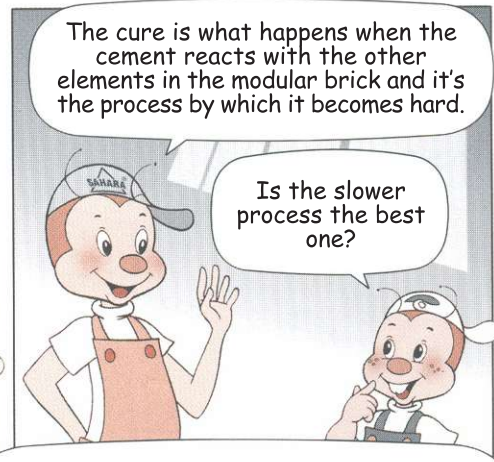


That's why the stacks should be made over well leveled surfaces.



Besides doing a correct stacking we have to think about the cement's cure which will determine the brick's resistance.

What's the cement's cure?

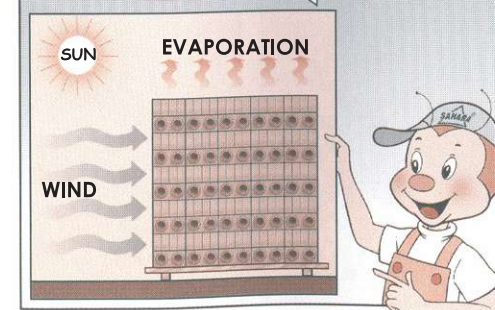


The cure is what happens when the cement reacts with the other elements in the modular brick and it's the process by which it becomes hard.

Is the slower process the best one?

Yes! That's why we have to avoid evaporation through sun or air because too much or quick evaporation will cause fast drying process damaging the cement's cure.

The stack should be moisturized with a fine spray during the first 3 morning hours in order not to alternate the bricks texture and to ensure a slower and safer cure.



During the first two days the piles must be sprayed 3 to 4 times a day.



To avoid evaporation and moisture loss the piles must be covered with a plastic for at least 3 days and sprayed constantly.



After how many days can the bricks be handled?

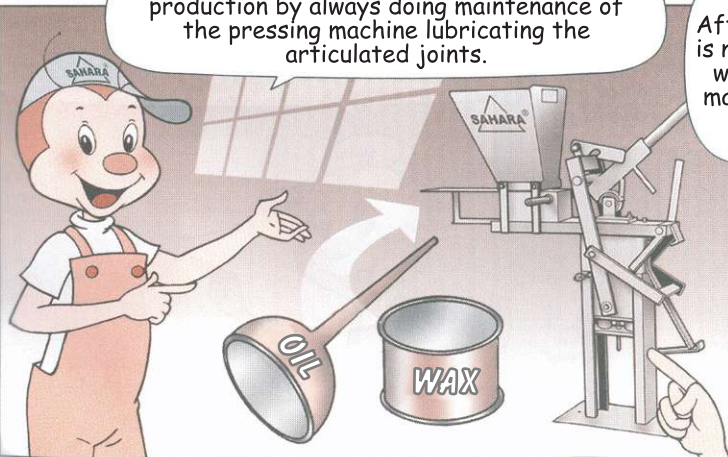
7 days after pressing they can be transported.

7 days after pressing the modular brick may be used, but the ideal is to wait 28 days.

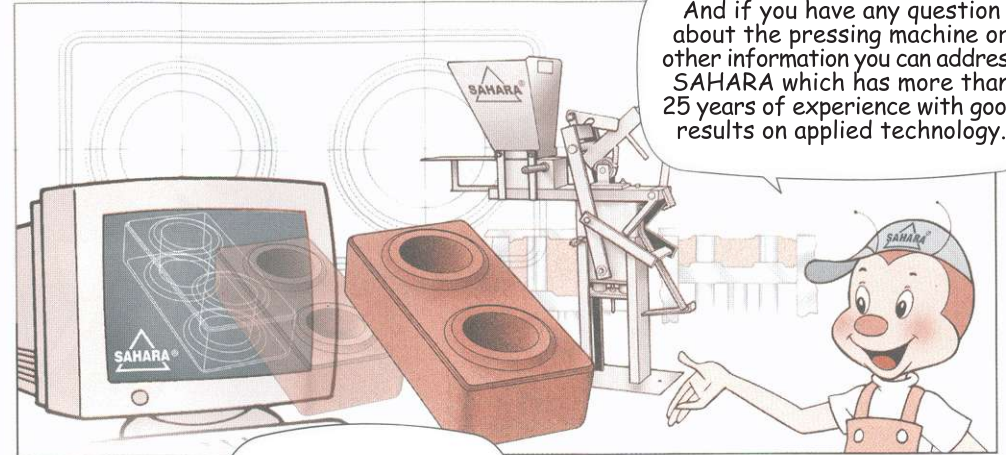


Now we just have to take care of the production by always doing maintenance of the pressing machine lubricating the articulated joints.

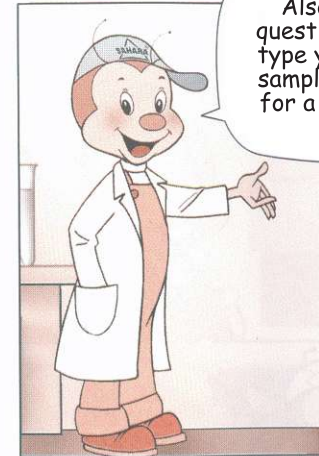
After each day of work it is necessary to disassemble, wash and lubricate the machine to ensure a long life of use.



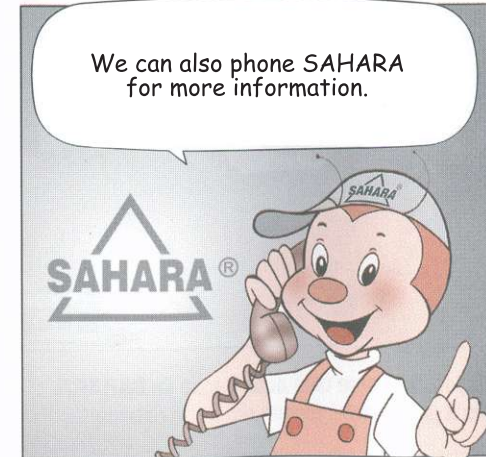
And if you have any question about the pressing machine or other information you can address SAHARA which has more than 25 years of experience with good results on applied technology.



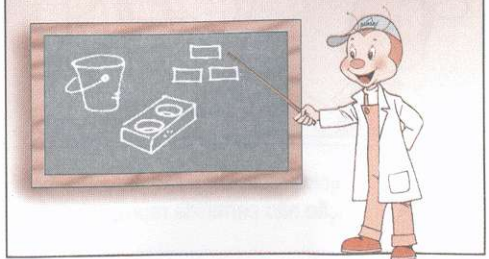
Also, regarding questions about soil type you can send a sample to SAHARA for a free analysis.

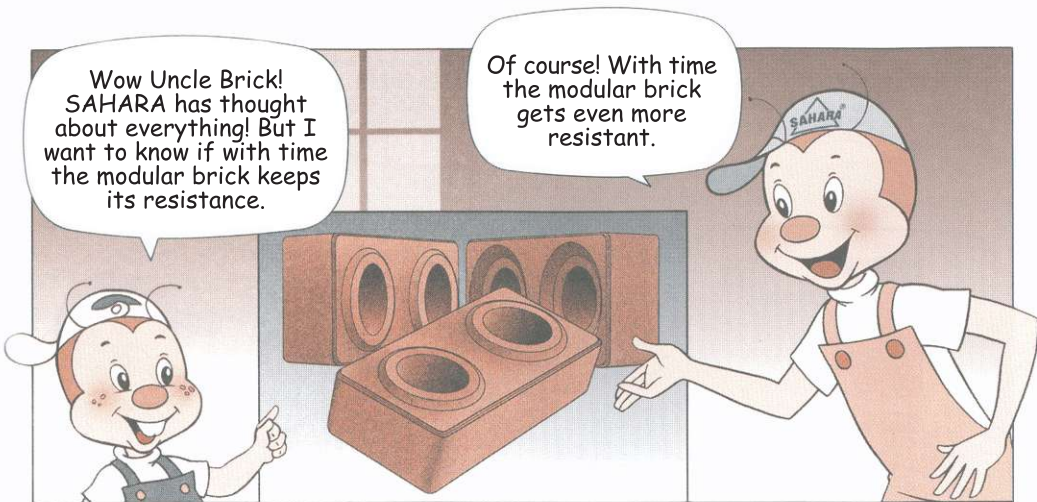


We can also phone SAHARA for more information.



SAHARA also offers free courses on the Soil-Cement Technology in the fabrication of the modular brick, and basic notions of the Modular Building System.






PREGRESSIVE RESISTANCE PERCENTAGE OF THE MODULAR BRICK AFTER PRESSING

7 DAYS	65% RESISTANCE (APPROXIMATE)	READY FOR TRANSPORT
28 DAYS	96% resistance (approximate)	IDEAL TO BE USED

AS TIME GOES BY THE MODULAR BRICK REACHES AN EVEN HIGHER GRADE OF HARDINESS.




The modular bricks are patent registered and may be produced only with SAHARA's authorization. The production that has not been allowed is a crime and is subject to law enforcement.