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Mali, Poor storage

## **Grain Storage in Mali**

Mali is a landlocked country located in West Africa. The countries that are around it include Algeria, Niger, Burkina Faso, Côte d'Ivoire, Guinea, Senegal, and Mauritania. Mali is around 1,240,000 square kilometers (Nations Encyclopedia 2022). It has a population of around 22.5 million people (Mali Population 2022). This country is made up of mostly young people. The population is greatly affected due to the previous and current military activity.

The country's main industry is mining for gold. Mali has the third highest mining rate in Africa making that its biggest export. As of 2021 gold made around eighty percent of Mali's exports. Not only is gold one of the countries leading sources of revenue, a little over ten percent of households depend on it for their primary income. Though many mines have closed there are still new ones being opened as they are being discovered. Since 2018 there have been three new mines located and have begun contributing to the country's economy. Other big industries are food processing, phosphate mining, and construction. These industries combined make up a large chunk of Mali's money (Mali-mining 2022).

An average family in Mali is around five to six people (Demographic and Health Surveys 2018). They are usually headed by men. Only around seventeen percent of households are headed by women (Demographic and Health Surveys 2018). In their culture men think that they are the decision makers. However, when the women are asked they think that it is more of a decision jointly agreed upon. These families struggle with hunger related problems every day. In one household there might be aunts, uncles, cousins, grandparents, parents, and children living under the same roof. They are forced to work everyday to try to make a living. Most women work in and around the house doing things like laundry that the men would never do because it is not viewed as a male's responsibility. Men do other jobs usually away from their homes, under an employer. Teenage girls usually work around the house with their mother, while teenage boys work alongside their fathers. Another thing that is uncommon in most cultures that is different in Mali is they find it disrespectful to make eye contact with their elders.

Mali has a very different look to a house in comparison to here in the United States. Their houses are made out of less durable materials. For the walls they use timber and adobe which is a mixture of mud, grass and other organic materials. Their roofs are made out of either grass or several wood beams that are supported by adobe walls to keep rain and other things out of their houses. However with climate change and deforestation they are having problems with their housing. Since the early sixties there has been a documented increase in the average daily temperature, and records show that it will continue to climb as time goes on (Climate change 2022). Due to a lack of precipitation they are experiencing droughts, making the already limited supply of timber even less. This constant deforestation is threatening their building resources. The shortage of proper building material grossly affects the ability to construct adequate homes as well as grain storage huts.

Mali is amongst one of the ten poorest countries in the world (Giovetti, Olivia 2022). They are a very underdeveloped country that does not have the money to do a whole lot of improvements. In Mali they struggle with storing food. Mali's most common crops are cotton, grains, rice, millet, sorghum, and wheat (International Trade Administration 2022). They are able to grow these crops however, when it comes to storing it they are not as advanced. They use storage units

made of other natural resources they have readily available. Adobe is one commonly used supply. Another thing they use is thatch. To make their thatch they use a bunch of dried pieces of straw, grass, or other dried out resources. Usually the thatch is used as the roof to keep rain, dirt, animals, and other things out. The thatch is arranged and usually tied together in a way that helps keep the rain from entering into the inner roof.

Once their crop is grown and harvested they put it in an outdoor homemade storage hut, regardless of the amount of moisture. In Mali they have no way of properly drying any of their grains. These storage huts are made up of materials that are found around their area as mentioned earlier (adobe and thatch). After the food is put into the grain storage huts it sits there until needed. As it sits, there is no way to monitor the condition of the grains. There are multiple issues that commonly occur with this current storing method.

Take wheat for an example. It is grown all over the world including in Mali. Storage of wheat requires a certain set of conditions. For the best turn out in storage, wheat should stay around forty to sixty degrees Fahrenheit. If the temperature exceeds sixty degrees the wheat is more likely to have a rapid decline causing the seed to have problems germinating. If the moisture levels are higher than twelve percent the potential for mold growth increases significantly and the grains are able to respire. When the moisture levels reach fifteen percent the mold is guaranteed to grow. If the moisture levels reach more than twenty percent, bacteria are able to start growing (Ngounou, Boris 2022). When storing grains a basic rule of thumb is, no stored product of more than five years.

These storage containers are not very effective in storing their food. The containers are found outdoors by their homes. These containers are usually not protected or in a sheltered area. They are out in the open where animals and passerbyers can easily access them. People in Mali struggle with starvation and hunger. When these containers are left unattended, neighbors or other passerbyers see this, they steal the food and ruin the containers. Sometimes they even take the containers along with the grains inside of them. If people don't get to the food first the animals get into it. When the animals get into it they contaminate it. The animals will nestle in and eat, sleep, and go to the bathroom there. When the animals get into the containers the food is no longer safe to eat. Another problem with their storage containers is that there is a lack of ventilation. When there is no ventilation or way of getting air to effectively flow through the containers it causes the grains to spoil.

In order to try to solve the problem with their grain storage they would need to make some changes to their storing methods. There are a few different things they could do however due to a lack of funding some of the solutions are unattainable. If they had the proper funding they could invest in better materials to improve and or build safer grain storage units. These units would be constructed using a variety of materials that would increase the shelf life, quality and security of its contents.

One possible solution that Mali could look into would include using a turbine roof vent, squirrel cage fan, small solar panel, and socked drain tile. With this combination of materials it would help to prevent the crops from spoilage due to molding and make a better ventilation system.

The people of Mali could add a few simple ventilation items to greatly improve the issue of spoiled and molded food. They could incorporate these items into their already built huts as there is already a shortage of money and supplies. Building a new hut from new materials would not be mandatory.

When you look at how a grain bin is set up here in the United States you would notice there is an elevated floor. The reason for having an elevated floor is to prevent contact with the concrete and to help air flow through the bin. Here in the United States the bin floor is a specially designed metal layer that is perforated to help air flow through efficiently and prevent the grain from going down and filling the elevated gap. On the outside of the bin there is usually a fan that is either on the ground or attached to the side of the bin. This fan pushes air up through the perforated floor into the grain which starts drying out the crop. The longer the air is in the bin the warmer it gets. As the air heats up it rises up and out an opening at the top of the bin. With this constant air exchange it keeps the grains from getting full of moisture, helps keep it from molding, and helps to prevent it from getting all clumped up.

In comparison Mali's grain huts have some aspects that are the same but not quite as advanced. Most of their grain huts are elevated. Instead of using a metal that is designed for their grains they use natural resources that they have readily available. Some things they use are pieces of wood, rocks and other hard objects. Unlike here in the United States they currently do not have a fan system for their huts. The roof of their buildings are made of thatch with no designated spot to vent out the hot air. Some huts however look like they have holes on the sides which could be used for venting purposes. The overall layout of Mali's grain huts have the same basic design as modern grain facilities but need some additional inputs that would greatly improve the crop condition.

So if we start looking at different items to help fix some of the Mali grain hut issues we should start at the bottom of the grain hut by adding socked floor tile. When the grain hut is empty the socked floor tile could be installed fairly easily by securely connecting one end of the tiling to an opening on the bottom side of the hut near the ground. It should be evenly coiled throughout the entire floor of the hut. With the even coils the air distribution will be more effective as it can reach all of the grain better. The end of the coil that is located in the center of the hut should be capped off so no grain is able to get inside the tiling. It is ideal for the tiling to get the most air flow possible. In order for the tiling to get the most air flow there should be no grain inside the tile clogging it up. In order to get enough air pressure pushed through the tile we will need a fan that has the correct cubic feet per minute (CFM).

When looking at the average size of Mali's grain huts a majority of them seem to be all around the same general size. If you were to securely add a squirrel cage fan to the end of the socked drain tile that is connected to the outer wall you would now have a better air flow into your tiling. When thinking about how a fan works, you usually plug it into a wall or some sort of power source. With only around twenty-five percent of people living in Mali having access to power these fans would not be able to run off of their current power sources. Instead, while they are updating their grain huts, they would need to install a solar panel that would collect sunlight throughout the day, store it, and later use it to power the fan. With this solar panel being installed there would be no need to try to connect these fans to a pre-existing power source. These solar panels might cost a little more than some of the people would want to pay up front. However, with these solar panels they are not using their already limited supply of electricity. Instead using a way more cost efficient solution.

Now that the air is being pushed into the storage hut there needs to be a way of venting the air out of the hut. As mentioned earlier on a grain bin here in the United States there are specially designed spots in the roof of the bins for the air to get out. These spots are put toward the top of the bin because hot air rises. By adding a turbine roof vent to the top of the storage huts there will now be a way for hot air to be circulated out of the hut making way for new air flow. These turbines are specially designed to run off of no electricity and fully off of heat and a little bit off of

wind. When the turbine spins, the hot air from inside the hut is drawn out through the vent and released back into the atmosphere. These turbines should be placed at the peak of the hut where most of the heat will rise to. When adding these turbines it could become a little bit challenging due to the current structural conditions of the existing roof. When installing a turbine to a roof it needs a fairly sturdy spot to be attached to with an airtight seal only allowing air from within the hut to be vented out through the turbine. Being that the hut roofs are currently made out of thatch they will need to add about a pipe with about one to two feet sticking directly out of the center of the roof and around a foot of the pipe in the center of the hut where the hot air can travel through to get to the turbine that will then pull the air out of the hut. On the pipe the thatch will be sealed to the pipe either using some kind of adhesive or by tying a string of some sort making a stronghold between the pipe and the thatch. Where the thatch is connected to the pipe it is mandatory that it is sealed so that no rain or moisture is able to get in. Above where the meeting point of the thatch and pipe is, that is where the turbine roof vent will be installed. This roof vent will be attached to the pipe with an airtight seal. If the neck of the turbine and the pipe are not the same size something will have to be figured out on how to get the airtight seal here too. If there is not an airtight seal the turbine will not be efficient because it will not pull the air out of the hut properly.

If all of these adjustments, mentioned above, were made to their current structures they would now have a better storage unit that would help with the shelf life, quality, and security of the contents. This project will be most efficient if all of these things were added to the huts. With these alterations to the huts it won't solve all of their problems related to their grain storage but it would help quite a bit. There are other simple things that they could also invest in too.

As mentioned before it is very common to see their grain storage outside their homes. Being that the storage containers are outside their homes they are more likely to get stolen. One of the simplest ways to help with their problem is to move them indoors into a protected area. Not only will the chances of their grain getting stolen go way down, the accessibility of the grain to rodents and other animals will also decrease. Adding a better locking system to the storage container will also increase the storage's effectiveness. Locking the storage container and moving it to a protected area will be the best possible solution. These other little things would not be needed right away for this ventilation project but would also be beneficial to add to the bins at some point in the future. Some families might invest in them right away while others might need to wait until they are able to financially.

Overall, Mali is a very poor country that has financial instability and problems with storing food. By making these adjustments to the containers there will be a better ventilation system that will promote the shelf life, quality, and security of its contents.. In trying to convert to the more improved storage systems the country of Mali might struggle to find the funds to initially start to convert to these. It is always difficult to convince the poor to invest in capital projects, but this could be a solution. Over the span of about five or less years they would be saving money and have more food that is readily available at all times now and in the future.

## Works Cited:

Admin. "Grains in Mali: More than Meets the Media." *Gro Intelligence*,  
<https://gro-intelligence.com/insights/grains-in-mali-more-than-meets-the-media>.

AFSUSA (Retrieved 2022) Mali <https://www.afsusa.org/countries/mali/>

"Climate Change and Violent Conflict in Mali - Mali." *ReliefWeb*, 8 July 2021,  
<https://reliefweb.int/report/mali/climate-change-and-violent-conflict-mali#:~:text=Mean%20annual%20temperatures%20in%20Mali,occurred%20in%20the%20recent%20past>.

Giovetti, Olivia. "The World's Ten Poorest Countries." *Concern Worldwide*,  
<https://www.concern.net/news/worlds-ten-poorest-countries>.

International Committee of the Red Cross. "Mali's Invisible Front Line: Climate Change in a Conflict Zone." *International Committee of the Red Cross*, 23 July 2021,  
<https://www.icrc.org/en/document/mali-invisible-front-line-climate-change-conflict-zone>.

*Mali - AFS-USA*. <https://www.afsusa.org/countries/mali/>.

"Mali." *Encyclopædia Britannica*, Encyclopædia Britannica, Inc.,  
<https://www.britannica.com/place/Mali>.

"Mali - Location, Size, and Extent." *Encyclopedia of the Nations*,  
<https://www.nationsencyclopedia.com/Africa/Mali-LOCATION-SIZE-AND-EXTENT.html>.

"Mali Population 2022 (Live)." *Mali Population 2022 (Demographics, Maps, Graphs)*,  
<https://worldpopulationreview.com/countries/mali-population>.

*Mali 2018 Demographic and Health Survey - Key Findings [SR261.E]*.  
<https://www.dhsprogram.com/pubs/pdf/SR261/SR261.E.pdf>.

"Men, Gender Equality and Gender Relations in Mali: Findings from the International Men and Gender Equality Survey." *Equimundo*, 7 June 2022,  
<https://www.equimundo.org/resources/men-gender-equality-and-gender-relations-in-mali-findings-from-images/>.

Okoyoray. "8 Pros and Cons of Turbine Roof Vents." *Roof Critics*, 17 Oct. 2021,  
<https://roofcritics.com/pros-and-cons-of-turbine-roof-vents/>.

Ngounou, Boris. "Mali: Ngos Sound Alarm at 82 per Cent Forest Loss." *Afrik 21*, 10 July 2020, <https://www.afrik21.africa/en/mali-ngos-sound-alarm-at-82-per-cent-forest-loss/>.

Slegh, H., Barker G., Toliver M., Bah A., and Keita M. (2013) Men, Gender Equality and Gender Relations in Mali.

<https://promundoglobal.org/wp-content/uploads/2015/01/Men-Gender-Equality-and-Gender-Relations-in-Mali-Findings-from-IMAGES.pdf>

University, Utah State. "Preserve the Harvest: Storing Wheat." *USU*, 9 Nov. 2021, <https://extension.usu.edu/preserve-the-harvest/research/storing-wheat>.

75. "Mali - Agricultural Sectors." *International Trade Administration | Trade.gov*, <https://www.trade.gov/country-commercial-guides/mali-agricultural-sectors#:~:text=Agricultural%20production%20in%20Mali%20is,a%20unique%20opportunity%20for%20investors>.

75. "Mali - Mining." *International Trade Administration | Trade.gov*, <https://www.trade.gov/country-commercial-guides/mali-mining#:~:text=2022%2D08%2D08-,Overview,with%20the%20world%20market%20price>.