



Solar dryer design and distribution model for North East Chilli Producers Association (NECPA)

Farm Africa and the North East Chilli Producers Association (NECPA) are implementing a three-year project to build a more competitive and profitable chilli value chain within Lira, northern Uganda, to capitalise on growing international demand for varieties of Ugandan African bird's eye (ABE) dried chillies.

Through this partnership, Farm Africa is strengthening the technical capacity of NECPA to help make the chilli value chain more competitive, through supporting market-orientated chilli production with 3,000 farmers in the sub-counties of Barr, Amach and Aromo. Farm Africa's technical support is also targeting the improvement of the quality and supply of inputs such as seeds, as well as post-harvest handling technologies like solar dryers and promoting their use by chilli farmers.

Solar drying technology for smallholder farmers

Solar drying is one of the most efficient, cost-effective and sustainable renewable energy technologies to enable the preservation of agricultural products. It uses solar energy to heat up and dry produce that is loaded into the dryer. A solar dryer converts light energy to heat, which warms up the air trapped inside the structure and is then forced out through the products inside to the vents at the top.

The basic principles employed in a solar dryer are:

- **Converting light to heat:** Any black colouration on the inside of a solar dryer will improve the effectiveness of turning light into heat.
- **Trapping heat:** Isolating the air inside the dryer from the air outside the dryer makes an important difference. Using a clear material, such as a plastic sheet or a glass cover, will allow light to enter, but once the light is absorbed and converted to heat, a plastic sheet or glass cover will trap the heat inside. This makes it possible to reach similar temperatures on cold and windy days as on hot days.
- **Moving the heat to the produce:** Both the natural convection dryer and the forced convection dryer use the convection of the heated air to move the heat to the produce.

The design of the solar dryers varies, depending on the desired size, use and availability of materials. The most common designs for smallholder chilli producers are in cabinet form (wooden boxes and glass cover), others make use of cardboard boxes and non-reflecting polythene or ultraviolet (UV) polythene sheeting. NECPA has adopted a simple design that is made using wooden poles and UV polythene sheeting. The chambers are incorporated with black polythene to increase absorption of heat.

The materials for this design are selected because they are readily available, light in weight, cheaper than other materials and are also easily made by local artisans in the community. We believe that this simple, more affordable design can increase the adoption of solar drying technology among chilli farmers earning low incomes.



Solar dryer adoption challenges among chilli farmers

The lack of proper post-harvest techniques has significantly impeded Uganda's ability to fully participate in international fruit and vegetable markets (Agwang, 2013). Poor post-harvest handling techniques can also account for up to 35 per cent losses in fruit and vegetables. In the case of chillies, post-harvest losses are mainly attributed to a lack of proper drying facilities. Smallholder producers often cannot afford to buy traditional solar dryers because of their high cost (about 150,000 UGX, approximately 50 USD) with drying capacity of about 15kg per week.

Solar dryer distribution model

To address the post-harvest handling challenges faced by smallholder producers, there is a need to popularise the new design and increase its uptake by chilli farmers in the region. A number of approaches have been suggested to ensure this happens:

Sensitisation and demand aggregation by NECPA Extension Officers (EOs)

During group training and farmer home visits, EOs can sensitise their group members about the low-cost solar dryer and encourage them to adopt this technology. The EOs are also tasked with consolidating the solar dryer demand from farmers and linking those farmers to the solar dryer artisans in those locations. This is the most effective approach since all the 120 groups (3,000 farmers) are within the reach of the EOs. The demand consolidation can also include other farmers in that area who need this technology for drying fruits and vegetables other than chilli.

Demand aggregation by the artisans

The solar dryer artisans have been trained on how to make solar dryer construction a viable business, earning from every solar dryer they make. This has been a huge motivation for them to continue aggregating demand from farmers and constructing low-cost solar dryers for them. The artisans have signed agreements with NECPA as their lead in the technology promotion and they keep records of every farmer who purchases solar dryers from them.

Field agents as selling points

The 15 NECPA affiliated field agents are fairly evenly distributed in the chilli-growing sub-counties. Their major role is selling inputs such as seeds and fertilisers as well as buying dried chillies from farmers. The field agents enforce quality standards of the chillies they buy from farmers and encourage farmers to make use of solar dryers as a way of ensuring quality dried chilli. They can also gauge demand for the dryers and link interested farmers to the artisans.

Group leaders

The group leaders are farmers, elected by community members to lead their farmer group activities. Being influential in the groups, the group leaders are another avenue that NECPA uses to popularise the low-cost solar dryers among their group members. Group leaders help in sensitising their members about the technology, aggregating demand as well as linking interested farmers to the artisans. The group secretary has records of members who purchased and are using solar dryers in their group.



Success factors for solar dryer adoption

1. **Cost:** It should be affordable to the average farmer; the cheapest start from 50,000 Ugandan shillings upwards to 150,000 depending on the farmer's production capacity and therefore the size of dryer that they require.
2. **Mode of payment:** Most farmers prefer to pay in kind (using harvested chilli), or pay in instalments. However, it should be considered that the payment mode shouldn't halt artisans from continuous production. An agreement is signed between the artisan and the farmer.
3. **Availability:** The dryers should be readily available when needed. In this case, the artisans should be within reach of the farmers and aware of where and how to get all the required materials for constructing the dryers.

Sustainability plan

1. The artisans can work individually or jointly in groups. The artisans are encouraged to open bank accounts to bank their revenues, or save in the Village Savings and Loan Association (VSLA). If they work jointly, they can register their business with the local government so that they can win contracts for bulk making for other groups/companies/organisations.
2. The artisans see the work as an independent business opportunity, which is not attached to project budgets or timelines. They must take charge of the costs of materials, profits and work to make their business self-sustaining.
3. The artisans will need training in business and financial management skills, to develop business sense and enable them to think strategically about the opportunities available to them. Other capacity development opportunities could include learning visits to other businesses related to this kind of work.

Investing in smallholder farming is the number one way to combat poverty in rural Africa. Farm Africa is a leading NGO specialising in growing agriculture, protecting the environment and developing businesses in rural Africa.

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Photos: Farm Africa/ Jjumba Martin

This project is funded by aBi Development Ltd and Ajahma Charitable Trust.



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