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SOLUTIONS LAB FINAL PROJECT REPORT – EXPERIMENTATION PROJECT

INCREASING FARMER INCOMES: SOLAR DRYING SOLUTIONS PHASE ONE

CONTEXT

The majority of people in Pajinian village, Adonara Island, East Flores, East Nusa Tenggara (NTT), Indonesia, are either farmers or fishermen. Through our research we learned that in Pajinian village, agriculture is dominated by cashew, coconut, and candlenut. The average income per person in NTT is US$24/month (Statistics Indonesia, 2016).

LOCATION



HYPOTHESIS

A solar dryer would create a more effective drying process when compared to the traditional drying process by:

a) drying larger quantities of produce more quickly using less space;
b) having the ability to dry produce during the rainy season;
c) increasing the quality of produce, and
d) increasing the sales price.

METHODOLOGY

Kopernik rapidly tests innovative solutions in last mile contexts in order to determine their potential to reduce poverty effectively. In our experiments we adopt a lean approach, collecting and analysing small-scale data to learn the effectiveness of the solutions. In this

project, we conducted side by side tests of the traditional method of drying versus drying in the solar dryer with cashews and copra to determine and compare the following:

- How long it takes to achieve optimum moisture level, measured using a moisture meter (Image 1). The optimum moisture level is 6 - 7% for copra and 5% for cashews;
- How the drying processes perform when it rains;
- How the quality of the dried product differs between the two methods, including appearance and taste.



Image 1. Optimal moisture level reached, measured using a moisture meter

FINDINGS

Post-harvest process for cashews

For cashews, there are three separate stages of drying:

1. The first one takes place once the cashews are collected and removed from the cashew apple. At this point the cashews are still in the shell.
2. The second drying process takes place once the cashews have been removed from the shell, but still have a soft skin around the cashew nut.
3. The third drying process takes place once the shell and the skin has been removed from the cashews and the cashews are already white.

The traditional drying practice can only be used for the first stage of drying - when the cashews are still in their shell, due to the risk of contamination of open-air drying once opened.

Soft-skin and white cashews fetch a much higher price for farmers than cashews that are still in their shell therefore it would be economically beneficial for farmers to open the cashews

and sell white cashews instead of those still in their shell and the solar dryer enables them to dry them throughout the entire post-harvest process.[1]

Solar Dryer

The solar dryer has a maximum capacity of 1,000kg. The produce can be laid out on shelves in the dryer, resulting in more effective use of space as compared to the traditional drying method where produce is laid out in one layer on the ground. Our solar dryer has five layers of drying racks allowing farmers to dry 2.25[2] times (in kilograms) more produce in the same space when compared to the traditional drying method. The solar dryer protects the commodity from contaminants and can also be used during the rainy season. The traditional drying process cannot take place when it rains (Image 2).



Image 2. The solar dryer facility in Adonara Island dries more produce faster using less space. Photo: Depot Desa team

Our experiment resulted in the following findings:

For copra, the solar dryer:

- **Reduced the number of days needed for drying by 15%,** reaching the optimal moisture level of 24% in 3.5 days. Using the traditional drying process it took 4 days to reach a moisture level of 40%;
- Made the drying process possible **during the rainy season, taking only 1.5 extra days to reach the optimal moisture level when compared to dry season**;
- Produced a higher quality product with **a more optimal moisture level of 24% as opposed to 40%;**[3]

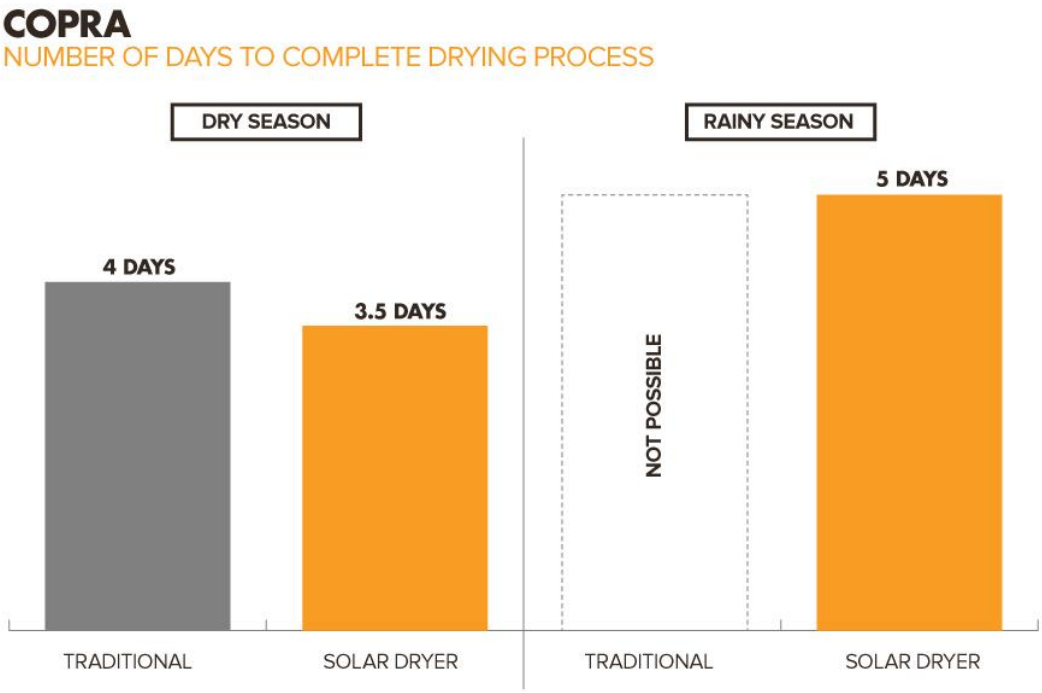
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[1] *It is important to note however that having access to a solar dryer, while enabling the drying process during the soft skin and white cashew stages, does not automatically guarantee a higher sales price. Other factors such as access to opening technology and access to buyers who buy white kernel cashews are necessary.*

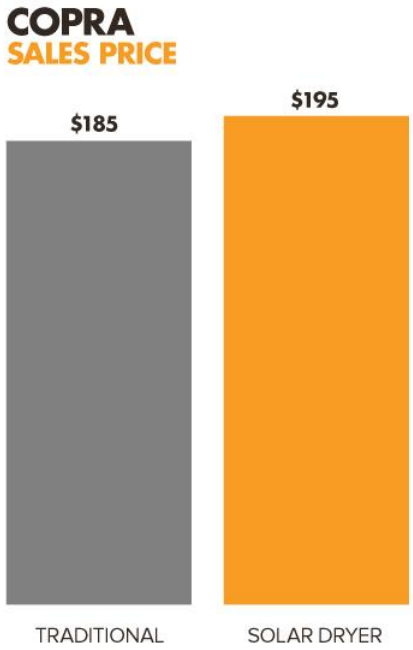
[2] *Compared with the traditional drying method capacity, which is 9.4kg/m²*

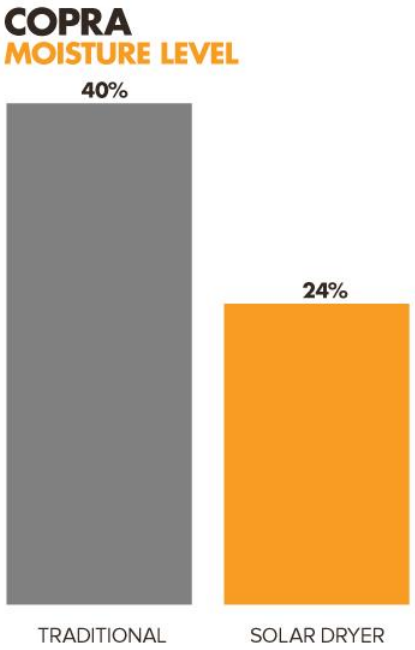
[3] *According to three buyers we interviewed, they defined higher quality copra as having the optimal moisture level of between 22-26%.*

- Had the potential to increase the sales price by **5.4%, an increase of US$10 per 300kg.**[4]



Note: In 3.5 days we reached a more optimal moisture level of 24% producing a higher quality product than the 40% achieved in 4 days by the traditional drying method.

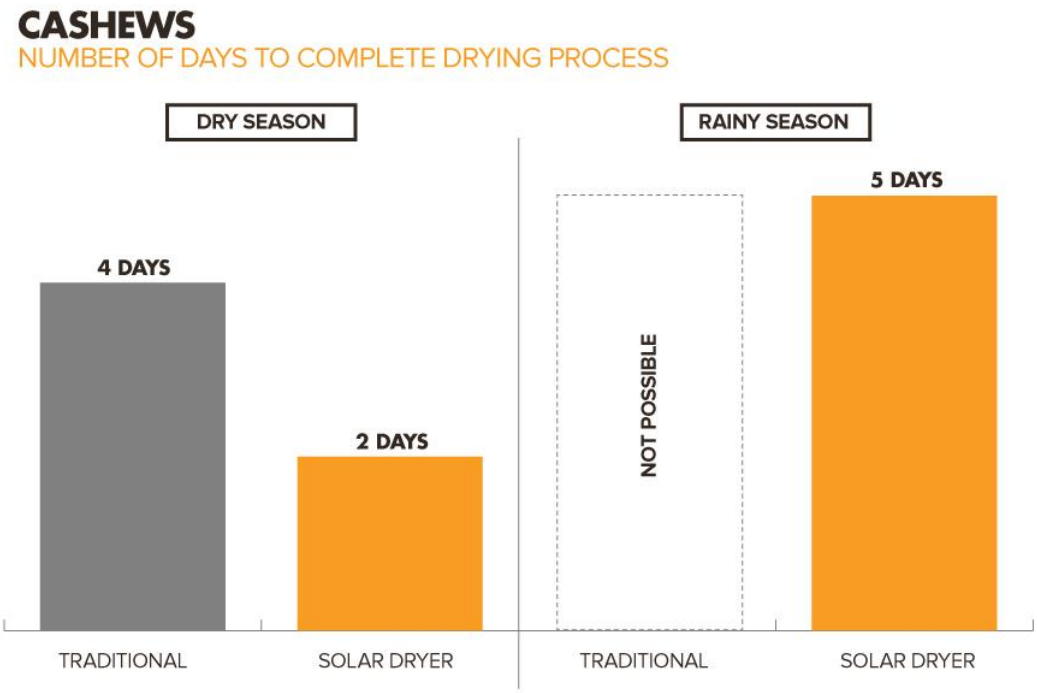




[4] *The three buyers we interviewed all provided us with a sales price of $195/300kg at the time of our research but this price is subject to fluctuations and change in demand.*

For cashews, the solar dryer:

- **Reduced the number of days** required to complete the drying process by **50%**;
- Made the drying process possible **during the rainy season, taking only 1.5 extra days to reach the optimal moisture level when compared to dry season**;
- Enabled the drying of dry soft skin and white kernel cashews which is not possible using the traditional drying method;
- Had the potential to increase sales price from **US$1.40 to US$13 per kg** by enabling the drying process to continue till the white cashew stage.[5]



[5] *This is the market price of cashews. Having access to a solar dryer, while enabling the drying process during the soft skin and white cashew stages, does not automatically guarantee this higher sales price. Other factors such as access to opening technology and access to buyers who buy white kernel cashews are required.*

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CASHEWS
SALES PRICE



CONCLUSION

Our experiment concluded that a solar dryer did indeed create a more effective drying process when compared to the traditional drying process. The solar dryer dried larger quantities of agricultural produce more quickly, using less space and adding value by increasing the quality and sales price.



TESTIMONIAL :

"I like this solar dryer because it can dry a large amount of produce. It can dry up to 350kg of cashews at once. It also does not depend on the weather. Using the traditional drying process we cannot dry our crops during the rainy season. The solar dryer is more convenient and we don't need to turn the copra over to make sure that it dries evenly on both sides. Some improvements need to be made - the roof junction needs to be improved to prevent leaks during the rainy season."

- Yeremiah Letor, Cashew Farmer, Pajinian Village, Adonara Island

RECOMMENDATIONS

Based on the data collected, we recommend that:

1. Organisations working on increasing smallholder farmers' income, introduce solar drying technology as one of their areas of their support to farmers;
2. Kopernik improves the design of the solar dryer and creates an open-source blue-print that can be be easily accessed by other organisations;
3. Kopernik tests the improved design of the solar dryer as well as other solar drying solutions.

LEARN MORE

Kopernik's Improving Processing Technologies: Cacao Beans Phase One experiments with a different model of solar dryer to dry cacao beans.

Kopernik's Senior Analyst, Nadya Pryana from our Last Mile Consulting Team recently published a Kopernik Insight, concluding that ineffective drying causes losses of up to US$3 billion across ten agricultural commodities in Indonesia.