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Conjunctive Use of Low Cost Polyhouse for Multicrop Drying

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Abstract - *Storage is an important marketing function, which involves holding and preserving food items from the time they are produced until they are needed for consumption. The storage of goods, therefore, from the time of production to the time of consumption, ensures a continuous flow of goods in the market at good price. If the growers can dry and store the products safely, they may be encouraged to grow more than they need for their families. Good grain storage can thus lead to more food, more money, better planting material, and a better future. Drying is an essential step in post-harvest technology operation as every agricultural food product in natural form certainly contains high amount of water called as moisture content and is usually expressed in percentage. To preserve the quality of food product and increasing its shelf life, this moisture content needs to be reduced to a safe level for storage. Drying is, therefore, a key process for managing adequate moisture content. This paper describes the low cost conjunctive use of polyhouse for excess agricultural produce drying.*

Key Words: Excess crop, marketing, moisture, post-harvest, solar drying.

1. INTRODUCTION

Drying is amongst the most important steps of post-harvest technique where food product is dried to safe-moisture level for preservation. The main aim is to lower moisture content of agricultural produce to guarantee favorable conditions for storage so that it could be used latter or marketed during the off-season for getting high price. The process of drying for removal of moisture is referred to as dehydration. Traditional way of drying is open sun drying which results in contamination of product by dust, birds, insects, rain, and fungus etc. Drying/dehydration process is used to reduce the spoilage and increase the shelf life or storage durability of agricultural products [1]. Removal of moisture is a complex simultaneous heat and mass transfer process but treating it as such is not sufficient because end use characteristics or quality of the product cannot be handled this way [2]. The purpose of drying is to store the dried product with protection against insects, molds, rodents, birds, and to prevent moisture from re-entering the product. But if the drying is not done properly, you will have losses no matter how good the storage is. The presence of moisture content above the prescribed level usually 8 to 10 percent results in the spoilage any fresh agricultural produce. Removing of extra moisture by dehydration process increases the shelf life of the food product without addition of any chemicals, preservatives or additives, and keeps all the minerals and proteins preserved in the food.

An exclusive polyhouse solar dryer has been reported in [3]. Many dryers with drying kinematics have been fabricated so far [4-9] but the cost factor is main hindrance for adaption of technology by marginal farmers. Low cost polyhouse are now being commonly used for protected cultivation. We propose a shelf type dryer fabricated along the south direction polyhouse which is enclosed by polythene and is erected above the cultivable area. The experiment was conducted at COAE&T, SKUAST-K, Shalimar under local RCM project. The material of agricultural produce like tomato, capsicum, bottle gourd, apples etc. are cut into the small slices and after blanching are put on the shelves for drying. The shelves of the dryer are kept completely air tight inside the polyhouse and are kept at least three feet above ground level. For the circulation of hot air and removal of moisture four inch PVC pipes are fixed on the two sides of drying chamber. The dryer enclosed within the polyhouse is aided with additional heat of self-contained heat of polyhouse resulting in extra heat generation for drying purpose. The air enters through one pipe and leaves through the other thereby enhance drying process. The objective of the dryer is assisting the welfare of the marginalized farmers for preserving their excess agricultural produce and for marketing in off season for better price.

2. Material and methods

During peak season when farmers have surplus crop production and market value is low for abundant availability of agricultural produce, the excess crop can be dried and packed so as to market in off season to fetch good price. The sketch of shelf type polyhouse drier is depicted in Figure 1.

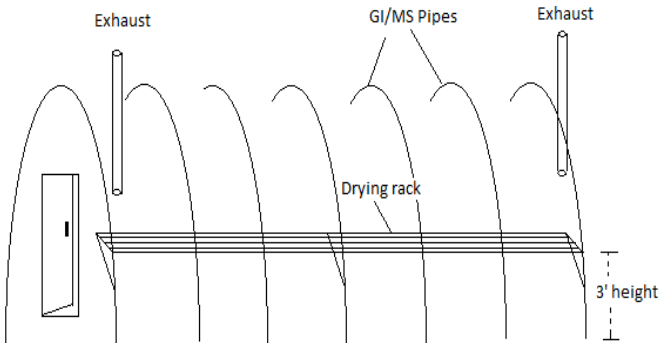

Figure 1 Sketch Shelf type drier within the polyhouse

The hollow mild steel low cost half inch pipes colored to protect from rust are used to fabricate the dryer. The UV polythene is covered around the shelf to enclose the chamber for drying purpose. The dryer chamber is fabricated along East-West direction so as to have maximum sun shine hours. This drying process is cheap, innovative, and easy to operate with no extra space needed. The experimental data of drying of different agricultural produce is shown in table 1. Figure 2 depicts the temperatures recorded inside the drying chamber, polyhouse and of open sun. Figure 3 depicts the relative humidity within drying chamber, inside the polyhouse and open sun. Since the Kashmir region comprises of extreme conditions of temperatures in summer and the winter. During summer the valley has surplus production of both fruits and vegetables and the people of valley are used to consumption of dried vegetables and fish products during harsh and long winter's conditions. This experiment was conducted in the month of July-August 2020. Solar dryers prevent contamination of food produce from dust, insects, birds etc. when compared to the traditional open sun drying.

3. RESULT AND DISCUSSIONS

For the better performance of Polyhouse Solar Dryer (PSD), it is to be fabricated in polyhouse with long sun hours. The drying in PSD depends mainly on temperature, relative humidity (RH), shape, size and thickness of the product to be dried.

Bottle gourd, Tomato, capsicum, Apple and some leafy vegetable were dried using PSD and was compared with sun drying. The said parameters were recorded using digital thermometer and hygrometer (Temperature ranging from -40^{0}C to70°C, humidity 10% to 98%, with accuracy of ± 1°C with ± 5%) for 9 hours daily at an interval of 1 hour from starting at 9:00 AM till 6:00 PM.

Product	Drying period		%age moisture wet basis
	Open Sun drying OSD	Polyhouse Solar drying PSD	
Bottle gourd	7-8 days	2.5 days	91.2 %
Tomato	6-7 days	2.5 days	93.5 %
Capsicum	5-6 days	2 days	92.2 %
Apple	9-10 days	3 days	84.2 %

Table 1 Open sun drying and polyhouse solar drying in the month of September

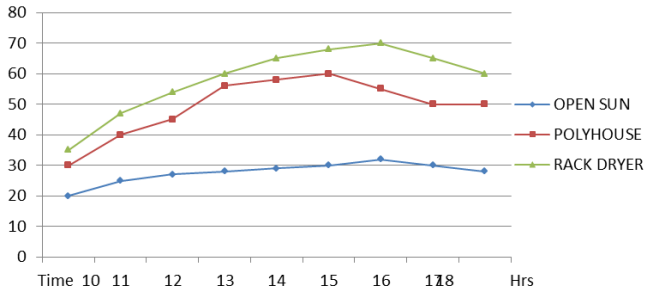

Figure 2 Temperature recorded inside dryer, inside polyhouse and open sun

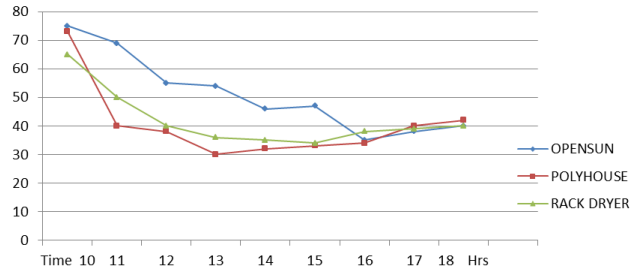

Figure 3 Relative humidity inside and outside of polyhouse

4. CONCLUSION

After a comprehensive review of various designs of polyhouse solar dryers and the requirement of marginal farmers with geographical location, production output and flexibility requirements the special type PSD was designed and fabricated. The designed rack type polyhouse dryer was found best alternative to open sun drying which saves time, easy accessibility, quality and hygienic conditions of the final dried produce. The cost of the fabrication of dryer could be recovered within one or two months of operation only, as the market value of protected drying is usually around 20% higher as compared to open sun drying.

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BIOGRAPHIES

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