ON FARM SOLAR POWERED SEED STORAGE SYSTEM FOR COMMUNITY LEVEL SEED BANK FOR MARGINAL FARMERS AND TO CHECK THE SEED GERMINATION RATE

Project Reference No.: 42S_BE_1871

College : Angadi Institute of Technology and Management, Belagavi  
Branch : Department of Mechanical Engineering  
Guide : Prof. R. H. Angadi  
Students : Mr. Maruti B Kempallingavar  
          Mr. Mahantesh V Maritammanavar  
          Mr. Ajit R Badiger  
          Mr. Manjunath N Naikar

Keywords :  
Seed Bank, Wet paper towel test method, Peltier effect, thermo electric cooling, Solar energy.

Introduction: 
As climate change has a significant impact on agricultural production, growing local varieties, which have a high degree of genetic diversity, is highly important because these varieties have the ability to better withstand and adapt to environmental stresses and changes. Setting up community seed banks may help farmers to acquire varieties that are adapted to local conditions; these varieties may not be accessible through formal seed systems, may be costly or may suffer from erratic supplies. A typical peltier plate is of 4x4cm² semiconductor. Thermoelectric module is made up of thin ceramic wafers with P and N bismuth telluride semiconductor material connected in series between them. These elements are electrically parallel connected .The doping of P type semiconductor is done with some atoms having fewer electrons than what is required to complete the atomic bond within the crystal lattice. If there is a concern about seed quality, especially if it is seed that is over a year old, a wet paper towel germination test can be used to test the seed. A home germination test will provide a reliable estimate in like of an official test some of seeds used for storing are listed below. Solar energy is the most efficient renewable energy source available easily and its free.

<table>
<thead>
<tr>
<th>Seed name</th>
<th>Temp ( °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Gram (Vigna radiata)</td>
<td>12-15</td>
</tr>
<tr>
<td>Carrot (Daucus carota subsp.sativus)</td>
<td>15-20</td>
</tr>
</tbody>
</table>

Objectives:
1. To determine seed quality suitability for planting  
2. To determine need of drying and processing  
3. To store the seeds using solar powered seed storage system on farming  
4. The long stored seeds are used to check the seed germination rate by different methods of seed germination process in bio-technology labs in Horticulture University.  
5. The peltier cooling system are used run by solar powered cooling system

Methodology:  
1. After the harvesting of crops the seeds from the marginal farmers are collected which are going to be used for growing crops for next season
2. The seeds are dusted, cleaned and dried which will be then ready for storage
3. These seeds are then packed in air tight container and then will be placed in a seed storage system
4. The factors that affect the seed viability must be controlled
5. The temperature of the system should be maintained with the help of thermoelectric cooling system
6. The storage system should be frequently maintained and checked for variation in humidity of the atmosphere
7. The germination rate is checked by different methods like soil test method, paper towel method, rock wool method and plain old regular seed germination method
8. Comparing the seed germination rate of normally stored seeds and seed stored in storage system

Experimental Setup:
The inner cabinet is made air tight with 4 mm of medium density wooden board of 2 ft × 2 ft × 2 ft which is internally covered with polystyrene sheet from all sides having a total capacity of 56.63 liters. The cabinet is insulated by 0.8 mm thick sun mica sheet from outside for thermal insulation from surrounding and the polystyrene (thermocol) sheet is covered with 20 mm of medium density fiber board for maintaining the rigidity of the cabinet. The door is attached with hinges for better and easy movement of it.

Fabrication Procedure:
1. A thermocol box of inner cabin volume of 2 foot is slotted on 1 faces with the reference of the measurement of CPU heat sinks (50mmx60mm).
2. The inner surface of the cabin is insulated completely using thermocol sheets (20 mm) so as to isolate the cooling cabin from the atmosphere.
3. The thermo electric module is sandwiched between two CPU heat sinks of different sizes using thermo paste to set a single unit (it will look exactly like peltier cooling kit which we shown in above). Thermo paste plays a vital role in conduction of heat from Peltier module to the aluminum heat sinks. And at the end it is attached to the left side of the storage system where pocket is made.

4. These units are placed in the cut slots with the smaller CPU heat sinks facing the interior of the cooling cabin and the larger CPU heat sinks on the outside of the cabin to establish greater heat rejection.

5. Addition fans are fitted on the outer side of the heat sinks.

6. Electrical connections are made and power is supplied from a AC 12V 6A adapter is connected to the electric plug

**Project Cost Estimation**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Particulars</th>
<th>Cost(Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>WOODENBOX,WHEELS,HINGES,HANDLES</td>
<td>3000</td>
</tr>
<tr>
<td>2.</td>
<td>SUNMICA COATING</td>
<td>1000</td>
</tr>
<tr>
<td>3.</td>
<td>PELTIER COOLING SYSTEM</td>
<td>3000</td>
</tr>
<tr>
<td>4.</td>
<td>STAND</td>
<td>1200</td>
</tr>
<tr>
<td>5.</td>
<td>SOLAR PANEL , BATTERY</td>
<td>2700</td>
</tr>
<tr>
<td>6.</td>
<td>TRAY,THERMOCOL,THERMOMETER</td>
<td>1000</td>
</tr>
<tr>
<td>7.</td>
<td>NAME PLATE</td>
<td>300</td>
</tr>
<tr>
<td>8.</td>
<td>KSCST FORMAT</td>
<td>1025</td>
</tr>
<tr>
<td>9.</td>
<td>TRAVELLING</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>14725</strong></td>
</tr>
</tbody>
</table>

**Applications:**

1. Seeds maybe kept for one year without appreciable decrease in germination
2. Storage may extend to ten or more years under proper conditions. Seed moisture and storage temperature are the most important factors in determining how long seeds can be stored.
3. Maintenance of the seed quality in storage from the time of production until the seed is planted is imperative to assure its planting value.
4. To check seed quality suitability for planting.
5. It is used to check the need of drying and processing.
6. Solar energy is a renewable energy hence it is used to store the seeds in storage banks.

**Scope For Future Work :**

1. This system can be further improved by installing thermo sensor which can be programmed using arduino board, to vary the power supply with in specific range of temperature.
2. Reducing the time of cooling by adding good insulation materials.
3. The same project can be used for storage of dairy products.
4. Seeds like Lettuce, Broccoli can be used as they are having low germination rate