SUN AND SOFTWARE
SIERRA LEONE'S SOLAR RICE DRYER

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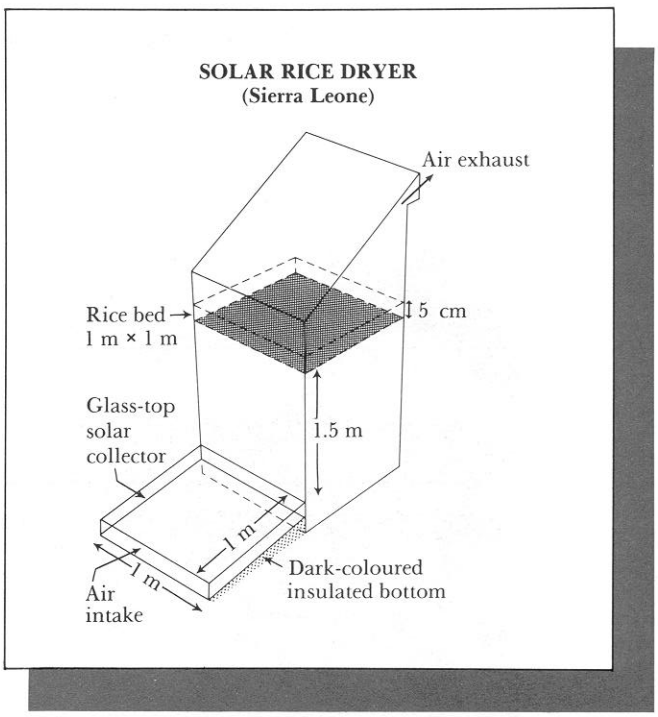
If a few simple design rules are followed, solar dryers can be built to work efficiently. The rice dryer design at the right could probably be built for around US$75.



Rice is the staple crop of Sierra Leone, with about one third of the population growing a total of 275 000 tonnes every year.

But this isn't enough to go around. Sierra Leone still must import rice to meet everyone's needs. One reason is that a large percentage of the local harvest spoils or is otherwise lost.

Some of the loss occurs during drying. Farmers dry their paddy (unmilled rice) on the ground or on posts in the open air where birds, insects, and rodents can get at it. Losses as high as 10 percent may occur during drying.

Researchers at Queen's University in Ontario, Canada, may have found a way to avoid these losses. Their solution lies in the marriage of high-technology know-how and a low-technology device. Using computer-modelling techniques, they have designed a "natural convection" solar rice dryer that works as fast as ordinary open-air drying.

Solar dryer designs simulated

Such dryers are by no means a new idea. IDRC has sponsored several projects to build them in India, Southeast Asia, and several African countries. But few dryers, despite their success in cutting postproduction losses, have lived up to people's expectations. While it takes one to two days to dry rice in the sun, it takes at least twice as long with most solar dryers because of design flaws.

The IDRC-sponsored research at Queen's University is the first attempt to evaluate systematically how natural convection solar dryers work, and why some designs don't work well. Rather than build hundreds of different prototypes and then test each one over a long period in the field — all at great expense — the researchers created one computer program to simulate, at low cost, hundreds of different designs.

Dr Patrick H. Oosthuizen, Professor of Mechanical Engineering, and his graduate student, Alpha Sherrif from Sierra Leone, were able to pinpoint a number of design "rules" that guarantee satisfactory performance in dryers.

In natural convection solar dryers, the sun's radiation is the energy source. No mechanical device is necessary to pump air past the bed of rice. Rather, the air, heated by solar energy, rises naturally by "convection". In so doing, it collects moisture from the rice bed and deposits it outside.

Chimney not useful

Dr Oosthuizen and Mr Sherrif found that the chimney on old designs served no useful purpose. It cut down on performance by cooling the dryer and providing access to birds and insects. The new design has a simple wooden lid, and a small rear grating to let moist air out.

Crucial to a dryer's performance is the height of the rice bed above the solar collector. Earlier designs had these too close together. In the new design, the bed is ideally about 1.5 metres above the collector.

Also critical are the depth of the rice on the bed and the area of the collector relative to the bed's. The depth of the rice bed, it was found, should not exceed 5 centimetres. If it does, the rice may not dry uniformly and could overheat and crack. In countries near the equator, such as Sierra Leone (7-10 degrees North latitude), the area of the collector should be the same as the area of the rice bed. Farther from the equator, where solar energy is less intense, the collector should be proportionately larger. This "rule" can change, depending on a country's geography and climate.

Dr Oosthuizen says any size of dryer can be constructed, for any size of operation, provided the design rules are followed. Small farms, say one hectare in size, need dryers with at least one square metre of rice bed. Such a device could handle a load of 30 to 40 kilograms at one time, taking about two days to dry it.

A dryer of this size could probably be built for US$75 or less. Mud brick would be the principal construction material. Dr Oosthuizen says the collector should be made of inexpensive glass, not plastic, because glass has a longer operational life.

Solar dryers among top priorities

As part of the overall project, a new dryer design is now being field-tested by researchers at the University of Sierra Leone and the Rice Research Station in Sierra Leone. Dr Oosthuizen expects few problems in distribution of the technology, which may begin in a few years. Dr Michael Bassey, an IDRC program officer now based in Senegal and the leader of an earlier phase of the solar dryer research in Sierra Leone, has surveyed the needs of rice growers and reports that solar dryers are near the top of their list.

Dr Oosthuizen may some day modify his computer program to design dryers for fish, fruit, and other grain crops. He emphasizes that the design process can be successful only if it remains a cooperative process. Third world farmers will always be the best sources of information on what problems to solve and what materials to use. The computer is simply a tool that makes finding the solutions easier. ■

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