

Solar greenhouses: China's winning solution to global energy crisis

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Solar greenhouses have played a vital role in China's agricultural scene for years. New innovations in greenhouse design are allowing growers to produce more varieties of vegetables, even during long winter months. In a recently published report Chinese scientists called solar greenhouses "the most important type of infrastructures for growing horticultural crops in China." The team of researchers from the College of Agronomy and Biotechnology at China Agricultural University presented an extensive report on single-slope solar greenhouses in a recent issue of HortTechnology. Based on 20 years of systematic studies, the report noted: "Increased proliferation of efficient solar greenhouses in China may contribute to solving worldwide problems such as the energy crisis and global climate change."

Single-slope solar greenhouses are built facing south using support and insulation walls on the north, east, and west sides. A short roof is installed on top of the north wall. The south side is supported by metal or bamboo frames (or a mixture of both materials), and is covered with plastic film and an insulating blanket. These energy-efficient greenhouses use solar energy as the only source of light and heat for winter [crop production](#) in the region between latitudes 32°N and 43°N for production of warm season crops such as tomato and cucumber.

As in other parts of the world, the feasibility of using solar greenhouses in China largely depends on the relative duration of sunshine in the winter and temperatures at the greenhouse site. Solar greenhouses are widely used in the regions north of Huai River and the Beijing area,

where greenhouses usage has greatly reduced energy demand and carbon dioxide emissions. The success of China's solar greenhouse operations has contributed to the structures' adoption by countries such as Japan, Korea, and Russia.

The researchers noted that while solar greenhouses have many advantages—energy savings, reduced pollution, and improved economic development—the structures also have distinct disadvantages due to their heavy reliance on the sun and weather conditions. Especially during winter, less solar radiation and low temperatures can have a significant negative impact on warm-season vegetable productivity of the greenhouses, and addressing these issues can be challenging.

"Innovation and optimization of the greenhouse structure needs to continue. More work needs to be done on gutter-connected, double-arched, and semi-underground greenhouses. New wall insulation materials need to be developed to reduce the thickness of the wall while improving its insulation efficiency and expanding space utilization, said Zhen-Xian Zhang, lead author of the study. The study also recommended that breeding new varieties of horticultural crops that can adapt to low light and winter temperatures in solar greenhouses will provide another strategy to ensure sustainable development of the greenhouse industry.

"The solar greenhouse has a very bright future, especially given the amount of concern over the global [energy crisis](#) and climate change. Additionally, significant energy savings can be realized from switching to solar greenhouses. We hope this technology can be applied to regions of similar climate to help reduce energy consumption and CO₂ emissions", Zhang said.

More information: The complete study and abstract are available on the ASHS HortTechnology electronic journal web site:

horttech.ashspublications.org/...nt/abstract/20/3/626

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