Refrigeration System Pusa-FSF

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In news: Women scientists from the Indian Agricultural Research Institute (IARI) of ICAR developed Refrigeration System Pusa-FSF & a technology related to extraction of gluten from wheat dough and its regeneration

A brief note on the Pusa-Farm SunFridge (Pusa-FSF)

- It is a 100% solar-powered battery-less cold store that can preserve around 2 tonnes of freshly-harvested produce at 3-4°C during the day and 8-12°C at nighttime.
- Pusa-FSF is an on-farm green energy refrigeration system, and is the culmination of more than five years of work by a scientist at IARI's Division of Agricultural Engineering, in collaboration with researchers from Michigan State University.
- The 10x10x10 ft cold store structure designed by the scientists can stock enough vegetables and fruits to fully load a Tata 407 mini truck.
- The Pusa-FSF, built on dismantlable mild steel frames and plates, has been installed at IARI's New Delhi campus and two villages – Picholiya in Rajasthan's Ajmer district and Chamrara in Panipat, Haryana.
- The technology has been licensed to Jaipur-based SND Infraprojects Pvt. Ltd
- The total cost is Rs 5-5.5 lakh

How does it work?

- Pusa-FSF has rooftop solar panels that generate 5 kilowatt power, of which 3 KW is used to run a 1.5-tonne air-conditioner and bring down the temperature inside the structure to 3-4°C.
- This has been done by dispensing with the thermostat that limits the normal cooling in ACs to 16-17°C.
- The panels also power a 105-watt submersible pump

circulating about 1,000 litres of water from a tank through overhead PVC pipes.

- The AC and submersible pump operate throughout the day when the sun is out and automatically shut in the evenings.
- At night, there is only passive evaporative cooling, with the water chilled during the day acting as a natural heat sink.
- This, along with the materials that scientists have used (mesh, wetted nylon felt fabric walls, styrofoam/thermocol insulation and autoclaved aerated concrete floor), ensures that the nighttime temperatures are also maintained within 8-12°C,

Significance of Pusa-FSF

- It minimises the post-harvest losses, by having a cold store at the farm itself and running on solar power without any electricity from the grid.
- This can be taken in a single trip to the market when the prices are right.

Technology related to extraction of gluten

- It is a technology for imparting elasticity and structural strength to bajra and maize dough, making their chapattis as soft as from regular wheat atta flour.
- Is regeneration in bajra (pearl-millet) and makka (maize) flour, which can be easily kneaded to yield soft rotis, pooris and a variety of bakery products.

Gluten extraction

- Wheat has roughly 13% protein content. Up to 80% of that comprises glutenin and gliadin. These are proteins that bind to each other and form a network whenever water and energy (through kneading) is added to the wheat flour.
- The gluten formed by the combination of the two proteins

creates the elastic texture in the dough that allows the breads to come out light and fluffy.

- Bajra, maize, jowar (sorghum), ragi and other millets contain comparable levels of protein and more vitamins, minerals, crude fibre and other nutrients than wheat. But they don't have any gluten proteins, which results in poor dough quality.

- The proteins extracted and dried into powder should also have the capacity for regeneration or forming gluten networks in non-wheat dough.
- Soft atta requires the gluten proteins added in the flour to achieve proper networking for retaining their original viscoelasticity and water-absorbing properties
- The scientists at IARI have created gluten-based soft bajra and makka atta that combine the superior nutritional composition of these two cereals with the better dough and chapati-making quality of wheat.
- Their 'Hallur' soft bajra flour containing 23% protein, including 15% of pearl millet and 8% gluten can be used to make kachori and even cookies, cupcakes and pizza slices.
- Scientists claim to have also prepared nachos from their 'Makai' soft maize atta.

ICAR-IARI

- The Indian Agricultural Research Institute (IARI), commonly known as the Pusa Institute is India's national Institute for agricultural research, education and extension.
- The name Pusa Institute is derived from the fact that the institute was originally located in Pusa Bihar as the Imperial Institute of Agricultural Research in 1911.
- It was then renamed as the Imperial Agricultural Research Institute in 1919 and following a major

earthquake in Pusa, it was relocated to Delhi in 1936.

- The current institute in Delhi is financed and administered by the Indian Council of Agricultural Research (ICAR).
- The IARI was responsible for the research leading to the “Green Revolution in India” of the 1970s