



*A Ladakhi farmer outside her home in Rumbak Valley. India's cold desert is a large area devoid of vegetation.
Photo: Sharada Balasubramanian*

Winter farming technologies for India's cold desert farmers

Ladakh, tucked between Kashmir and Tibet in the northern Trans-Himalayan region, holds 90 per cent of India's cold arid region. Bitter winter, cold winds and extreme weather pose numerous challenges for farmers in this sparsely populated area. Scientists and agricultural department officials have worked hard to bring less labour-intensive technologies, enabling farmers to grow crops in the winter and earn more income.

Tall, brown, barren mountains crowned in snow dot the entire landscape of Ladakh, more popularly known as India's cold desert. Situated in the western end of the Tibetan Plateau, this region faces blasting winds from Central Asia, making winters bitterly cold and harsh. About 70 per cent of the people living here practise agriculture in such extreme conditions. In one of the highest and coldest farmlands of the world, temperatures dip to below minus 20 degrees Celsius in the winter, making farming impossible. Here, farmlands are scattered, and villages are disconnected from each other. The road to Leh town, the centre point of this region,

is shut between October and June, posing marketing challenges for farm produce.

"The agriculture season lasts from April to October, and in the other months, nothing grows," says Tashi Tsetan, Chief Agricultural Officer at the district agricultural office. This has an impact on access for locals to green vegetables during the winter. Further, farmers lack technology to stock vegetables for consumption in the winter. Non-availability of green vegetables adds to the nutritional problems of rural communities here. According to a scientist from the Defence Institute of High Altitude Research (DIHAR), a research and development organisation working on agriculture, animal husbandry and the flora of Ladakh, almost 72 per cent of the population face a deficit of cereals in their consumption, and 67 per cent lack access to green vegetables.

■ Unused opportunities

Despite the short farming season, farmers grow a large range of crops – capsicum, brinjal or aubergine, green peas, tomato, potato, chillies, cabbage, cauliflower and other leafy vegetables. The produce from here could be supplied to other parts of the country. "But the farmers here do not know how to earn money," says Tsetan. This is primarily because they are disconnected from the outside world. They are unaware of selling opportunities, what to produce, how to produce and how to sell their produce to earn income. There is a potential to sell vegetables grown here to the Indian Army troops deployed along frontiers in the Ladakh sector of Jammu & Kashmir and along the China/Tibet frontier. Then there is the local population. Including the army, vegetables are needed for 300,000 people in this region. More than 37,000 tonnes of vegetables

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would have to be produced to meet the demand. However, production has not yet reached 18,000 tonnes.

A few years ago, the district agricultural department initiated measures to increase farmers' income. "We chose a few far-off villages that did not have any readymade market. The farmers were asked to just grow one crop – green peas," Tsetan says. "We convinced them that we would find a market for the produce." Kashmiri traders purchase these vegetables, helping farmers earn income. Each farmer earned a profit of Rs 50,000–60,000 in the Kharu and Khaltse region of Leh district this year. The seeds for this were provided by the local agricultural authority.

■ Bridging the winter shortage gap

In the winter, vegetables are usually airlifted and sold for Rs 120–140 per kilogram – which is around three times the summer price (when for example a kilogram of potatoes costs Rs 40–50). "Even this supply depends on the cargo space, which is why local people only consume meat, pulses and dairy products in the winter," Anup Raj, a scientist at Sher-E-Kashmir University of Agricultural Sciences and Technology in Stakna, explains. The researchers give training to farmers on pickling vegetables for winter consumption.

The district agricultural department is supporting farmers with various technologies to lengthen the growing period, which, at altitudes of around 3,500 to 4,000 metres, is shortened to about two months. Greenhouses are well suited for this purpose. With them, the growing season can be extended by 45 days. Even fruits like watermelon and muskmelon can be cultivated. Greenhouses are not new to Ladakh; Europeans brought this technology to India long ago. They were initially set up for farmers' personal consumption. However, in the context of government support activities, commercial greenhouses were developed by the agricultural department. Tsetan says: "Our experts from the agricultural department went to China, looked at the model there and brought it here as climate conditions in Lhasa, Tibet, are similar to those here. They harvest tomatoes in the months of January and February, so we thought, why can't we do this in Ladakh?" The scientists modified the technology to suit the local conditions. The design is such that the temperature inside the greenhouse is 20 degrees higher than the outside temperature. Given that Ladakh has about 300 sunny days a year, greenhouses are a very appropriate technology. They are a passive solar heating system in which sunlight gets trapped, keeping the temperature and humidity high. Besides, both the farmers and the cattle can keep warm in them in the winter – without artificial heating.

The district government gives a 50 per cent subsidy on greenhouses for farmers. Tsering Angchok, a 55-year old farmer from Saboo village grows vegetables in his six acres of land. He set up a greenhouse six or seven years ago at a cost of Rs 150,000, with a government subsidy of Rs 80,000. "Before we had the greenhouse, we placed a plastic sheet on our crops, covering them before sunset and pulling the sheet away after sunrise," Angchok says. "Sometimes, we even covered the land with blankets and logs to keep the crop safe. Now, the quantity of vegetables produced has increased, and I can sell more."

The government is looking at an innovative way to cluster greenhouses in these villages. "Instead of giving greenhouses to individual farmers who are isolated from each other, if we have greenhouses in a group of 8–10, 400–500 kilograms of produce can be taken from one place," explains Tsetan. As the farmers using greenhouses are dispersed in different villages, there is no visibility of project implementation. But if a whole group of farmers in a village were to use greenhouses, the entire produce could be sold from village clusters. "This model, if implemented, could be replicated in other areas as well."

The farmers use local resources – mud, bricks, stones and timber – to build the greenhouses. The agricultural department gives them polythene sheets, in addition to the subsidy it provides. But after a few years, these sheets tear. The farmers then stop using the greenhouse. Long-lasting polycarbonate sheets that are also suitable in windy and high altitude areas could be an alternative. But they are more expensive and not subsidised right now. However, this year, the agricultural department has proposed that central government take this project ahead.

"The walls of the greenhouse should not be wasted, either," says Angchok Mahay, District Agricultural Officer. He adds: "Vertical trays can be fixed to these walls, and farmers can grow coriander, mint and other plants



Low tunnel, a low-cost technology, is used by farmers in Ladakh for growing vegetables.
Photo: Sharada Balasubramanian

on them. A bunch of coriander, for instance, sells at Rs 20 in the market. This can be a good source of income for farmers.”

The greenhouse has its own benefits, but it is costly and not movable. As an alternative, low tunnel technology was taken to farmers. It involves digging the soil at a depth of one and a half metres. The farmers can build the low tunnel anywhere on their land to grow leafy vegetables. Only a polythene sheet is needed to place over the tunnel. According to a recent publication in the Asian Journal of Horticulture, this technology has increased seed germination for cabbage cultivation from 75.3 per cent to 91 per cent in Kargil region. Time required for the production of marketable seedlings was reduced from 53 to 45 days and from 85 to 75 days for saleable cabbage. The total cabbage yield and net profit per unit area were above normal when grown under low tunnels as the produce reached the market earlier.

Digging underground trenches is also supported by the government. Farmers in the region are already familiar with the trench system, which is better known as the “poor man’s greenhouse” or the “vegetable cellar”, since vegetables are stored underground with this method. The open field trenches are 10 x 12 x 2.5 feet in size. Here, potatoes are stored in gunny bags, placed underground and covered by two feet of mud that is removed in March, when the vegetables are still fresh. The vegetables can also be taken out in the winter, only that the mud gets layered by ice that has to be dug out. In addition to potatoes, radish and carrots can be stored in these trenches, and farmers mostly use them for self-consumption.

■ Other earning opportunities

Despite the difficult environmental conditions, the region offers a big potential to provide the farmers with an income. Ladakh is a land of organic farming, where chemicals have not yet touched the soil. As Buddhists, the farmers do not use any pesticide

Government support

The district agricultural department has given support to build 1,670 vegetable cellars or underground trenches since 2000. They give each farmer Rs 8,000 to build them. The open field trenches have been supported by the local department since 2000 as well. So far, the department has helped build 4,780 trenches with a subsidy of Rs 2,000. Support for low tunnels started in 2014, and 689 have been supplied to farmers so far. In all, 73 greenhouses have been given to the farmers since 2007, with a subsidy of Rs 80,000 per farmer.

or insecticide on religious grounds. The soil is fertile, making the land suitable for generating high quality seeds. Here, cauliflower seeds are ready in a year, as compared to two years in other regions. Seed production for carrot, onion and potato would also be possible. However, a certified seed company is required along with packaging, grading and marketing support.

Floriculture could also be a great business opportunity for the local people. “Gladiolus flowers from here were sent for grading to the Department of Horticulture, Jammu & Kashmir. In one stick, there were a minimum of 10–11 florets and a maximum of 17–20 florets. Apart from Ladakh, people will find such quality only in France or the Netherlands”, says Tsetan. The congenial climate adds to the colour, fragrance and quality of the flowers. “About six or seven years back, we wanted to send these flowers by air to New Delhi, India’s capital. We asked for a concession, but there were other issues with the central government, and the scheme did not work. We have initiated talks to start this year, but we would still need marketing support,” he adds.

■ The human factor

However, the region also faces some very different challenges. Zaskar is one of the remotest places in the world, surrounded by 21 glaciers. One has to walk on a frozen river for 45 kilometres to reach this village. Here, snow falls to a depth of four to five feet, isolating the farmers. “They do not want to work with outsiders or trust people they don’t know,” says Raj, who has been working here for two decades. “There are huge socio-logical barriers to the implementation

of technologies. Once the trials are done, the technology is transferred, and the agricultural scientists have left, the farmers do not continue it. Scaling up is very tough.”

In such a difficult environment, government measures alone are not enough to secure livelihoods. Tata Trust, one of India’s oldest philanthropic organisations supporting community development, adopted two villages in the region as ‘potato villages’. With the Indian Army’s support, they airlifted potato seeds and distributed them among the farmers in the region. In May 2016, four truckloads of more than 20 tonnes of potatoes seeds were given to Ladakhi farmers for producing high quality potatoes. The Trust is also providing apricot farmers with harvest nets costing Rs 1,500 each. Farmers growing apricots, one of the main cash crops here, face 30–40 per cent losses as the fruit falls to the ground and gets dirty. Using the nets will reduce losses. “In the next two years, the trust will be looking at projects worth about Rs 30.6 million for Ladakh region,” says Raj.

Disconnected from the rest of the country, in an isolated highland, this place shows an immense potential to grow organic, healthy food that can reach other parts of India. But this requires strong marketing, packaging and technological and financial support. The research institutes, local agricultural officers and NGOs are working towards the development of this region. But more support from the central government is needed, above all in terms of concessional air freight rates to transport flowers, high quality organic potatoes and other vegetables. Once it is in place, development and better livelihoods could become a reality for the farmers.