

In this issue

Water Crisis in Punjab

Solution: crop diversification

The groundwater table in Punjab is going down fast. And one of the main reasons seems to be an increase in the cultivation of water-guzzling paddy. For sustainable agriculture, there is a need to switch to crops that are more efficient. But the farmers there are reluctant. Why?

Researchers from the Punjab Agricultural University examine the issue in a General Article in this issue.

Crop diversification is successfully implemented among subsistence farmers. Farmers with more than 2 hectares under cultivation grow crops for the market. Minimum support price is an assurance that it can be sold to recover the costs of cultivation and to make a modicum of profits. So, rotating wheat and rice seem more viable to them. Interestingly, about half the farmers in the state are not aware that there are more than 20 other crops that are supported by the government with the assurance of a minimum price.

Moreover, paddy does not get spoiled if it is not sold immediately unlike vegetables and fruits, where post-harvest losses are high, given the low number of agro-industries for processing and cold storage.

So what can be done to make agriculture more environmentally sustainable in Punjab? For solutions, turn to the article on **page 1303**.

COVID Vaccines

Conundrum of vanishing immunity

Coronavirus is transmitted through droplets and the infection starts in the mucosa of the respiratory system. The first line of defence in mucosal cells is immunoglobulin A. To prepare for a variety of microbes that can infect the respiratory system, the mucosal immune cells that respond have to be quickly recycled. The immunological memory in the mucosal compartment works differently from that of the systemic compartment by producing immunoglobulin G from memory B cells at short notice.

Vaccines that are injected produce immunoglobulin G as well as memory B cells against the antigens of the virus. However, these elements may not be detected in the upper respiratory system. So those who are vaccinated against SARS-CoV-2 may get infected later, but symptoms may be mild or even unnoticeable. Asymptomatic people may continue to spread the virus, caution researchers from JNCASR, Bengaluru in a Review Article in this issue. They point out the lacunae in the clinical trials of COVID vaccines which did not address this problem.

‘Systemic vaccines may provide partial protection against respiratory viruses, but expecting sterilizing immunity may be unrealistic and over-optimistic,’ say the authors. Turn to **page 1315** now.

Farming Carbon in Soils

Which cropping system is better?

Sequestering carbon into soil can check both soil erosion and climate change. And it has the added benefit of making soil nutrient-rich for better crop yield. So, sequestering carbon was one of the ideas proposed for food security as well as climate mitigation during the Paris climate talks 2015.

Storing carbon in soil is a natural process. Soil carbon in undisturbed forests is high. But, in agricultural lands, soil carbon starts getting depleted. This is what has happened in the Gangetic Plains.

Researchers from six different research institutions collaborated to assess farm carbon in the agricultural soils of the Gangetic Plains.

The results suggest that crops such as rice, wheat, pearl millet and vegetables alter the carbon sequestration in soil. These crops need extensive tillage, thus disturbing the carbon profile of the soil. However, leguminous pigeon pea does not need much ploughing. Reduced ploughing improves the carbon-sink capacity of soils. Thus, crops can be used in rotation to maintain the carbon level.

This is not a one-tool-fits-all solution. As soil uses are amazingly diverse, so is their carbon-holding capacity. But these results give a mechanistic understanding about the crop-carbon coupling.

Turn to the Research Article on **page 1334** in this issue, to read more.

Dynamics of COVID-19

Updating the SEIR model

Mathematical simulations and epidemiological modelling have proved useful during the pandemic. They provide snapshots of particular trends as the information input changes.

Mathematical modelling relies on available data and simplified assumptions. So, updating assumptions is a must to track transmission. Researchers from the SASTRA University and the Bharathidasan University tweaked the commonly used SEIR model to account for new uncertainties. This model divides a population into four compartments – susceptible, exposed, infectious and recovered. It uses differential equations to relate the parameters of the model to the population.

The researchers expanded the SEIR model. Previous models estimated the rate of infection based on the transmission rate and other biological factors of the virus. But transmission rate also depends on factors like government action, public perception, social media... The researchers added these layers of detail to their updated model.

Using the updated model, they projected the different trajectories of the pandemic, based on different scenarios. They find that individual action is more effective than government actions such as lockdown. The simple act of not going out can reduce the transmission of the virus.

Keep safe and turn to **page 1342** in this issue.

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