Crop Diversification Pathways for Punjab

Background

Widely recognized as 'India's Bread Basket', the state of Punjab for decades has been at the forefront of agricultural production and growth, primarily because of its monocropping-based farming approach, focusing on rice-wheat cropping practice. While this application has helped elevate Punjab's farmers within the bracket of 'highest income earners amongst agricultural households across all states', the ecological parameters have significantly decreased.

The over-dependence on wheat and rice and intensive use of farmland with nearly 184% cropping intensity have led to a crisis in terms of over-exploitation of natural resources, viz., soil, groundwater, and threats to biodiversity. Cultivation of paddy, which covered only about 7% of the state's total cropped area in 1970-71, currently covers more than 40%. The productivity level of wheat and rice has almost reached a plateau. Considering serious repercussions in overuse of natural resources, ecological problems, and growing farm income risk due to declining crop diversity poses a severe threat to the long-term sustainability of agriculture in the state.

Current Scenario

For several decades, Punjab's wheat-paddy cycle has consistently contributed to the centre's food security needs. In the 2021-22 procurement season, Punjab contributed more than 12.5 million tonnes or 20% of the total rice procurement of 56.81 million tonnes to the central pool managed by the Food Corporation of India. Similarly, the state contributed around 53% of wheat to the central pool in 2022. However, this high paddy cultivation is fast-depleting groundwater in the state (Gupta, 2023). As per the Ground Water Resource Assessment Report 2022, 114 out of 150 blocks in Punjab are currently in the over-exploited category regarding groundwater depletion (CGWB, 2022). Additionally, it must be noted that wheat and paddy growth rates have stagnated or declined over the last few years. Between 1970-1980, the rice yield rate in Punjab was 1.9%, while between 2008-2018, it fell to 0.3%. Similarly, between 1970-1980 wheat yield rate was 2%, and between 2008-2018 it fell to 1.5% (Singh et al., 2021). Scholarly work on the matter points to the decline in yield to the largescale rise in mean temperatures in the region during the growing period and the decrease in rainfall, which was reduced by 208 mm in the kharif season and 20 mm in the rabi season (Kumar & Sidana, 2019; Prabhjyot-Kaur et al., 2020).

Need for Diversification

Crop diversification has been touted as the most optimistic solution for substituting the non-viable agricultural practices that have been undertaken within the Trans Gangetic Plain for the plantation of wheat and paddy crops (Chhatre et al., 2016; Kaur et al., 2015; Perveen et al., 2012; Sidhu et al., 2011). Its success is laden in how it improves farm incomes and reduces aspects of poverty, enhances productivity, helps mitigate climatic shocks, assists in fertility restoration, augmentation of soil nutrient status and overall microbial counts (Birthal et al., 2015; Birthal & Hazrana, 2019; Reddy, 2013; Singh et al., 2020). While several empirical evidence based research works have established causal links between crop diversification and poverty alleviation (Birthal et al., 2015; Bravo-Uretaa et al., 2006; Michler & Josephson, 2017), multilateral organisations like United Nations over the years have reiterated that poverty alleviation shouldn't just be determined by an increase in income levels (UN Global Compact, 2021). From a sustainability lens, few authors have argued that the elements of poverty must also include environmental dimensions, a component missing from the existing policy framework (OECD, 2005; Schleicher et al., 2018).

Over the last few decades, the notion of crop diversification in Punjab has been widely discussed amongst policymakers, on academic forums and within government committee meetings. In 1986 and 2002, the Report of the Johl Committees (GoPb, 1986, 2002) suggested that at least 20% of the net cropped area under paddy and wheat, the dominant crops in Punjab, should be shifted to other crops for ecological sustainability, primarily for the prevention of groundwater depletion. Subsequently, in 2013-14, the Government of India came out with a crop diversification programme for the state of Uttar Pradesh, Haryana and Punjab, intending to diversify 5% of the area under paddy cultivation to alternative crops for all three states (Government of India, 2013). Further, in 2022 the Punjab Agriculture Department stated that the government is looking at a broad crop diversification plan in which around a million hectares or a third of water-intensive paddy areas in the state would be gradually shifted to alternative crops such as cotton, maize, oilseeds and pulses, over the next five years. It also stated that the government is also looking to incentivise farmers to shift around 10% of the wheat area to other crops such as oilseeds and pulses (Das, 2022).

Paddy is a water-intensive crop and needs around 5000 litres to grow a kilogram of rice. Paddy cultivation has created serious problems and environmental threats concerning soil fertility depletion, increased soil and water pollution, and enhanced GHG emissions through its cultivation or via residue burning (Gupta, 2023). While several alternative cropping mechanisms have been suggested to mitigate the agricultural issues in Punjab, some have received the most acclaim amongst stakeholders and policymakers alike, namely, millets, oilseeds and pulses.

Millet-based cultivation offers several advantages; they can seamlessly be inserted within the existing production patterns in some areas, aiding in the region's growth of crop diversification intensity (Singh et al., 2021), they consume 70% less water than rice, grow in half the time as wheat, and require 40% less energy in processing (Suri, 2022). Currently, the area under millet is almost negligible, with less than 1% under cultivation dedicated to millet farming. Thus, there is a significant opportunity for its amalgamation with the existing cropping system. On the other hand, oilseed crops are also a viable diversification option for the state's agricultural landscape. Punjab is traditionally known for growing rapeseed & mustard; however, its production area decreased from 1.2 lakh hectares in 1995-96 to 44 thousand hectares in 2021 (Chaba, 2018, 2021). India meets around 60% of its domestic edible oil requirements through imports valued at around INR 78000 crore. With the current edible oil consumption pattern at 19 kg per person per annum, India will have to increase its production capacity significantly to feed over 1.43 billion people by 2025 (Singh et al., 2021). Diversification activities in Punjab can help the state lead the country towards self-dependency in oilseeds. Soybean is one of India's primary oilseed crops and can be consumed in various forms. It improves soil health through symbiotic nitrogen fixation, and its residue can be used as a substrate for the mushroom industry. Furthermore, the residue decomposes very fast, thus not requiring burning, unlike paddy straw.

Apart from oilseeds and millets, experts largely prefer pulse-based crops when it comes to shifting any agricultural landscape away from a monocropping-based system (Singh, 2018). They improve soil properties and reduce pest and disease incidence. The specific role of pulses in cropping systems includes high carbon sequestration capacity, low carbon footprint, fixing atmospheric nitrogen in soils, low water footprint, hydrogen fertilization of soils and improving soil biodiversity (Adarsh et al., 2019). By virtue of their diverse characteristics with respect to duration, adoption to different climates and other nitrogen-associated benefits, pulses are an integral part of different cropping systems across the country. Their versatile nature makes them ideal components in crop diversification and intensification (Singh, 2018). At 3 kg grain/ha mm, the water use efficiency for a pulse, such as pigeon pea, is two times better than irrigated rice, whose water use efficiency is 6-8 kg grain/ha mm. Pulses contain 22–24 % protein which is about 2–3 times more than wheat and rice, respectively, and blending with cereal makes its protein value very high (Singh et al., 2021).

Workshop Objective

TERI, under its commitments to the FOLU India platform operations, has taken the responsibility of developing a roadmap for the crop diversification of Punjab. The general approach adopted is to initiate a value chain-based gap analysis to identify the enabling conditions required to make the alternate crops economically lucrative to the farmers.

A preliminary value chain analysis covering the stages of production, pre-harvest, postharvest and marketing of the alternative crops – Maize, Pulses (Arhar), Oilseeds (Soybean) and Millets (Bajra) have been undertaken. To evolve a strategic module for the wholesome development of agriculture in Punjab, there is a need to identify gaps, efficiency levels, and inherited advantages across the value chain of potential identified crops. This also needs to be done against the backdrop of socio-economic, ecological and cultural background of the farmers of the State.

During the process of creating a plan of action for crop diversification for the state of Punjab, TERI would like to do in-depth and extensive consultation with the farmers, and the starting point would be outcomes of the four value chain analysis. In this regard, FOLU India and TERI have joined hands with Bharat Krishak Samaj and the Indian School of Business, Mohali, to initiate the consultation process through a one-day workshop.

The workshop would like to achieve the following objectives:

- Identification of the enabling conditions and hurdles for the farmers in accepting the economically lucrative production systems with support instead of the existing rice-wheat cultivation system
- Understanding the dynamics of crop diversification in Punjab as shaped by its political economy, the role and nature of the state, coupled with the trade and market mechanism for transforming the production structure.

Synthesis of the outcome of the consultation into a socio-economic and environmental analysis going forward is envisaged to act as the fundamental document for the state of Punjab to draft their crop diversification policy around.

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