TIGR2ESS
Transforming India's Green Revolution by Research and Empowerment for Sustainable food Supplies

2022

Development and Application of Comprehensive Farm Assessment Index in the Evaluation of Alternate Farming Systems in Punjab

UNIVERSITY OF CAMBRIDGE
GLOBAL FOOD SECURITY
GCRF Global Challenges Research Fund

Life of an Organic Farmer

Though mosquitoes suck my blood without my permission,
They rely after all on our blood donation.
The sharp sugar cane leaves do cut my flesh while weeding,
No pain no gain, plants will grow well, thanks to my bleeding.
Horse flies do harass me too, thinking I'm a donkey,
Or because I'm white , they assume I am a Yankee .
Ants hiding behind the leaves bite me mercilessly,
They save themselves, nothing against me personally.
While sweating like a horse, I think life is beautiful,
I don't have to go to the Turkish bath, and that's cool.
Like a soldier, a farmer has to shed sweat and blood.
He may harvest his crop after facing drought or flood .
The monsoon can bring hope, but also devastation,
He prays for it, rains guarantee food for the nation.
A farmer can sow seeds, work hard and hope for the best,
For it is through God's Grace, if one day he can harvest.
In Punjab, wheat and rice are the main cultivation,
The only crops favoured by the green revolution.
Punjabis don't relish rice , it's not their cup of tea,
To grow food we don't eat is a great absurdity.
Organic farmers don't believe in using pesticide ,
To work against nature is like committing suicide .
To pollute soil and water is not sustainable,
And produce pure and safe food, is only sensible.
Multi cropping combined with a wise crop rotation,
Can protect the soil from any deterioration.
Such farming does not rely on petrochemistry,
It provides healthy food for home and the country.
Such farmers who produce their food are self-reliant,
They won't make a fortune, but they are self-sufficient.
Hard work and organic food keep the farmer healthy,
If one stays in poor health, what's the point of being wealthy.
Farmers who feed the world are looked upon with contempt,
But when there is a lockdown, they are self-sufficient.
Do boost your immune system in time of pandemic,
Organic food will help you along with turmeric.

Darshan Singh Rudel
(Raza Farm, Nurpur Bedi)

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About TIGR²ESS

Objectives and Outcomes Jointly Framed by the Consortium Partners

India's Green Revolution produced significant benefits. The greatest positive impact was felt in regions and on farmers who were able to harness benefits from the combination of new technologies, increased inputs and research-led innovation that have characterised agrarian transformation over the last fifty years. Despite these positive outcomes, there is widespread agreement that the 21st century demands new thinking to address new and emergent challenges, driven by changes in migration and settlement patterns, new forms of economic activity, changes in global commodity markets, and significant environmental challenges.

Objectives

1. To define the requirements and set the policy agenda for a second Green Revolution in India, framed by demographic changes affecting rural communities and feminisation of smallholder farming systems.
2. To develop and strengthen alliances across a carefully selected network of UK and Indian experts, to build a collaborative, long-term research partnership in sustainable agriculture that will set India on the path to a second Green Revolution.

Flagship Projects

Objectives were attained through fundamental research, structured into six Flagship Projects.

- **FP1** Sustainable and Transformative Agrarian and Rural Trajectories (START);
- **FP2** Crop Sciences: Water Use and Photosynthesis;
    - Improving Water Use and Yield Stability in Millet and Sorghum;
    - Crop Sciences: Enhancing Photosynthesis;
- **FP3** Heat and Drought Resilience in Wheat;
- **FP4** Water Use and Management in a Changing Monsoon Climate;
- **FP5** Supply Chains: Modelling Water Use for Sustainable Livelihoods;
- **FP6** Impacting Wellbeing in Rural and Urban Communities: Education, Empowerment and Entrepreneurship Leading to Improved Human Nutrition;
    - Education Food, Nutrition and Empowerment (EFNE);
    - Education, Employment, Empowerment and Entrepreneurship (4E);
    - Cross-Cutting FP6 Projects are the Mobile Teaching Kitchens and the Innovation Farm Model.

About the Research Team

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Executive Summary

The agricultural system should preserve or augment the natural environment, providing safe food and social welfare besides being economically viable. Economic, environmental and social sustainability indicators that allow an integrated farm assessment have increasingly received considerable attention. The present study is based on a stock-and-flow framework for a systemic identification and selection of indicators, further aggregated to create a holistic Comprehensive Farm Assessment Index (CFAI) to assess alternate farming systems in the select districts of Punjab.

The sample comprised 88 organic and 90 conventional farming plots across three agro-climatic zones, viz., the North-East (Districts of S.A.S. Nagar, Rupnagar, and Hoshiarpur), Central (Patiala District) and South-West (Districts of Mansa and Bhatinda) over two cropping seasons (Rabi 2020-2021 and Kharif 2021). An extensive validated questionnaire was used to collect the quantitative details of farm inputs, including machinery usage, materials used and labour, along with their actual and opportunity cost. In addition, qualitative parameters were built into the questionnaire to measure the contextual aspects of farming in the national indicator framework of sustainable agriculture. Furthermore, soil samples were collected from all the farm plots to test the soil's physicochemical properties.

The results highlight that for 96 per cent of the farmers, agriculture is their primary occupation. With 100 per cent of irrigated land, around 83 per cent of the organic farmers plough their own owned land compared to 67 per cent of the conventional ones. Further, organic farmers are primarily practising on small and marginal farm plots, with 43 per cent having a second source of income. The one-way ANOVA procedure shows statistical mean differences between the organic and conventional farming systems on the key production costs and income for wheat, rice, and cotton crops. The normalised values of social indicators like the knowledge of best farming practices and their sources, self-reliance in terms of self-borne costs, health impacts from no usage or organic pesticide usage, and institutional strength due to advice received from a community or producers' group and availability of credit are higher for organic in comparison to the conventional farming system, irrespective of the crops sown or the agro-climatic zones. Similarly, on the environmental dimension, more biodiversity and less water contamination were on organic vis-à-vis conventional farms. Overall, the comparative CFAI highlight that except for paddy cultivation in the North-East region, the composite indices for organic farming (wheat and cotton) are higher than that for the conventional systems.

Over the past six decades, farmers in Punjab have been entrapped in an ecologically unviable cropping pattern and concomitant commercial fallouts. Currently, organic farming is being promoted and facilitated through central governmental and non-governmental institutions, however with marginal success in Punjab. If organic agriculture is to play a role in providing sustainable food security and livelihoods, economic sustainability must be ensured through effective policy interventions. A participatory approach with local communities, promoting networks, training and extension services will go a long way in addressing the impacts on multiple ecosystems and rural incomes. As a way forward, alternate methodological frameworks can be explored, and good or best organic management practices be documented and disseminated to achieve environmental sustainability.

Acknowledgements

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We would like to acknowledge the unstinting guidance and expertise provided by Siva Muthuprakash K.M. (VikasAnvesh Foundation) in the development of quantitative-cum-qualitative Farm Assessment Index to better capture economic, social, and ecological dimensions of alternate agricultural systems. We are indebted to our colleagues at Panjab University, especially the Department of Public Administration, School of Communication Studies, University Institute of Applied Management Sciences, University Institute of Hotel and Tourism Management, and University Business School in our pursuit of research across inter-disciplinary issues. Our sincere thanks to Prof. Shailaja Fennell (University of Cambridge), Prof. Sumantra (Shumone) Ray (NNEdPro Global Institute for Food, Nutrition and Health), Prof. Srijit Mishra (IGIDR), Prof. R. Padmaja (ICRISAT) and Dr. Vandana Shiva (Navdanya) for their expert insights and direction.

We have depended on support and advice from numerous stakeholders in each district and village, especially in the field. We are beholden to the wife-husband duo of Khaalis for unravelling the nuances of organics and ethos behind the farmers' collective. We are grateful to our technocrat farmer, Mr. C.S. Grewal (Grewal Farms) and engineer farmer, Mr. Tarjinder Singh (member of the organic grower's group of PAGREXCO), who provided us with a deep insight into farming practises and processes. Their knowledge of organic farming systems and clarity helped in the cost computations. A special thanks goes to our poet farmer, Mr. Darshan Singh Rudel (Raza Farm), who shared his precious and illuminating work titled 'Punjab Bachao (Save Punjab)' and 'Life of an Organic Farmer.' Our deepest thanks to all the farmers who came forth to respond and put forth their perspectives under challenging times of pandemic and farmers' stir at Delhi borders.

Our young talented research team's consistent perseverance and efforts are highly appreciated. Their multitasking skills contributed to every aspect of research, from field surveys and data collection to analysis *support. It has been a great pleasure to work with them. Co-investigators and the team had the privilege of presenting and discussing their research findings with all our stakeholders at the Final Policy Dissemination Workshop, especially with Mr. Suresh Kumar (TIGR^{2}ESS Policy Fellow). We are most grateful for their well-meaning engagement and thought-provoking suggestions for the way ahead. The creative help of Abhishek Kralia (Department of Geology, Panjab University) in producing maps is acknowledged. We also put on record the administrative support provided to us by the Department of Public Administration, Panjab University.*

It is a pleasure to acknowledge our resilient and steadfast Principal Investigator, Prof. Ramanjit Kaur Johal. Her mentorship skills, unstinting spirit, constant nudge, and upfront observations made it possible to work on myriad themes and connect with our roots. I am glad we made such a good team and took our work to another level.

Suveera Gill
29th July 2022

Abbreviations

ANOVA	Analysis of Variance
BCR	Benefit-Cost Ratio
CFAI	Comprehensive Farm Assessment Index
EIQ	Environmental Impact Quotient
CNV	Conventional
FAI	Farm Assessment Index
FIQ	Fertiliser Impact Quotient
Ha	Hectares
IDEA	Indicauters de Durabilité des Exploitations Agricoles
K	Potash
Kg	Kilogram
KVK	Krishi Vigyan Kendra
MESMIS	Marco para la Evaluación de Sistemas de Manejo incorporando Indicadores de Sustentabilidad
N	Nitrogen
NABARD	National Bank for Agriculture and Rural Development
OECD	Organisation of Economic Cooperation and
ORG	Organic
P	Phosphate
PG	Public Goods Tool
pH	Potential of Hydrogen
PIQ	Pesticide Impact Quotient
QL	Qualitative
QN	Quantitative
RISE	Response-Inducing Sustainability Evaluation
SAFA	Sustainability Assessment of Food and Agriculture Systems
SAFE	Sustainability Assessment of Farming and the Environment Framework
SOC	Soil Organic Carbon

Conversion Table

Length

1 kilometre (km) = 1000 metres (m)
1 km = 0.6214 miles
1 m = 1.0936 yards
1 m = 3.2808 feet
1 mile = 1760 yards
1 mile = 1.609 km
1 yard = 0.9144 m
1 foot = 0.3048 m

Area

1 km^2 = 100 hectare (ha)
1 km^2 = 0.3861 square mile
1 km^2 = 247.105 acre
1 m^2 = 10.7639 square feet
1 ha = 10.000 m^2
1 ha = 2.4711 acres
1 square mile = 2.59 1 km^2
1 acre = 0.4047 ha
1 acre = 4046.86 m^2
1 acre = 4840 square yard
1 square yard = 9 square feet
1 square yard = 0.8361 m^2
1 square foot = 0.0929 m^2

Weight

1 tonne = 1000kg
1 tonne = 1.1023 US ton
1 US ton = 0.9072 tonnes
1 hg = 100 gram
1 kg = 2.2046 pounds (lb)
1 kg = 35.274 ounce (oz)
1 lb = 0.4536 kg
1 oz = 28.3495 gram

Units

1 crore = 10 million
1 million = 10 lakh
1 lakh = 100000
1 billion = 1000 million

1. Economic, Social and Ecological Dimensions of Agricultural Systems

A sustainable agricultural system meets numerous goals, including economic viability with preservation or augmentation of the natural environment, providing food safety, and social welfare across time (Hansen, 1996). According to Francis and Youngberg (1990), the multifaceted concept of sustainability would involve a triple bottom line approach encompassing profitable operations, equitable and fair generation of wealth, and maintenance of natural ecology. In agriculture, the three pillars – economic, social, and environmental – integrate land stewardship to create resource-conserving and equitable farming systems for future generations. Furthermore, when accompanied by suitable institutional, cultural, and ethical settings, it can result in the well-being of nations and people.

Maintaining economic growth is a vital objective accepted by practitioners and decision-makers. However, there is difficulty in trading off sustainability and economic viability (Moldan et al., 2012). An economically sustainable farming system should generate sufficient earnings to reimburse the farm's production factors at a rate comparable with other sectors and provide an adequate cushion to face the vicissitudes of changing times. Further, the factors of production must be used productively and efficiently to maximise value-added products and minimise the risk in farming operations. If the efficiency of the factors of production can be improved, it stands to reason that the farming system can increase output and create higher quality produce at lower prices. Any increase in production contributes to the economic growth of the country.

Social sustainability is a critical long-term pillar around which societies evolve in social values, identities, relationships, and institutions (Diamond, 2005). The agriculture system is pivotal in providing sustainable livelihoods through employment opportunities, especially for vulnerable people. In addition, the sector employs large numbers of non-salaried family members, particularly women, unskilled or semi-skilled workers and seasonal migrant workers. Therefore, sustainable farming should result in social equity, self-sufficiency, preserving traditional agrarian and indigenous wisdom and culture, and supporting smallholders (Weil, 1990). Thus, adequate access to housing, income, health, labour and good working conditions, services, facilities, education and financial security should be available to the farmers as a part of their social inclusion. Additionally, a respectful social identity with their values and social norms should be restored. Finally, it should help them build networks and trust collectives, thus furthering their social capital.

The resource-limited ecological strategy would involve significant regeneration, substitutability, assimilation, and irreversibility (OECD, 2001). Farming practices should promote the sustainable use of soil, water, and air with environment and biodiversity conservation, livestock management, and improved quantity and quality of produce. Given the limited availability of virgin fertile soils, the required growth of agricultural production will have to come from yield enhancement on currently cultivated soils. Therefore, efforts must be made to add maximum value with minimum resources to minimise environmental impact (Jollands et al., 2004). Further, concerted efforts must be diverted towards waste reduction, specifically hazardous waste and food loss across the value chain.

Integrating a wide range of issues and indicators is imperative to capture a holistic view of farm-level sustainability. Generally, two approaches are followed for sustainability assessment – bottom-up and top-down (Spohn, 2004). The bottom-up involves the systematic participation of several stakeholders to decipher the framework and the indicators. On the other hand, the top-down approach looks into the overarching structure, which is subsequently classed into sets of sustainable indicators. A host of indicators have been developed to measure the sustainability of farming systems and practices (e.g., Rigby et al., 2001; Häni et al., 2003; Zhen and Routray, 2003; Wezel et al., 2014; De Olde et al., 2016a, b). Further, composite indicators, a compilation of individual indicators into a single index, have been constructed to evaluate sustainability.

Economic, environmental and social sustainability indicators that allow an integrated farm assessment have received substantial attention. Several frameworks have been developed to evaluate the sustainability of agricultural systems using composite indicators. An indicator can be a quantitative or qualitative measure, or both, derived from a series of observations in a given context. The indicator value can be derived in myriad ways, such as through measurement, expert opinion or model estimates (Van Cauwenbergh et al., 2007). The normalisation of indicators, weighting system and method employed in aggregating component scores plays a predominant role in developing the composite index. As apparent in Table 1, internationally indicator-based farm assessment tools vary widely in their scope, target group, and methodology.

By supporting on-farm decision-making, agricultural sustainability assessment tools can significantly impact the holistic development of farms and farmers (De Olde, 2016b). Evidence from research expounds on the perceived relevance of the tool by the farmers as the underlying reason for its adoption (Van Meensel et al., 2012). Factors contributing to the same

Table 1 Select Farm-Level Assessment Tools

Tool	Method	Sector (Target Group)	Domain/Scales	Attributes/Dimensions (Indicators)	Reference
Delphi	Adapted in agriculture to build and select the indicators	Universal (Farmers, policy-makers, education)	Farm family unit, natural resource base, finance base, capital items, and cropping system	Farming system components (17), the management of the components (13), the interrelationships between components and the sum of these components (8), as well as the external factors that influence and interact with the system (41)	King et al. (2000)
Marco para la Evaluación de Sistemas de Manejo incorporando Indicadores de Sustentabilidad (MESMIS)	Involves the systems' characterisation, the identification of critical points, the selection of specific sustainability indicators (environmental, social and economic dimensions), and integration indicators through mixed techniques and multicriteria analysis.	Smallholder (Farmer, policy-makers, education)	Environmental, economic, and social	Productivity, stability, reliability, resilience, adaptability, equity, self-reliance, and self-empowerment (21)	López-Ridaura et al. (2002)
Indicauters de Durabilité des Exploitations Agricoles (IDEA)	Assesses whole-farm sustainability by conceptualising around 16 objectives, three scales, and ten components to develop a matrix with the 41 indicators used to characterise them.	Universal (Farmers, policy-makers, education)	Agri-ecological, socio-territorial, and economic	Diversity, organisation of space, farming practices, quality of the products and land, employment and services, ethics and human development, economic viability, and efficiency (41)	Vilain et al. (2003)
Response-Inducing Sustainability Evaluation (RISE)	Evaluates all types of production; three aspects of sustainability with a set of 12 indicators.	Universal (Farmers)	Ecological, economic, and social	State and driving force of sustainability (12)	Häni et al. (2003)
Sustainability Assessment of Farming and the Environment Framework (SAFE)	Designed for three spatial levels to identify important links between management by the farmer and impacts and effects on the agro-ecosystem and its sustainability levels using a hierarchical framework.	Universal (Farmers, policy-makers, education)	Economic, social, and environmental	Air, soil, water, energy, biodiversity, viability, food security and safety, quality of life, social acceptability, and cultural acceptability (51)	Van Cauwenbergh et al. (2007)

Tool	Method	Sector (Target Group)	Domain/Scales	Attributes/Dimensions (Indicators)	Reference
Public Goods Tool (PG)	Assesses the main public goods provision on a farm through several activities (developing questions and considering data requirements and constraints)	Universal (Farmers, policy-makers)	Economic, social, and environmental	Soil management, biodiversity, landscape and heritage, water management, manure management and nutrients, energy and carbon, food security, agricultural systems diversity, social capital, farm business resilience, and animal health and welfare (54)	Gerrard et al. (2012)
Sustainability Assessment of Food and Agriculture Systems (SAFA)	Structured according to several hierarchical or aggregation levels (i.e., dimensions, themes and indicators) and applies to large as well as small and medium-sized farms and all stakeholders involved in the production process	Universal (Food and agricultural enterprises, organisations, governments)	Good governance, environmental integrity, economic resilience, and social well-being	21 sustainability themes (corporate ethics, accountability, participation, the rule of law, holistic management, atmosphere, water, land, biodiversity, materials and energy, animal welfare, investment, vulnerability product quality and information, local economy, decent livelihood, fair trading practices, labour rights, equity, human health and safety, and cultural development) with 58 sub-themes (116)	FAO (2013)
Sustainable Agricultural Spatial Model (SASM)	Sustainable utilisation of agricultural land is gauged through the integration of five factors using a geographic information system (GIS), analytical tools to combat and tackle sustainable agricultural constraints and optimum land use planning	Universal (Framers, policy-makers, education)	Geomorphology, land use, social index, economic index, security index, productivity index and protection index	Productivity (8), security (3), protection (3), economic viability (5), and social acceptability (6)	Mohamed et al. (2014)

Note: The sustainability tools are peer-reviewed and include economic, environmental and social sustainability indicators in an integrated assessment at the farm level.
Source: Compilation by Gill.

include a context-specific model, user-friendliness, data type and availability, and value judgements of tool developers and users' participation (Lynch et al., 2000; Gasparatos, 2010; De Mey et al., 2011; Triste et al., 2014; Van Meensel et al., 2012).

A few studies have used composite indicators for agricultural sustainability (e.g., Sharma and Shardendu, 2011; NABARD, 2012). However, such studies either ignore the agronomic and environmental parameters of farm sustainability or lack methodological rigour. Contrary to these, Muthuprakash (2018) advanced a stock-and-flow based framework for a systemic identification and selection of quantitative indicators, further aggregated to create a farm assessment index. With the need to move beyond quantitative indicators, Muthuprakash and Damani (2019) used an alternative methodology for measuring the qualitative and contextual aspects of farming. The Comprehensive Farm Assessment Index (CFAI) in the present study assesses alternate farming systems in the select districts of Punjab based on the composite quantitative and qualitative elements in the indicator framework, as proposed by Muthuprakash (2018) and Muthuprakash and Damani (2019), respectively.

2. Design of the Comprehensive Farm Assessment Index (CFAI)

There are many stages in the construction process of the CFAI. This involves data selection, cleansing, normalisation, weighting, and aggregation decisions. These selections are context-specific and influence the outcome of the constructed composite indicator. The following distinctive steps were carried out in this study:

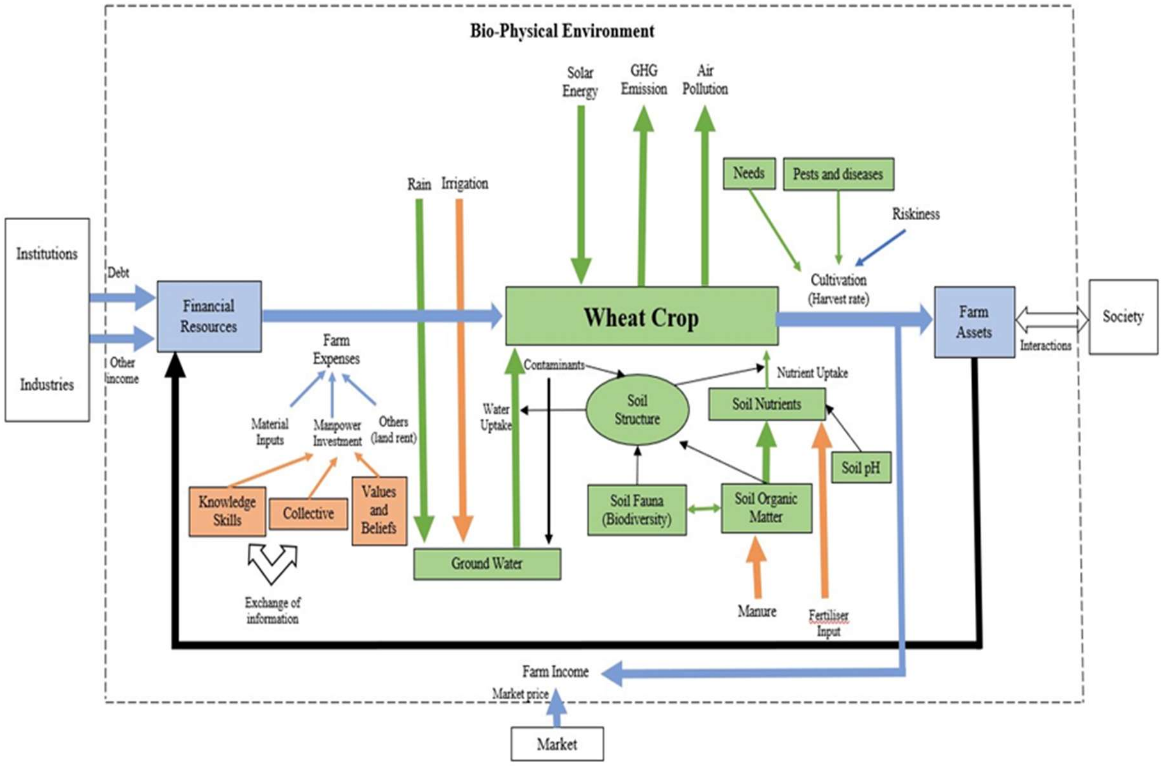
2.1 Development of the theoretical framework

The delineation of the theoretical framework is the basis for constructing a composite indicator. Using the concepts of stock and flow, the systems approach formed the basis of indicator identification. Stock describes the system's characteristics accumulated over the long term, and flow describes the transient and dynamic characteristics of the system (Sterman, 2000). In addition to the number of stocks and their flows, attributes or characteristics of the system, which are usually context-specific, are considered.

Stocks are a quantifiable amount of material or information, with ecological stocks often defined in a spatial context (Jones et al., 2016). In ecological parameters, stocks include soil organic matter quantified in grams per metre square or the volume of water in a pond quantified in cubic metres. Almost all the economic stocks are quantifiable (e.g., farmland, farmsteads), though challenges exist in determining the value of the realised service or intervention programmes. Some stocks of social capital can be harder to quantify, like, farmers'

Box 1 Stocks and Flow in Wheat Production

In the case of economic components, the stock of farm assets and total financial resources available to farmers determine the financial viability of the wheat crop production system. The ecological aspects include groundwater and soil nutrients stocks, with input inflows of other environmental elements of rainfall and solar energy. Economic and social aspects further augment these in producing a wheat crop. Factors of production – men, material, and machines – are necessary to cultivate the land involving both economic (expenses) and social (resources) flows. For wheat crops, stocks of soil nutrients are supplemented by inputs of organic or inorganic fertiliser. Though the wheat crop requires less water, soil moisture stocks are enhanced by irrigation. Other forms of social capital include farmers' knowledge, skills and formal or informal networks. The undesirable impact caused by farm inputs, like the stock of soil nutrients and the water table, is depleted by flows to the growing crop. Similarly, excessive discharge of harmful fertilisers and pesticides can adversely impact the ecology and society.



Note: Rectangular boxes are stocks; ovals are other system components; solid arrows depict capital flows; thin line arrows show other dependencies; economic, social and ecological elements are in blue, peach and green, respectively.
Source: Depiction by Gill and Sharma.

knowledge about the fertiliser requirement for different crop varieties or a collective of organic farmers quantified their network connections. Flows into or from stocks represent an amount of matter or information defined in a spatial and temporal context. The inflows are the resources consumed, and the outflow includes both the intended and unintended outputs. In addition, there are ecological flows (e.g., rainfall amount as millimetres per year) and social flows (e.g., flows of information from farmer to farmer on the best pesticide to be used against invading pests).

2.2 Indicator selection

The system behaviour depends on the attributes both within and outside the system (Gallop, 2003). Unlike other frameworks where indicator selection depends on experts' decisions, the process here begins with the definition of boundary conditions followed by the conceptualisation of the system using a stock-and-flow model, which is then used to identify and select appropriate indicators (Muthuprakash and Damani, 2017). Identification of independent boundaries along the three dimensions – economic, social, and ecological – are essential to determine the inflows and outflows of the system.

The stock variables present within the system boundary are taken as indicators to account for long-term sustainability. When variables are associated with more than one process, an appropriate alternate measure must be selected to capture the system's required characteristics. The input and output flow across the system boundary follows next. Flow variables constitute the biophysical interactions within and outside the system. However, the stock-and-flow based framework focuses on the production efficiency of only those components within the system boundary. As Andrieu et al. (2007) suggested, the indicators related to desirable outcomes are measured in terms of input-output efficiency; the undesirable in absolute values. Other uncontrollable attributes, like precipitation and sunlight, are taken as peripherals and not as indicators. Efforts were made to select each stock and flow variable in all three dimensions.

The selection of indicators requires a careful selection of variables that should not be associated with more than one process. This is important since it would lead to over or under accounting of any process attribute otherwise. There may be then some indicators whose measurement is complex. In such a case, the stock-and-flow diagram enables identifying appropriate proxy indicators for complex variables in the system. A proxy indicator is a substitute variable used when the desired data are unavailable or too complicated to measure. It should represent the variable of interest and have a close approximation to the target indicator. For example, estimating farm biodiversity in the ecological pyramid is arduous. Therefore, soil microbial diversity and richness have been taken as their proxy.

The comprehensive set of quantitative and qualitative indicators identified and selected across the economic, social, and ecological dimensions using the stock-and-flow framework with their component, proxy indicator, measure, units, explanation, and source are listed in Annexure A. Over and above nineteen quantitative indicators, the qualitative indicators considered in the present study are seven.

2.3 Normalisation of indicators

The normalisation of indicators is a precondition for aggregating indicators since they are in varying units that are not aggregative. Normalisation is a mathematical procedure for converting different measures into a comparable scale. The min-max method with a pre-set reference was selected in the present study to normalise indicators. The method is widely accepted in indicator studies (e.g., Hajkowicz, 2006; Gómez-Limón and Sanchez-Fernandez, 2010; Nathan and Reddy, 2011; NABARD, 2012). The min-max method performs a linear transformation of data to a pre-set minimum and maximum points of the sample with the function as stated below:

$$I_{qc}^{t} = \frac{x_{qc}^{t} - min_c(x_q^t)}{max_c(x_q^t) - min_c(x_q^t)}$$

where $max_c(x^t q)$ and $min_c(x^t q)$ are the maximum and minimum values of $x^t qc$

To determine the operating range of the normalisation, reference values, which enable measuring the relative position of the system to the benchmark, play an essential role. The reference points for normalisation are identified for each indicator based on benchmarks (national or state standards), extant literature, or expert opinion. For example, the Punjab state crop-specific average is used to set the socio-economic indicators reference point. In the case of the fertiliser impact quotient (FIQ), crop-specific nutrient consumption per unit yield is taken to set the reference point. In contrast, for the pesticide impact quotient (PIQ), the specific maximum recommended dosage provided by manufacturers is taken.

A value between '0' and '1' is assigned for different ranges of each indicator to normalise, as in the literature (e.g., Nambiar et al., 2001; Praneetvatakul et al., 2001; Sharma and Shardendu, 2011). For indicators where the crop- and state-specific average is taken as '0.5' reference point, double its value is taken as reference point '1' or '0' for impact indicator, respectively. Table 2 illustrates the reference points for seven socio-economic indicators and three crops for Punjab. For PIQ, the maximum recommended dosage of a particular pesticide is set as '0.5' reference point, and double or more than double the maximum recommended dosage is put as '0'. The reference point '0' is the quadrupled average consumption of crops for FIQ. In the case of soil parameters, reference points were set based on their scientific thresholds. Similarly, each qualitative question has an unequal number of choices. Thus, the normalisation process was completed by seeking the opinion of the experts for a value ranging between '0' and '1'. The normalisation was carried out using a negative slope function for the cost and impact indicators, such as farm cost and pesticide impact. The normalisation references for PIQ, FIQ, soil parameters and NPK composition are presented in Annexure B.

Table 2 Select Reference Values for Socio-Economic Indicators for the State of Punjab

Crop	Farm Expenditure (₹/acre)	Paidout Cost (₹/acre)	Gross Income (₹/acre)	Net Income (₹/acre)	Benefit-Cost Ratio	Labour Expense (%)	Drudgery (₹)
Wheat	24,157	10,122	81,730	71,608	6.77	0.37	4,513
Rice	33,912	12,407	99,309	86,902	5.86	0.79	13,332
Cotton	43,222	14,474	1,07,265	92,792	4.96	1.01	21,857

Source: Directorate of Economics and Statistics (2019).

2.4 Weighting and aggregation

The normative or opinion method of the hierarchical analytical process has been adopted to assign weights to indicators. Hierarchical weighing of attributes reduces biases that implicitly creep into decision-making by increasing or decreasing the weights assigned to indicators (Weber et al., 1988; Pöyhönen and Hämäläinen, 1998). Weightage was assigned using the Delphi technique, which involves a group communication process to converge opinions and build consensus amongst stakeholders and experts. An organised interaction was conducted with various study stakeholders and an expert panel to agree on the indicators' selection and weights.

The method of aggregation of indicators has a crucial role in retaining ordering inferred in the use of the index value irrespective of any admissible transformation to the scale or unit used (Ebert and Welsch, 2004). Aggregation of the normalised indicators has been done using a simple weighted mean. Progressive aggregation, where the weighting and aggregation are done at each hierarchical level individually, has been adopted. For example, for multiple-choice qualitative questions ($Q_1, Q_2, \ldots. Q_m$), the final value for each indicator ($I_1, I_2, \ldots. I_n$) is estimated from the weighted sum of the raw score of the indicator (v_i^j) from each question as given in the equation each indicator has different weight (w_{i1}, w_{i2}, …. w_{im}) for a different question as:

$$I_i = w_{i1} \times v^1{}_i + w_{i2} \times v^2{}_i + \ldots\ldots w_{im} \times v^m{}_i$$

$$v^j{}_i = s^j{}_{i1} \times b^j{}_1 + s^j{}_{i2} \times b^j{}_2 + \ldots\ldots s^j{}_{ic} \times b^j{}_c$$

where each question has a constant (c) number of options with specific score associated for *jth* question and *ith* indicator. *Bj* is a binary matrix based on the input choice selected by the farmer for the *jth* question.

Three separate indices – economic index, social index, and ecological index – have been determined by aggregating the indicators (36) and the sub-indicators (16) at the dimensional level (Table 3). As can be observed, there are seven dimensions, viz., financial benefits and resource efficiency under the economic index, producer development, consumer impact, and national impact under the social index, and ecosystem and field under the ecological index. Each index conveys the disaggregated information about each aspect of a sustainable farming system relevant to assessing the risks and returns as well as the socio-economic implications that are not that apparent from the aggregated index. The aggregate of indicators across all the dimensions forms the CFAI of the farming system – organic and conventional. The weightage at the highest hierarchy of the dimension was rounded off to 40 per cent, 30 per cent and 30 per cent for economic, social and ecological dimensions, respectively.

2.5 Validation

Validation is a process by which a judgement is made as to whether a tool is fit for purpose. As specified earlier, the present work draws from the research work of Muthuprakash (2018), who had carried out both the validity and sensitivity analysis of the indicators comprising the FAI tool. The present composite index, CFAI, added thirteen additional qualitative indicators based on the past research. The validation of the indicators used in developing the CFAI has been carried out through the Delphi technique. As a first step, a focused group discussion cum workshop on *'Exploring Sustainable Farming and Innovative Marketing Practices'* was held in collaboration with Krishi Vigyan Kendra (KVK), S.A.S Nagar (Mohali).[1] The discussion cum workshop provided insight to farmers and other stakeholders regarding various indicators

[1] Held on Tuesday, 23rd November 2021, with twenty-three participating farmers and two resource persons, Dr. Harmeet Kaur and Dr. Parul Gupta, from KVK, S.A.S. Nagar (Mohali).

Table 3 Hierarchical Classification of Indicators

Comprehensive Farm Assessment Index (CFAI)																				
Economic Index					**Social Index**												**Ecological Index**			
Financial Benefits			***Resource Efficiency***		***Producer Development***						***Consumer Impact***		***National Impact***				***Ecosystem***			***Field***
QN	QN	QN	QN	QL	QL	QL	QL	QN	QN	QN	QN	QN	QN	QN	QL	QL	QL	QN	QN	QN
Income per acre	Benefit-cost ratio	Riskiness	Nutrient use efficiency	Water use efficiency	Farmer knowledge	Social capital	Farm resources	Financial resources	Self-reliance	Drudgery	Health impacts from fertilisers	Health impacts from pesticides	Agricultural output	Employment	Gender equality	Institutional strength	Biodiversity	Soil contamination	Water contamination	Soil health[a]

Note: [a]Soil health has six sub-indicators (N, P, K, SOC, pH, and salinity); QN and QL are quantitative and qualitative indicators, respectively.
Source: Adapted by Gill from Muthuprakash (2018).

and their weightage to different index dimensions. Since the Delphi technique does not call the expert panels representative samples for statistical purposes (Powell, 2003; Thangaratinam and Redman, 2005), as a second step, three experts were chosen based on their knowledge and experience in sustainable farming practices and processes.[2] As suggested by Skulmonski et al. (2007), two iterations were considered sufficient. At the end of two rounds, the indicator set and its hierarchy was agreed upon by participating experts.

3 Materials and Methods

The questionnaire was prepared in conjunction with the delineation of the conceptual framework and methodology for index construction. Important decisions relating to spatial distribution and selection of farmers were taken to initiate data collection. Several steps were taken to clean and validate the data using a software package. Finally, the estimation of the index with respect to economic, social and ecological parameters was done.

3.1 Selection of the agro-climatic zones

Punjab is traditionally classified into three agro-climatic zones primarily based on homogenous factors like climatic conditions, precipitation distribution, soil type, and cropping pattern (World Bank, 2003). The organic and conventional farming systems for 178 farm plots across three agro-climatic zones – the North-East (Districts of S.A.S. Nagar, Rupnagar, and Hoshiarpur), Central (Patiala District) and South-West (Districts of Mansa and Bhatinda) – were assessed, as depicted in Figure 1. Thus, 88 organic and 90 conventional farm plots were identified from the three zones.

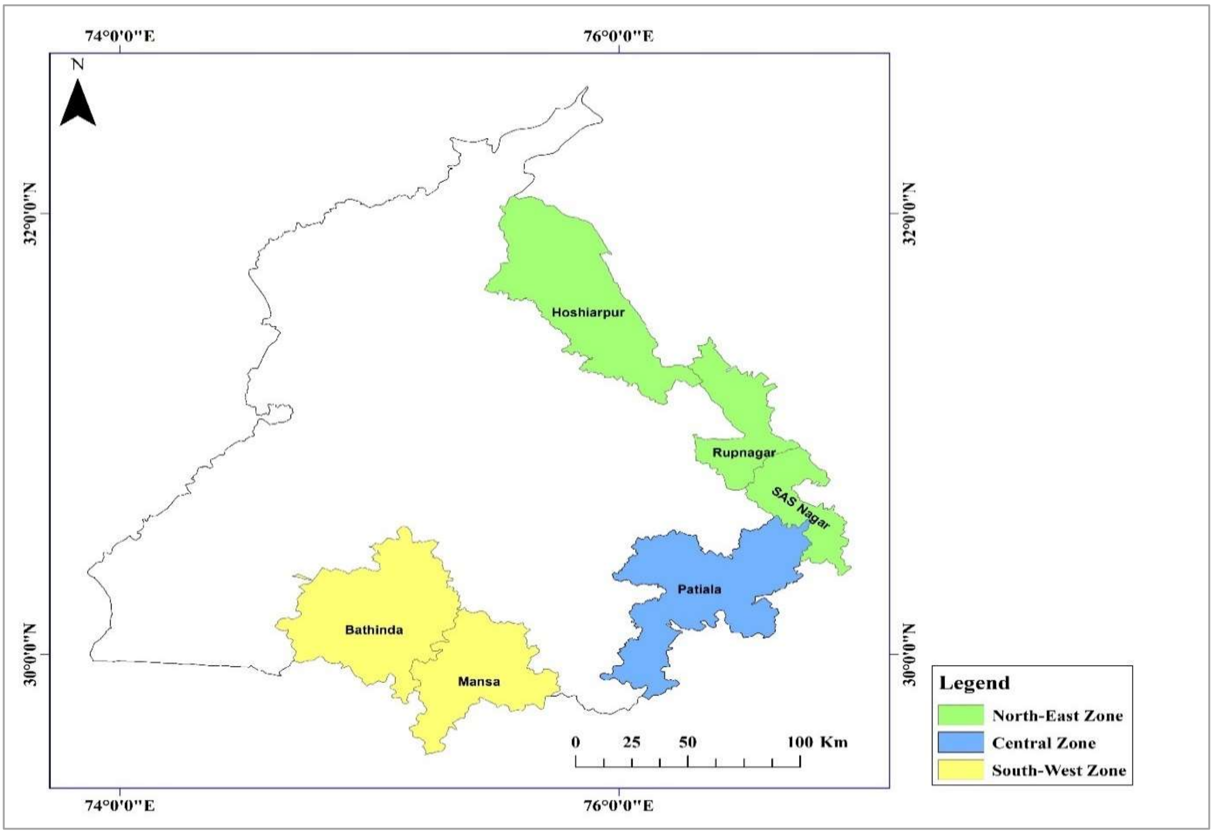
The northeast zone is a sub-mountainous region also called the Kandi or wheat-maize belt, covering around 19 per cent of the geographical area of the state, with relatively high rainfall (950 mm) and low levels of groundwater. The central or wheat-paddy zone covers 47 per cent area with 650 mm rainfall and a depleting groundwater level. The South-West Zone or wheat-cotton region accounts for 34 per cent area with 400 mm of rain and faces waterlogging problems. Thus, the research provides an opportunity to capture the spatial variations in agriculture.

3.2 Description of the sample crops

The two cropping seasons – Rabi 2020-2021 and Kharif 2021 – were considered for the purpose

[2] The participating experts were Prof. Srijit Mishra (Indira Gandhi Institute of Development Research, Mumbai), Dr. Siva Muthuprakash K.M. (VikasAnvesh Foundation, Mumbai), and Mr. C.S. Grewal (Technocrat and certified organic farmer, Mohali).

Figure 1 Sample Agro-Climatic Zones under Study



Source: Depiction by Kralia (Department of Geology, Panjab University).

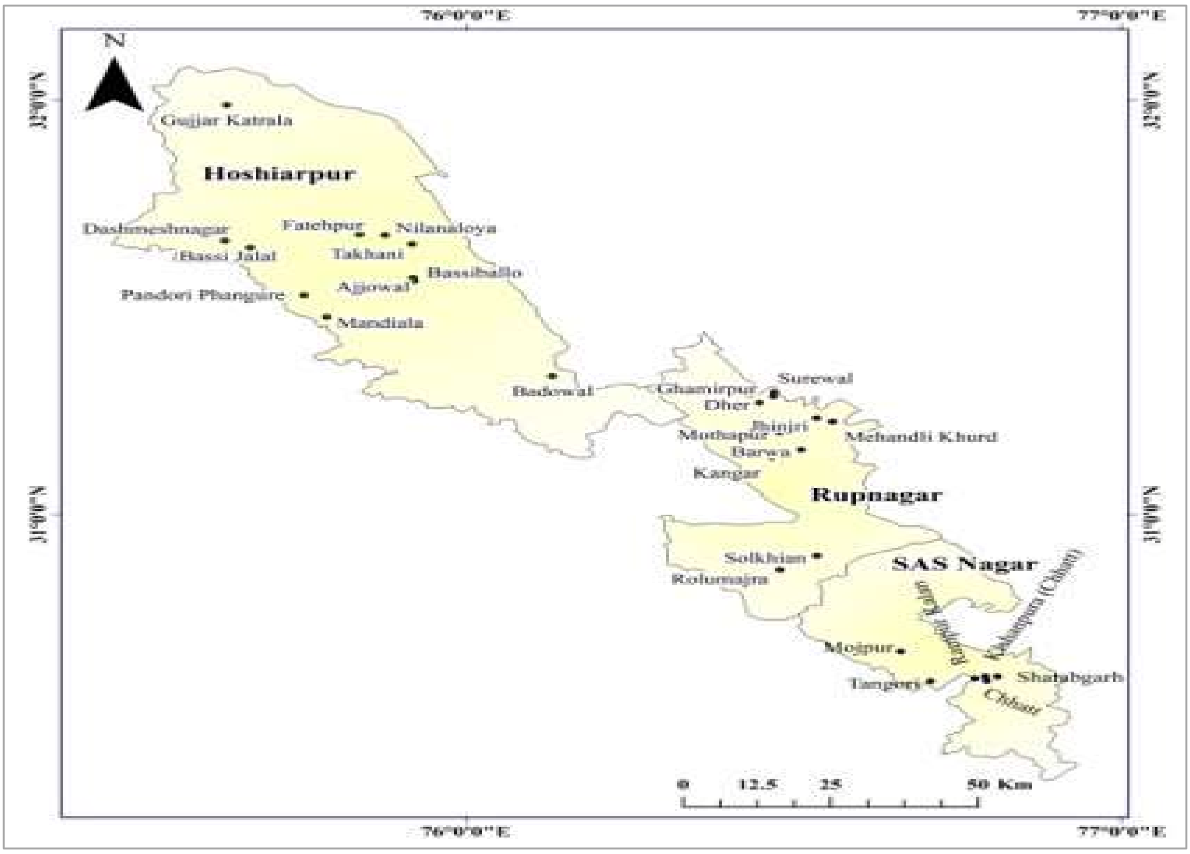
of analysis. According to the Punjab Economic Survey (2020-2021), approximately 40 per cent of the total cultivated land in Punjab is being used to grow rice, an area of 31.42 lakh hectares. Other major Kharif crops include cotton (3.2%), followed by maize (1.5%) and sugarcane (1.2%). Approximately 45 per cent of the total cultivated land or 35.21 lakh hectares is used to cultivate wheat, a Rabi crop. Accordingly, wheat, rice and cotton are the major crops of interest in the present study. Wheat is a prime Rabi cereal crop of Punjab, with the optimum sowing time being the first fortnight of November. The crop is harvested in mid-April. Paddy is a significant Kharif crop cultivated in all the districts of Punjab, with the sowing period commencing in June-July and harvesting carried in October-November. Cotton is the second major crop in the Kharif season, with sowing completed by mid-May. The cotton-picking period is from mid-September to November.

3.3 Profile of the sample

A list of organic farmers from the six districts under study was accessed through the database provided by the Kheti Virasat Mission, a non-profit registered trust and Nabha Foundation, a charitable trust. These trusts work with farmers to revive and conserve natural farming practices. Purposive sampling with samples selected based on the population's characteristics and the research objectives was adopted for covering the best comparative pairs of organic and conventional plots. The main criteria for selecting organic farmers in the study was to ensure that the paired organic and conventional fields have similar farming conditions (e.g., soil, water availability, crop pattern) at the closest possible locations. Organic farmers were shortlisted based on their conversion to organic farming at least three years earlier, irrespective of whether they are certified. Punjab has a relatively minor share of marginal and small farmers (below 2 hectares) in comparison to the national averages. It was observed that the organic farmers have marginal and small landholdings in Punjab. However, the plot size matching was a daunting task due to organic farming primarily being carried out on small and marginal plots. Further, several farmers were practising both organic and conventional agriculture.

A total of 125 farmers were interviewed across 68 villages from six districts. The field locations in the North-East Zone of Punjab are shown in Figure 2. Six, ten and eleven villages were visited each in the districts of S.A.S. Nagar, Rupnagar, and Hoshiarpur respectively. The distance between sample farms at the remotest east, Shatabgarh in S.A.S. Nagar District (30.61°N, 76.81°E), and farther north, Gujjar Katrala in Hoshiarpur district (31.99°N, 75.64°E) is over 230 km.

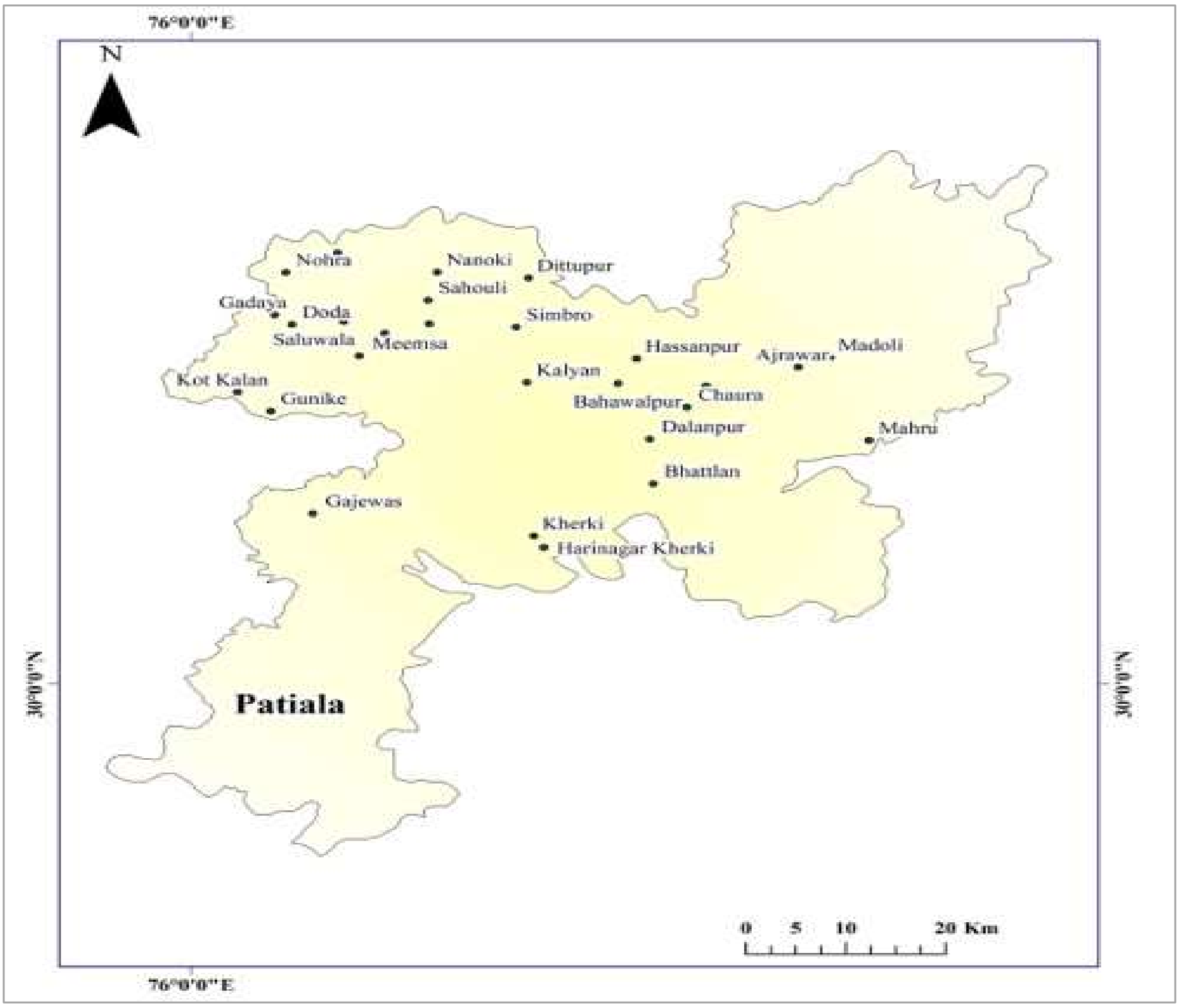
Figure 2 Field Locations in the North-East Zone of Punjab



Source: Depiction by Kralia (Department of Geology, Panjab University).

The farm sites in the Central Zone of Punjab are shown in Figure 3. Twenty-eight villages were visited in the Patiala district. The sample farms are spread over 40 km around Bahawalpur village in Patiala. Located in the Nabha Tehsil of Patiala, the Nabha Foundation has undertaken several initiatives to promote sustainable agriculture among small and marginal farmers.

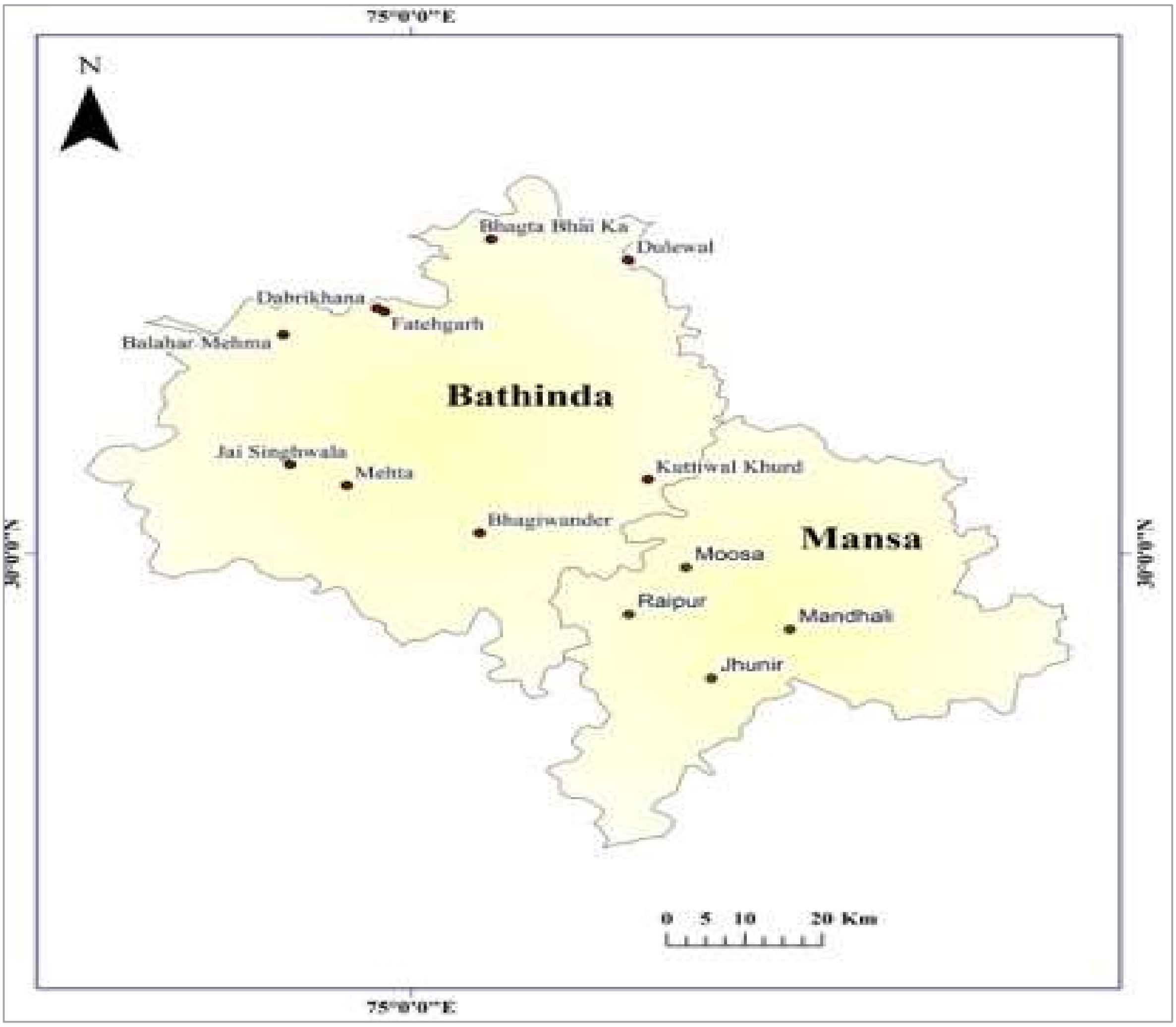
Figure 3 Field Locations in the Central Zone



Source: Depiction by Kralia (Department of Geology, Panjab University).

Figure 4 shows the field locations in the South-West Zone of Punjab. A total of four villages in the Mansa district and nine villages in the Bhatinda district were surveyed. Before 1992, Mansa was a part of the erstwhile Bathinda district. The farms were spread over a relatively large radius, with a latitude ranging from 29.81°N for Jhunir village to 30.48°N for Bhagta Bhai Ka village. The distance between these two villages is approximately 103 kilometres. Similarly, Mandhali village at a longitude of 75.44°E and Balahar Mehma at 74.85°E is around 94 km. The Nabha Foundation has been promoting sustainable farming practices among the farmers in Mansa District together with Talwandi Sabo Power Ltd. as a corporate social responsibility initiative of the Vedanta Group.

Figure 4 Field Locations in the South-West Zone



Source: Depiction by Kralia (Department of Geology, Panjab University).

As can be seen from Table 4, the overall sample has only two per cent women farmers and that too concentrated in only one district, i.e., Patiala. The average age of the respondents is 47 years, with the youngest and oldest of 23 years and 72 years, respectively. Further, 46 per cent of farmers are 50 years and above. The participation of the youth (< 30 years) in farming is a dismal ten per cent. The education-wise distribution of farmers shows that 63 per cent of farmers are educated upto higher-secondary level and above. With an average farming experience of 25 years, 70 per cent of the farmers have an experience of 20 years and more.

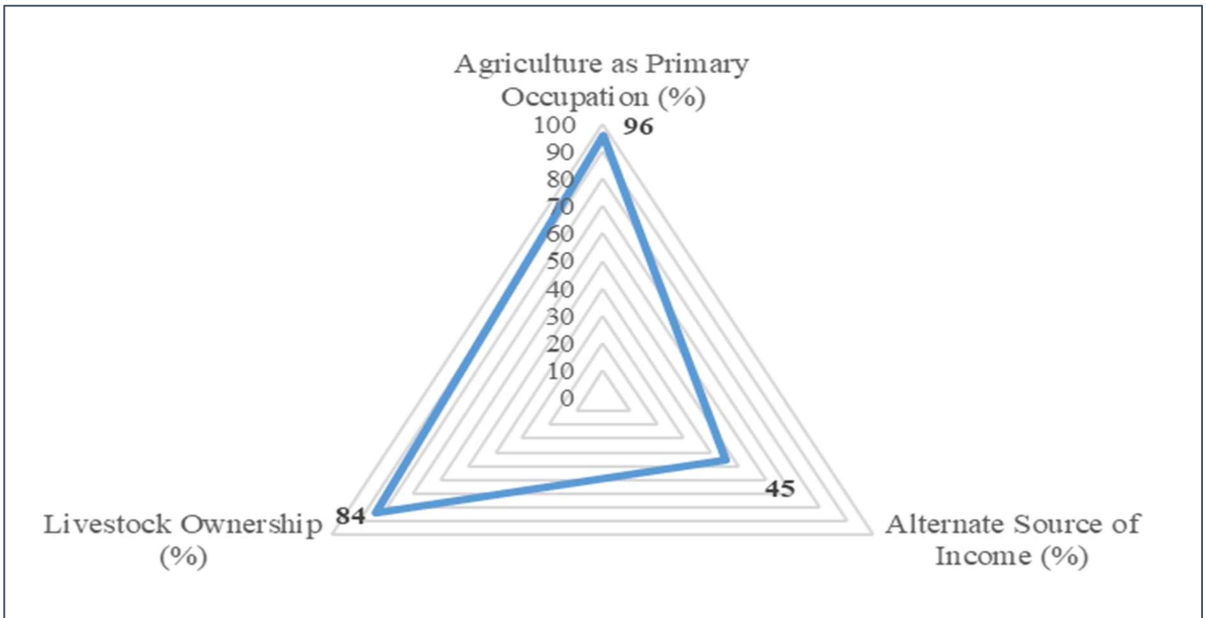
For 96 per cent of the farmers, agriculture is their primary occupation, as depicted in Figure 5. About 45 per cent of the farmers have an alternate source of income, protecting them against the vagaries leading to production let-downs. Around 84 per cent of farming household's own livestock, primarily buffaloes and cows.

Table 4 Demographic Profile of the Farmers

		Number	Percentage
Gender	Male	122	98
	Female	3	2
Age (in years)	Less than 30	13	10
	30-39	27	22
	40-49	28	22
	50-59	29	23
	60-69	22	18
	Above 70	6	5
Education	No formal education	5	4
	Primary	6	5
	Secondary	35	28
	Higher-Secondary	33	26
	Graduate	30	24
	Post-graduate	16	13
Farming experience (in years)	Less than 10	16	13
	11-19	21	17
	20-29	34	27
	30-39	27	22
	40-49	19	15
	Above 50	8	6

Note: $n = 125$
Source: Compilation by Gill and Sharma.

Figure 5 Sources of Income and Livestock Ownership



Note: $n = 125$
Source: Depiction by Gill.

With 100 per cent irrigated land, around 83 per cent of the organic farmers plough their own owned land compared to 67 per cent of the conventional ones. As can be seen from Table 5, the average size of organic plots is 2.56 acres, with minimum and maximum being 1 acre and 9 acres, respectively. The mean, maximum, and minimum farm field size for conventional farming plots is 11.16 acres, 36 acres, and 1 acre respectively. Thus, organic farmers are primarily practising on small and marginal farm plots. Amongst organic farmers, 49 per cent are certified, with 43 per cent having a second source of income.

Table 5 Farm Plot Sizes

	Crop	Obs.	Mean	Std. Dev.	Min	Median	Max
Panel A: North-East Zone (Districts of S.A.S. Nagar, Rupnagar, and Hoshiarpur)							
Organic	Wheat	30	2.87	2.50	0.50	2.00	10.00
	Rice	27	3.02	2.59	0.50	2.00	10.00
Conventional	Wheat	32	6.63	7.48	1.00	3.50	30.00
	Rice	31	6.47	7.05	1.00	4.00	30.00
Panel B: Central Zone (Patiala District)							
Organic	Wheat	30	2.73	2.59	1.00	2.00	14.00
	Rice	28	2.82	2.66	1.00	2.00	14.00
Conventional	Wheat	30	19.48	17.01	4.00	15.00	70.00
	Rice	30	19.48	17.01	4.00	15.00	70.00
Panel C: South-West Zone (Districts of Mansa and Bathinda)							
Organic	Wheat	31	2.10	1.49	1.00	1.50	7.00
	Rice	18	2.33	1.50	1.00	2.00	7.00
	Cotton	13	1.56	1.11	1.00	1.00	5.00
Conventional	Wheat	31	15.40	13.16	1.50	15.00	64.00
	Rice	23	14.11	13.05	1.50	14.00	64.00
	Cotton	07	12.21	8.70	3.00	8.00	25.00
Panel D: Plot Sizes (in acres)							
Organic	Total	88	2.56	1.88	1.00	2.00	9.00
Conventional	Total	90	11.16	8.58	1.00	9.00	36.00

Source: Compilation by Gill and Sharma.

3.4 Preparation and administration of the survey instrument

The survey instrument used in this research is an extended version of the farm assessment index proposed by Muthuprakash (2018). Accordingly, an extensive validated questionnaire was used to collect the quantitative details of farm inputs, including machinery usage, materials used and labour, along with their actual and opportunity cost. In addition, qualitative parameters were built into the questionnaire to measure the contextual aspects of farming in the national indicator framework of sustainable agriculture (Muthuprakash and Damani, 2019). A multidimensional nature of sustainability necessitated this diversity to obtain more reliable measures of general tendencies and extricate them from circumstantial ones resulting in the present questionnaire (Annexure C).

Each questionnaire (English and Punjabi) consisted of three parts. In the first section (questions 1 and 2), respondent farmers provided their personal and asset details. The second section (questions 3-12) pertained to soliciting data feeding the construction of quantitative CFAI and has been closely designed around the one used by Muthuprakash (2018). This was followed by questions (13-18) on getting details about farmers' other sources of income, debt position, and agricultural insurance or subsidies. Finally, the third section (questions 19-22) related to questions on the general perception of the respondents' on-farm management resources, social interface and extension activities, as well as experiences, challenges and suggestions. This section was framed around one proposed by Muthuprakash and Damani (2019) and Muthuprakash et al. (2020).

The social sciences have been paying increasing attention to the issue of research ethics (e.g., Finch, 1984; Borland, 1991; Hornsby-Smith, 1993; Gilhooly, 2002). Researchers are responsible for ensuring that research participants' physical, social, and psychological well-being is not adversely affected by the research (British Sociological Association, 2002). Therefore, informed consent was secured from the respondents at the initiation itself after sufficiently informing them about the research objectives and the stated outcomes. A common problem faced in participative research is that respondents often over-report desirable activities and under-report undesirable ones (Krumpal, 2013). As a result, researchers gather situation-specific information that cannot be generalised. To address this, the questionnaire's cover page stated that anonymity would be observed. Further, the respondents were gently apprised of the value they were potentially bringing to the research. The questionnaires were personally administered and completed on the field by trained facilitators over a six months period.[3]

3.5 Analysis of the soil physicochemical

Concerted efforts were made to collect soil samples from all 178 organic and conventional farm plots. The experimental soil samples were collected randomly at 0-15 cm and 15-30 cm

[3] A PU-TIGR^{2}ESS workshop on *'Survey Field Work and Data Collection'* was held on Tuesday, 31st August 2021, for the facilitators (Maitri Sharma, Malika Kukreja, Sheena Chadha, Bhagel Singh, and Simran Rajput), by the resource person Dr. Amandeep Singh Sidhu, Agronomist, School of Organic Farming, Punjab Agricultural University, Ludhiana.

depth.[4] Estimating soil parameters like nutrient content, soil pH, soil salinity and soil organic carbon required soil sample analysis. Each sample was collected as per the Government of India's soil testing manual (Department of Agriculture and Cooperation, 2011) and analysed using the standard protocol. Accordingly, available nitrogen (N), phosphorus (P) and potassium (K) were estimated by Kjeldahl (Singh and Pradhan, 1981), modified Bray (Bray and Krutz, 1945), and flame photometric methods (Jackson, 1973), respectively. The determination of pH (1:2) was done by a digital pH meter and salinity by an electrical conductivity meter (ELICO-L11 62). The soil organic carbon (SOC) was assessed by Walkley and Black's rapid titration method (Walkley and Black, 1934). All the samples were packed in a labelled poly bags and sent for analysis purposes to the Bhumi Vigyan Vibhag (Soil Testing Laboratory), Punjab Agricultural University, Ludhiana.[5] As part of the survey research process' commitment made to participant farmers, soil test reports were shared with the farmers to manage their farms better (Annexure D).

3.6 Application of the CFAI

The spreadsheet tool devised by Muthuprakash (2018) enabled making detailed data entry about the farm activities and automating the estimation of indicators and composite indices.[6] However, the tool was improvised to make it region-specific and include qualitative factors, as discussed in Section 2. Accordingly, the reference points used for normalisation and the weightage distribution were altered among the indicators to compute CFAI with a new set of weights for indicators. The data from field visits were entered into the CFAI tool and verified for completeness. Efforts were made to ensure that data gaps and extreme entries were avoided.[7]

3.7 Statistical analysis

The main quantitative characteristics of the sample were explored by applying descriptive statistics, i.e., using mean and standard deviation of scores between subjects and groups of them. Due to their immediacy, this analysis also employs histograms and radar charts to represent the dimensions of different attributes. Significant differences between the organic and conventional farming methods were analysed using SPSS software (version 26). Univariate

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[4] A PU-TIGR^{2}ESS workshop on *'Taking a Soil Sample for Soil Testing'* was held on Monday, 13th September 2021, for the facilitators with the resource person Dr. Gurpreet Singh, Extension Scientist (Soil Science), Farm Advisory Service Center, Patiala demonstrating the nuances of soil testing.

[5] Punjab Agricultural University, established in 1962, is a pioneer state agricultural university in India for research, education and extension in India.

[6] https://www.cse.iitb.ac.in/~damani/FAI/fai.html

[7] Extreme entries/outliers as to landholdings were statistically identified and removed for six plots each for both organic and conventional.

analysis by invoking one-way analysis of variance (ANOVA) using the general linear model was done to determine the differences between farming systems in different agro-climatic zones.

4 Results and Discussion

The examination of the CFAI score and it's three constituting indices is valuable for discussing assessment output. A detailed discussion of constituent indicators and sub-indicators in each index presents a host of information that unfolds the variability and the complexity of socio-economic and biodiversity within spatially different agro-ecosystems. As discussed, the cost and impact indicators like farm cost and pesticide impact have been normalised using a negative slope function. Therefore, for interpretation, the normalised value being on a positive scale implies that the lower the farm costs, higher will be the value of normalised farm cost, indicating a better farming system.

4.1 Economic indicators

The one-way ANOVA procedure shows statistical mean differences between the organic and conventional farming systems on the key production costs and income for wheat, rice, and cotton crops, together with the *F*-test results as presented in Table 6. For wheat, there was a statistically significant difference between organic vis-à-vis conventional system for labour cost ($p = 0.003$) and gross income ($p = 0.032$) in the North-East zone, with the mean values higher for organic farm plots. Similarly, for the Central and South-West zones, machine-related costs and total costs are significantly higher for organic farmers ($p < 0.001$). On the other hand, for the South-West Zone, the average gross income on organic wheat was significantly lower ($p = 0.005$).

For paddy, as shown in Table 7, mean scores for material cost and total cost were significantly higher for organic vis-à-vis conventional farm plots for both the North-East and South-West zones. This income divergence for gross ($p = 0.002$) and net ($p = 0.018$) rice production shows lower income realisation for organic production. A similar outcome has been reported in the South-West Zone, though insignificant. Mansa and Bhatinda districts are a part of Punjab's cotton belt. As apparent from Table 8, though the material cost is significantly higher ($p = 0.099$), due to lower labour and machinery costs, the net income of organic cotton growers is higher at a 10 per cent level of significance.

Table 6 Zone-wise Descriptives of Farm Costs and Income for Wheat (in ₹/acre)

	Organic (ORG)		Conventional (CNV)		Mean Difference (ORG - CNV)	df	F	Sig.
	Mean	Std. Deviation	Mean	Std. Deviation				
Panel A: North-East Zone[a]								
Material cost	2,02,455.19	8,93,047.80	28,681.36	45,982.13	1,73,773.83	62	3.761*	0.057
Labour cost	10,861.22	6,838.44	7,601.92	3,873.69	3,259.30	62	9.425***	0.003
Machine cost	5,349.34	4,285.66	5,105.63	1,782.84	243.72	62	0.769	0.384
Total cost	2,18,665.79	9,00,953.53	41,388.91	45,050.25	1,77,276.88	62	3.819*	0.055
Paidout cost	1,94,456.46	9,04,545.35	36,347.62	45,440.16	1,58,108.83	62	3.804*	0.056
Gross income	60,060.68	67,302.78	41,824. 70	11,269.16	18,235.98	62	4.822**	0.032
Net income	34,581.03	75,982.93	5,999.65	50,461.26	28,581.38	59	1.106	0.297
Panel A: Central Zone[b]								
Material cost	16,882.67	11,963.22	14,075.06	13,122.87	2,807.61	58	0.353	0.084
Labour cost	6,463.83	2,020.81	8,296.19	9,817.46	-1,832.35	58	3.081	0.555
Machine cost	42,538.78	55,654.36	6,861.17	3,525.88	35,677.61	58	33.646***	<0.001
Total cost	65,885.28	61,882.84	29,232.41	16,969.17	36,652.87	58	13.051***	<0.001
Paidout cost	26,770.04	26,573.22	23,914.55	16,860.07	2,855.49	58	1.598	0.211
Gross income	75,885.79	93,041.65	64,262.42	67,996.38	11,623.37	58	0.850	0.360
Net income	49,115.76	94,719.63	40,347.87	70,879.13	8,767.89	58	0.592	0.445
Panel A: South-West Zone[c]								
Material cost	29,194.56	60,497.78	16,618.79	50,904.21	12,575.77	60	1.224	0.273
Labour cost	7,510.40	2,711.07	6,587.99	2,308.37	922.40	60	1.492	0.227
Machine cost	5,682.02	3,062.30	5,176.80	2,471.26	505.22	60	0.366	0.548
Total cost	42,386.98	62,030.66	28,383.59	54,246.99	14,003.39	60	0.922	0.341
Paidout cost	11,922.93	6,425.14	13,958.89	9,982.54	-2,035.95	60	0.351	0.556
Gross income	35,499.19	17,398.28	46,056.21	9,617.64	-10,557.02	60	8.533**	0.005
Net income	23,576.26	19,123.07	32,097.32	15,354.97	-8,521.06	60	2.408	0.126

Notes: [a]Number of observations for organic and conventional plots are 33 and 31, respectively; [b]Number of observations for organic and conventional plots are 30 and 30, respectively; [c]Number of observations for organic and conventional plots are 31 and 31, respectively; ***, **, and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Source: Calculations are done using SPSS (version 26) software by Gill

Table 7 Zone-wise Descriptives of Farm Costs and Income for Rice (in ₹/acre)

	Organic (ORG)		Conventional (CNV)		Mean Difference (ORG - CNV)	df	F	Sig.
	Mean	Std. Deviation	Mean	Std. Deviation				
Panel A: North-East Zone[a]								
Material cost	1,73,158.40	6,65,351.46	3,677.319	2,004.22	1,69,481.07	58	1.443**	0.014
Labour cost	29,113.60	15,342.05	30,701.94	18,137.62	- 1,588.34	58	- 0.363	0.163
Machine cost	14,810.53	9,931.94	20,389.72	21,192.78	- 5,579.19	58	- 1.275	0.408
Total cost	2,17,082.50	6,59,702.79	54,768.98	33,927.95	1,62,313.53	58	1.391**	0.027
Paidout cost	35,895.29	22,818.13	31,578.05	21,676.87	4,317.24	58	0.751	0.613
Gross income	70,100.63	64,339.70	62,103.65	29,516.63	7,996.99	58	0.632	0.163
Net income	34,346.92	72,813.62	31,489.11	38,950.88	2,857.81	55	0.187	0.185
Panel A: Central Zone[b]								
Material cost	21,395.79	6,398.58	19,385.99	6,183.34	2009.80	56	0.004	0.950
Labour cost	15,503.71	7,263.96	15,827.19	6,755.78	- 323.48	56	0.001	0.979
Machine cost	9,681.22	12,579.44	6,014.17	10,916.11	3667.06	56	1.422	0.238
Total cost	46,580.72	15,794.34	41,227.35	12,268.22	5353.37	56	1.819	0.183
Paidout cost	29,384.14	11,707.87	27,866.23	12,486.48	1517.91	56	0.391	0.534
Gross income	53,678.11	28,785.86	59,963.13	11,706.54	- 6285.01	56	10.097***	0.002
Net income	24,293.97	32,998.30	32,096.90	19,315.90	- 7802.93	56	5..957**	0.018
Panel A: South-West Zone[c]								
Material cost	25,357.22	49,123.36	8,084.25	10,400.19	17,272.97	39	6.063**	.018
Labour cost	18,606.06	7,562.35	18,593.75	12,415.67	12.30	39	0.339	.564
Machine cost	15,732.18	9,647.76	14,056.67	8,164.40	1,675.51	39	0.046	.831
Total cost	59,695.46	46,895.01	40,734.67	20,508.46	18,960.78	39	3.293*	.077
Paidout cost	31,142.64	10,674.09	30,157.47	21,716.57	985.18	39	0.912	.345
Gross income	41,589.72	12,842.37	61,603.04	10,270.12	-20,013.32	39	0.775	.384
Net income	10,447.08	17,340.11	31,445.58	25,087.65	-20,998.50	39	0.053	.818

Notes: [a]Number of observations for organic and conventional plots are 27 and 30, respectively; [b]Number of observations for organic and conventional plots are 28 and 30, respectively; [c]Number of observations for organic and conventional plots are 18 and 23, respectively; ***, **, and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Source: Calculations are done using SPSS (version 26) software by Gill.

The normalised indicator values and their corresponding indicator means are given in Table 9. For wheat, the income and nutrient use efficiency is better in the case of organic farms situated in the North-East Zone. For the Central Zone, the normalised values are higher for income per acre and riskiness, i.e., the total cost of cultivation, including the imputed self-borne costs, for the former and water use efficiency for the latter. The nutrient use efficiency parameters for organic paddy are higher for the North-East and Central zones. Furthermore, the normalised values for income and riskiness are better for the Central Zone. On the other hand, the cropping of organic cotton in the South-West Zone yields higher income, benefit-cost ratio (proportion of the total value of farm produce to the paid-out cost of cultivation) and riskiness.

4.2 Social indicators

The normalised values of social indicators like the knowledge of best farming practices and their sources, self-reliance in terms of self-borne costs, health impacts from no usage or organic pesticide usage, and institutional strength due to advice received from a community or producers' group and availability of credit are higher for organic in comparison to the conventional farming system. This is irrespective of the crops sown or the agro-climatic zones (Table 10). Similarly, drudgery (i.e., gross income per unit labour cost) has been weak overall in organic and chemical farms as the net receipt from the farm produce is relatively less than the labour involved in the production process. Further, agricultural output measured in yield per acre and the employment generated calculated as the ratio of total labour cost to the total cost of cultivation has been higher for the conventional farming system.

For the wheat crop, farm resources (i.e., presence of peripheral field trees and livestock) for the North-East Zone, as well as social capital (i.e., associating with any community or producers' group and related benefits), financial resources (i.e., the paid-out cost of cultivation), and gender equality (contribution of women in agriculture operations) are higher for the Central and South-West zones. For rice cultivation in the North-East Zone, the values for farm and financial resources are higher for organic farmers. For the other two zones, the indicators for organics were higher for social capital and gender equality. For cotton crops, financial resources are an important factor for organic farmers.

4.3 Ecological indicators

Table 11 presents the normalised values of ecological indicators across different agro-climatic zones and crops. A striking observation across all zones and crops for environmental dimension was more biodiversity and less water contamination on organic vis-à-vis conventional farms.

Table 8 Descriptives of Farm Costs and Income for Cotton in South-West Zone (in ₹/acre)

	Organic (ORG)		Conventional (CNV)		Mean Difference (ORG - CNV)	df	F	Sig.
	Mean	Std. Dev.	Mean	Std. Dev.				
Material cost	7,494.63	11,578.31	6,384.52	2,610.27	1,110.11	18	2.997*	0.099
Labour cost	12,723.63	6,586.74	17,778.98	5,942.36	-5,055.35	18	0.080	0.781
Machine cost	5,874.25	3,648.27	5,891.31	4,456.52	-17.06	18	0.010	0.921
Total cost	26,092.50	12,829.68	30,054.81	6,632.82	-3,962.31	18	2.398	0.139
Paidout cost	16,739.73	7,866.97	25,927.26	8,418.70	-9,187.53	18	0.002	0.965
Gross income	53,215.08	24,033.77	50,808.57	10,338.22	2,406.51	18	1.427	0.248
Net income	36,475.35	26,971.58	24,881.31	6,932.95	11,594.03	18	2.963*	0.100

Notes: [a]Number of observations for organic and conventional plots are 13 and 7, respectively; **, **, and * indicate significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.
Source: Calculations are done using SPSS (version 26) software by Gill.

Table 9 Normalised Values for Indicators Constituting Economic Index

Indicator[a]	North-East Zone				Central Zone				South-West Zone					
	Wheat		Rice		Wheat		Rice		Wheat		Rice		Cotton	
	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV
Income per acre	0.52	0.38	0.39	0.49	0.47	0.41	0.40	0.39	0.38	0.47	0.19	0.44	0.38	0.27
Benefit-cost ratio	0.23	0.23	0.21	0.25	0.24	0.33	0.22	0.27	0.22	0.40	0.16	0.30	0.51	0.35
Riskiness	0.21	0.22	0.25	0.30	0.30	0.26	0.17	0.14	0.22	0.32	0.11	0.20	0.45	0.30
Nutrient use efficiency	0.14	0.11	0.13	0.11	0.25	0.30	0.21	0.19	0.12	0.14	0.11	0.12	0.13	0.20
Water use efficiency	0.23	0.23	0.22	0.22	0.16	0.17	0.15	0.17	0.19	0.20	0.19	0.20	0.19	0.22

Note: [a]Cost indicators values have been normalised using a negative slope function; ORG and CNV are organic and conventional, respectively.
Source: Compilation by Gill and Sharma.

Table 10 Normalised Values for Indicators Constituting Social Index

Indicator[a]	North-East Zone				Central Zone				South-West Zone					
	Wheat		Rice		Wheat		Rice		Wheat		Rice		Cotton	
	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV
Farmer knowledge	0.34	0.33	0.34	0.33	0.44	0.44	0.45	0.44	0.27	0.26	0.27	0.27	0.27	0.25
Social capital	0.60	0.62	0.59	0.62	0.57	0.56	0.58	0.56	0.57	0.58	0.61	0.60	0.52	0.56
Farm resources	0.26	0.23	0.26	0.24	0.26	0.28	0.27	0.28	0.17	0.19	0.17	0.19	0.17	0.19
Financial resources	0.08	0.21	0.61	0.21	0.20	0.16	0.24	0.26	0.25	0.16	0.00	0.17	0.24	0.03
Self-reliance	0.42	0.20	0.47	0.38	0.50	0.24	0.35	0.37	0.53	0.33	0.34	0.28	0.30	0.15
Drudgery	0.99	1.00	0.99	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Health impacts (fertilisers)	0.91	0.93	0.90	0.88	0.78	0.86	0.88	0.90	0.94	0.96	0.66	0.85	0.97	0.89
Health impacts (pesticides)	1.00	0.75	1.00	0.96	1.00	0.87	1.00	0.64	1.00	0.92	1.00	0.64	1.00	0.82
Agricultural output	0.95	0.99	0.63	0.92	0.95	1.00	0.62	0.99	0.91	1.00	0.78	0.99	1.00	1.00
Employment	0.59	0.68	0.57	0.73	0.76	0.94	0.62	0.61	0.73	0.88	0.48	0.58	0.51	0.58
Gender equality	0.46	0.47	0.46	0.47	0.50	0.48	0.50	0.48	0.27	0.26	0.21	0.23	0.50	0.50
Institutional strength	0.39	0.37	0.39	0.36	0.43	0.41	0.43	0.41	0.37	0.36	0.38	0.37	0.35	0.36

Note: [a]Cost and impact indicators values have been normalised using a negative slope function; ORG and CNV are organic and conventional, respectively.
Source: Compilation by Gill and Sharma.

Table 11 Normalised Values for Indicators Constituting Ecological Index

Indicator[a]	North-East Zone				Central Zone				South-West Zone					
	Wheat		Rice		Wheat		Rice		Wheat		Rice		Cotton	
	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV	ORG	CNV
Biodiversity	0.38	0.36	0.37	0.36	0.29	0.28	0.29	0.28	0.36	0.37	0.48	0.38	0.30	0.33
Soil contamination	0.91	0.93	0.90	0.88	0.78	0.86	0.88	0.90	0.94	0.96	0.66	0.85	0.97	0.89
Water contamination	1.00	0.75	1.00	0.96	1.00	0.87	1.00	0.64	1.00	0.92	1.00	0.64	1.00	0.82
Soil health (N)	0.12	0.11	0.13	0.11	0.14	0.12	0.14	0.12	0.09	0.08	0.10	0.08	0.06	0.08
Soil health (P)	0.77	0.84	0.80	0.83	0.80	0.79	0.78	0.79	0.66	0.68	0.80	0.74	0.47	0.53
Soil health (K)	0.42	0.44	0.44	0.44	0.64	0.53	0.65	0.53	0.70	0.53	0.73	0.49	0.66	0.63
Soil health (SOC)	0.79	0.72	0.80	0.72	0.85	0.78	0.85	0.78	0.59	0.58	0.70	0.58	0.45	0.61
Soil health (pH)	0.48	0.53	0.27	0.37	0.27	0.35	0.27	0.35	0.61	0.62	0.32	0.32	0.25	0.28
Soil health (Salinity)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Note: [a]Impact indicators values have been normalised using a negative slope function; ORG and CNV are organic and conventional, respectively.
Source: Compilation by Gill and Sharma.

Further, soil contamination is lower for paddy and organic fields in the North--East and South-West zones.

Amongst the soil health parameters of the field, the normalised values of soil organic carbon (SOC) and nitrogen (N) are higher for organic wheat and paddy, irrespective of the location of the farm plots. On the other hand, the soil pH level has been higher for the conventional plots in the sample zones. The soil physicochemical properties based on the actual field soil sample analysis have been depicted in Figures 6, 7, and 8 for wheat, rice, and cotton.

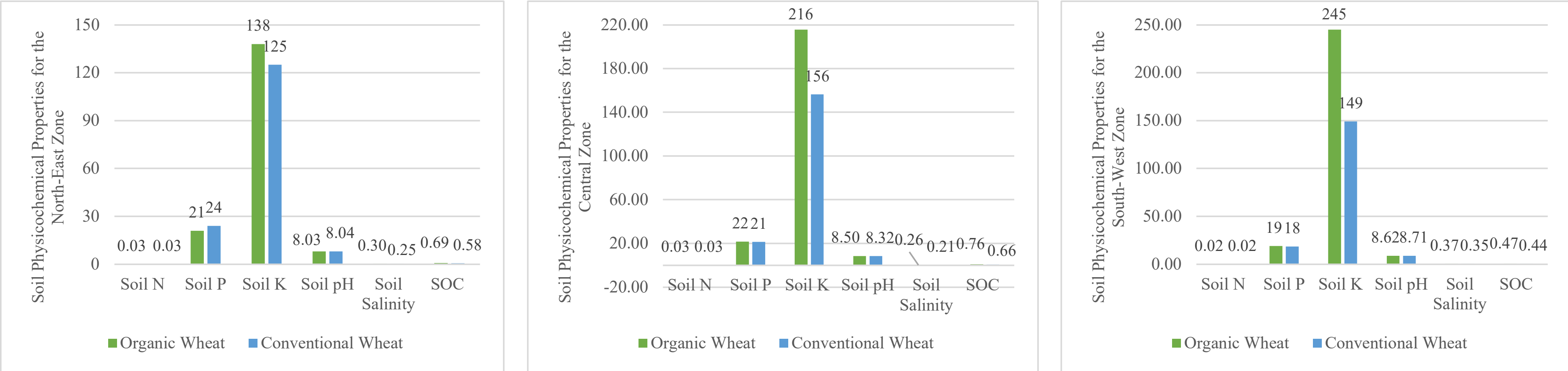
Concurrent with the normalised values, the SOC was higher for organic farms ranging from 0.69-0.47 for wheat and 0.71-0.56 for paddy fields. Likewise, the soil phosphorus (K) content was higher for organic plots. It has been observed, on several organic farms, that the use of composts, manures, bio-fertilisers, crop residues, and cover crops results in an increase in soil test P and K levels above sufficiency. Though it is not harmful to the environment and increases SOM levels, balancing nutrient inputs and outputs is necessary to create environmentally sustainable nutrient management (Kratochvil et al., 2006).

The overall snapshot of the variations observed for alternate crops on economic, social, and ecological indicators for the three agro-climatic zones is provided through the radar charts. These charts more clearly identify the strengths and weaknesses of alternative farming systems considering multiple individual metrics (Floridi et al., 2011). Since each metric's range is normalised, the length of a line from zero to a maximum value represents that indicator. Values closer to the perimeter represent measured values closer to the indicator standard. A larger area within a star plot suggests greater progress towards the stated indicator target.

Figure 9 (a-c) highlights the indicator values of the North-East Zone. Income due to lower cost of production, self-reliance, health impacts of pesticides, water contamination, and SOC are the major high spots of the organic over conventional farming system for wheat crops. Similarly, the foremost upside for paddy is better nutrient use efficiency, higher financial resources, lower water contamination, and high SOC. The soil pH level of organic farms is lower than that of conventional ones, though both are somewhat below the optimal standard. At the same time, the drawdown is income, BCR, riskiness, and agricultural output in terms of yields and employment.

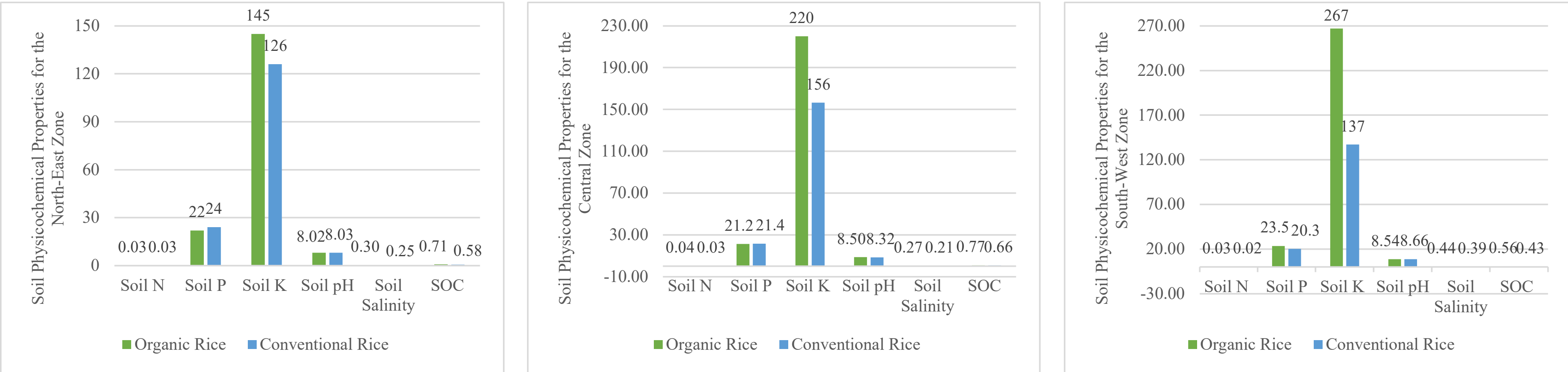
For the Central Zone, as can be seen from Figure 10 (a-c), on the positive side, the farmers growing organic wheat are more self-reliant, with an attendant positive impact on their

Figure 6 Soil Physicochemical Properties of Wheat (based on field soil sample analysis)



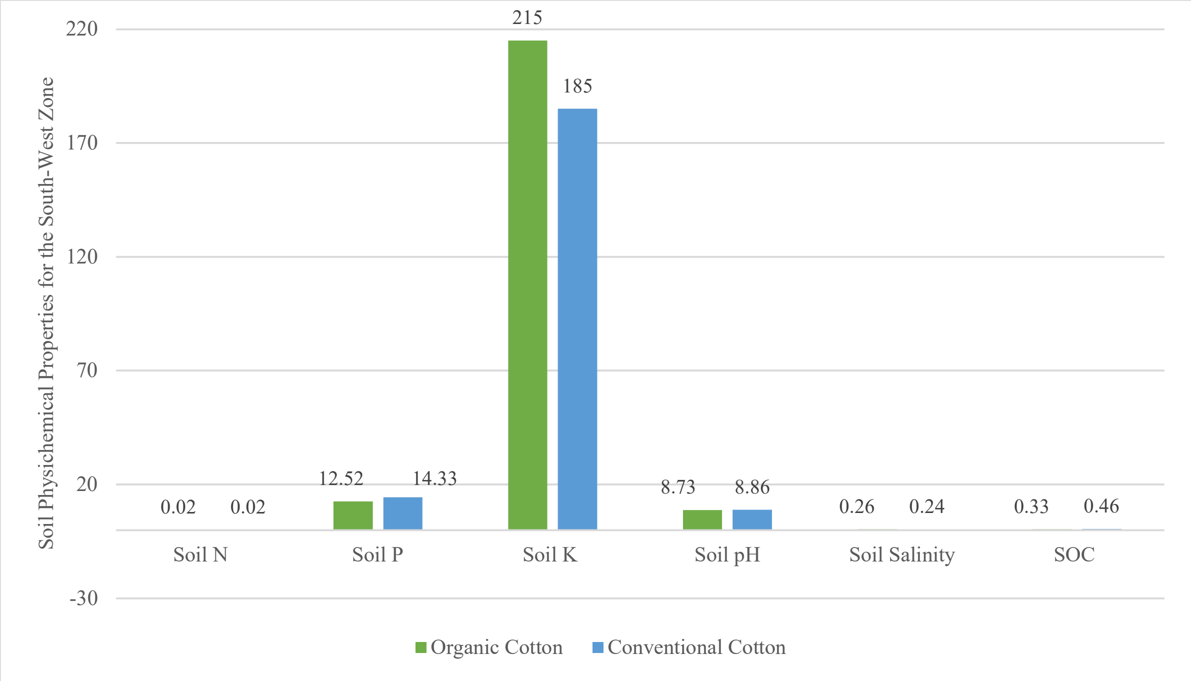
Note: Soil N, P, and K stand for nitrogen, phosphorus, and potassium, respectively; SOC is the soil organic carbon.
Source: Bhumi Vigyan Vibhag (Soil Testing Laboratory), Punjab Agricultural University, Ludhiana.

Figure 7 Soil Physicochemical Properties of Rice (based on field soil sample analysis)



Note: Soil N, P, and K stand for nitrogen, phosphorus, and potassium, respectively; SOC is the soil organic carbon.
Source: Bhumi Vigyan Vibhag (Soil Testing Laboratory), Punjab Agricultural University, Ludhiana.

Figure 8 Soil Physicochemical Properties of Cotton (based on field soil sample analysis)

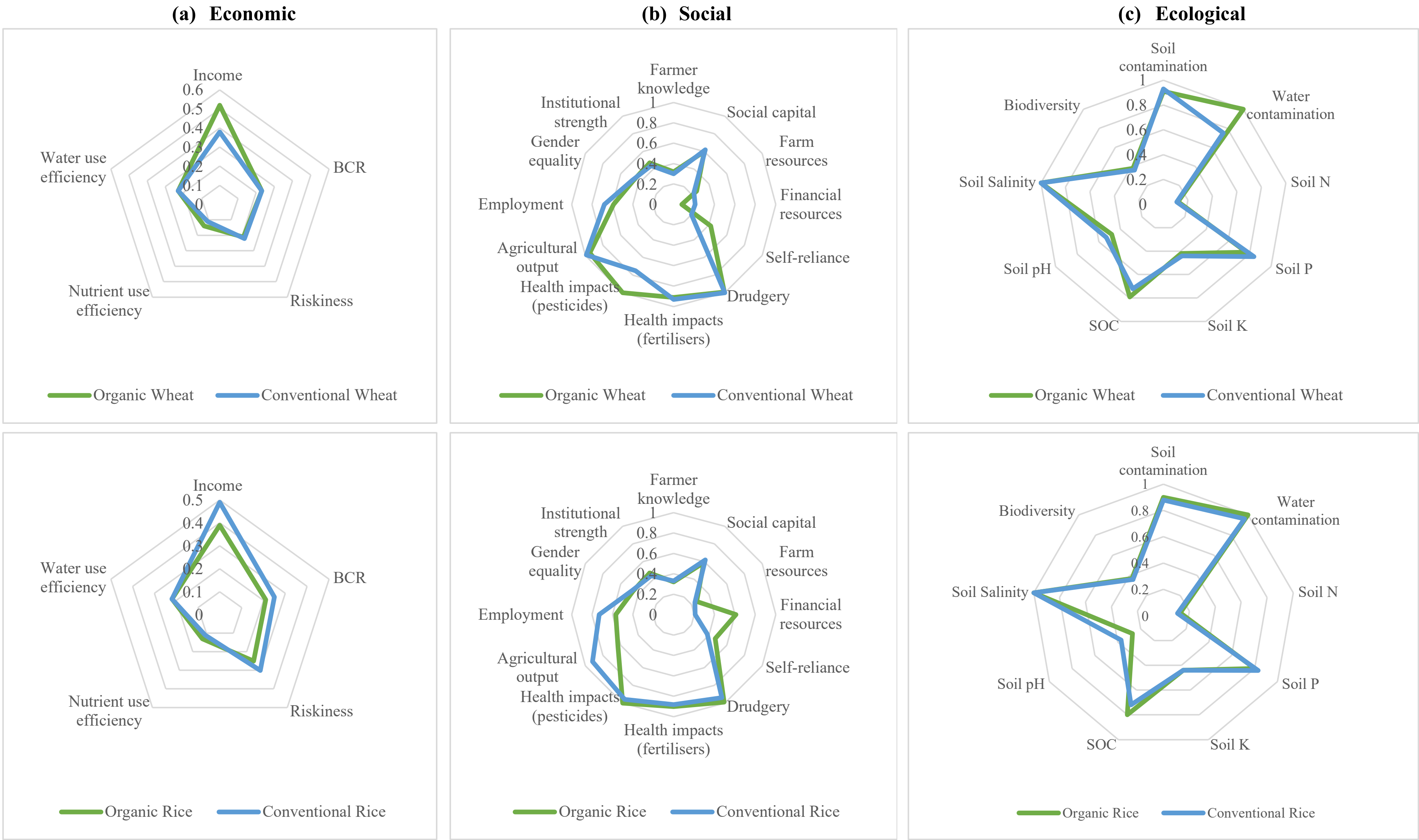


Note: Soil N, P, and K stand for nitrogen, phosphorus, and potassium, respectively; SOC is the soil organic carbon.
Source: Bhumi Vigyan Vibhag (Soil Testing Laboratory), Punjab Agricultural University, Ludhiana.

health because of the use of negligible amounts of insecticides. However, farming does not provide favourable employment opportunities due to lower yields and associated adverse BCR. On the other hand, the health impact of growing paddy organically with negligible usage of pesticides is positive. For similar reasons, water contamination is lower on organic plots. However, the agricultural output is meagre. Available potassium was higher in organic farms for both wheat and rice plots.

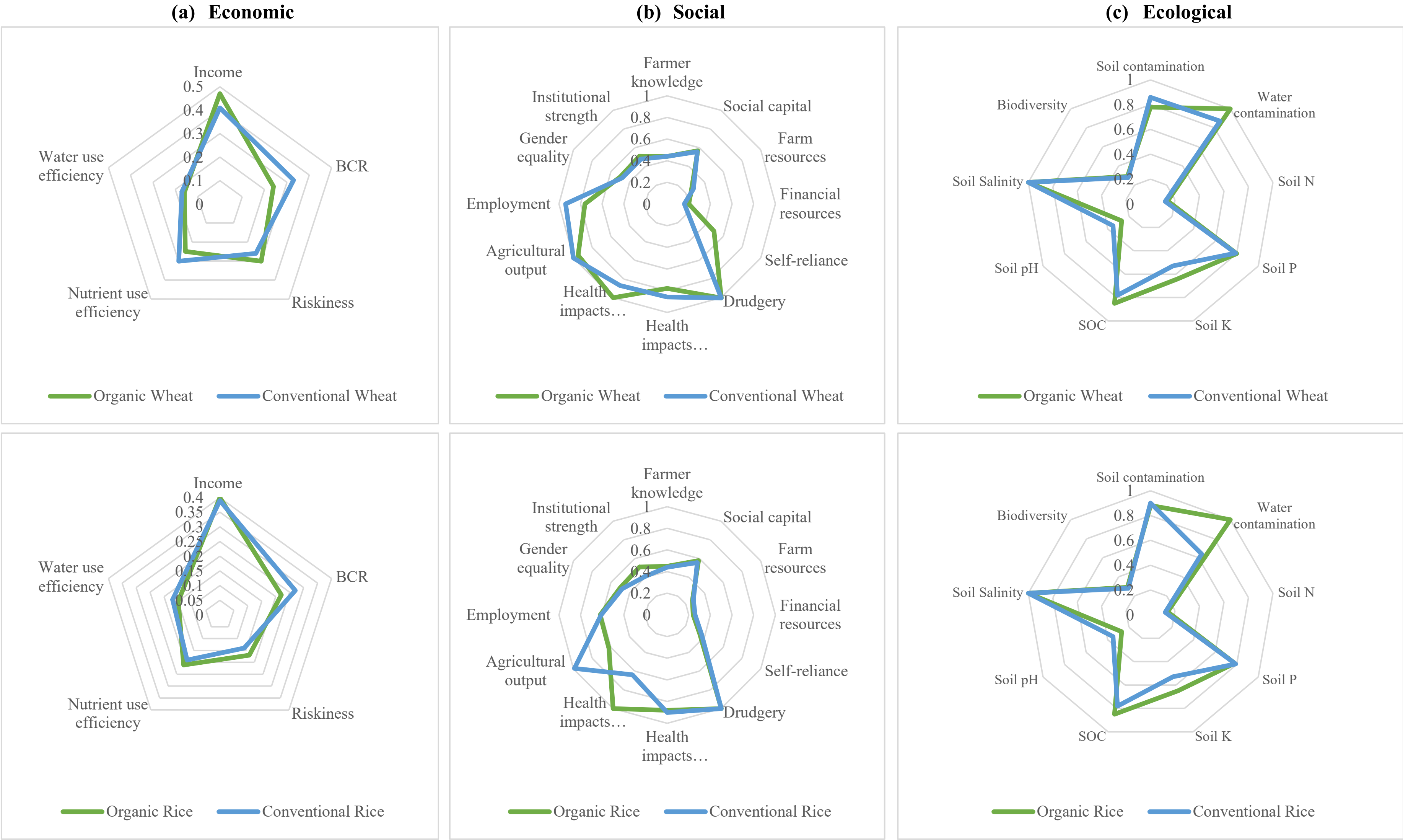
In the South-West Zone, as shown in Figure 11 (a-c), the income per acre, BCR and riskiness are way higher for conventional than organic farming for wheat and paddy. The wheat cultivators usually bear the costs themselves and are therefore self-sufficient. Further, the employment opportunities are significantly lower. For rice cultivation, since the agricultural output is low, it severely impacts the financial resources of sustainable farmers. However, the water contamination is low due to less application of fertiliser. For both organically grown wheat and rice plots, the available potassium in the soil was higher. The organic cropping of cotton has helped farmers consolidate their income, increase the total value of farm produce to the paid-out cost of cultivation, and make them self-reliant with positive health implications, as in Figure 12(a-c). Surprisingly, the organic cotton cultivators are seeking lower support or

Figure 9 Indicator Values for the North-East Zone of Punjab



Source: Depiction by Gill.

Figure 10 Comparative Indicator Values for the Central Zone of Punjab

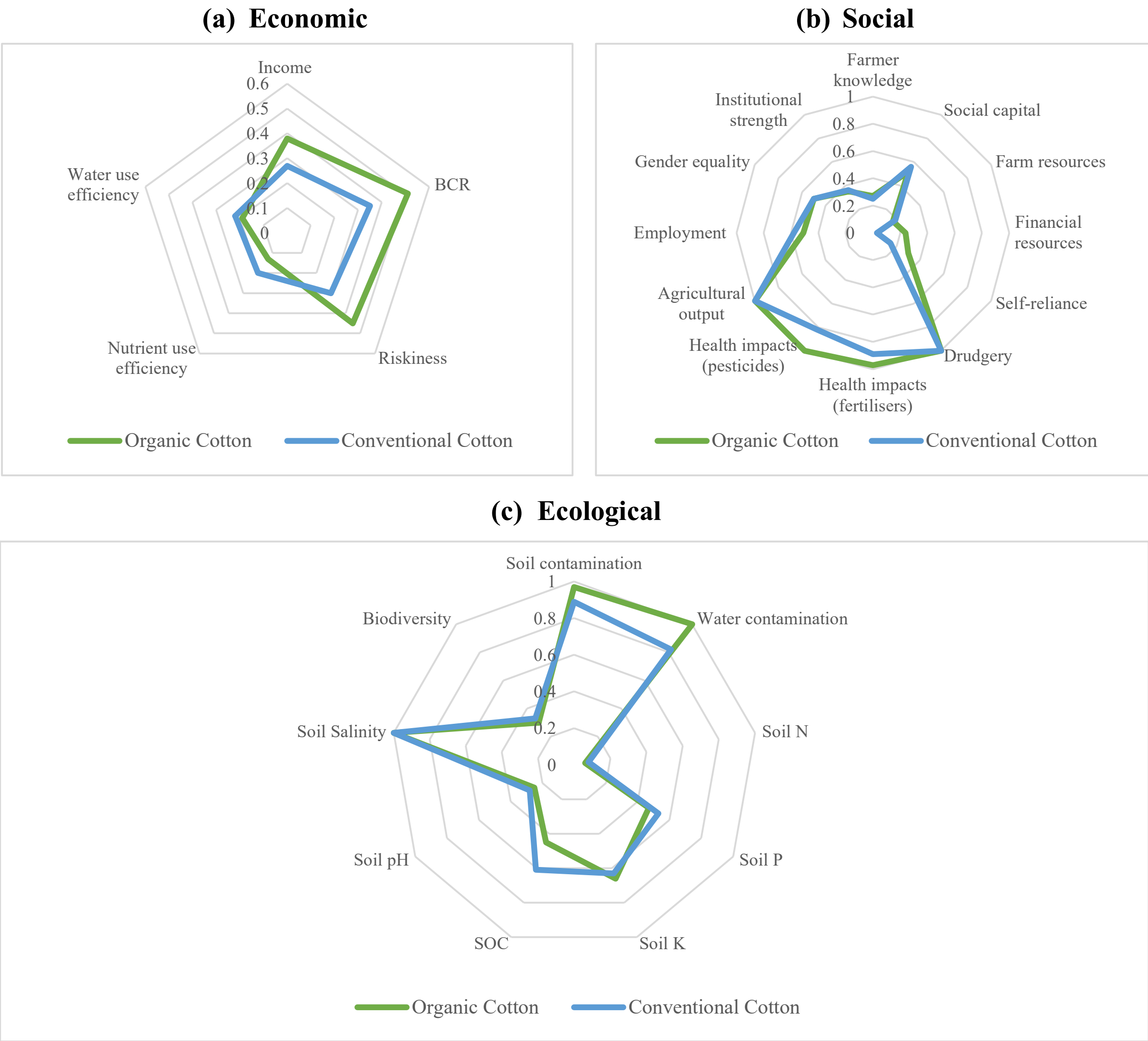


Source: Depiction by Gill.

Figure 11 Comparative Indicator Values in the South-West Zone of Punjab

Source: Depiction by Gill.

Figure 12 Comparative Indicator Values for Cotton in the South-West Zone of Punjab



Source: Depiction by Gill.

intervention, like advice regarding farming practices, from the group or collective they belong to as well as institutions.

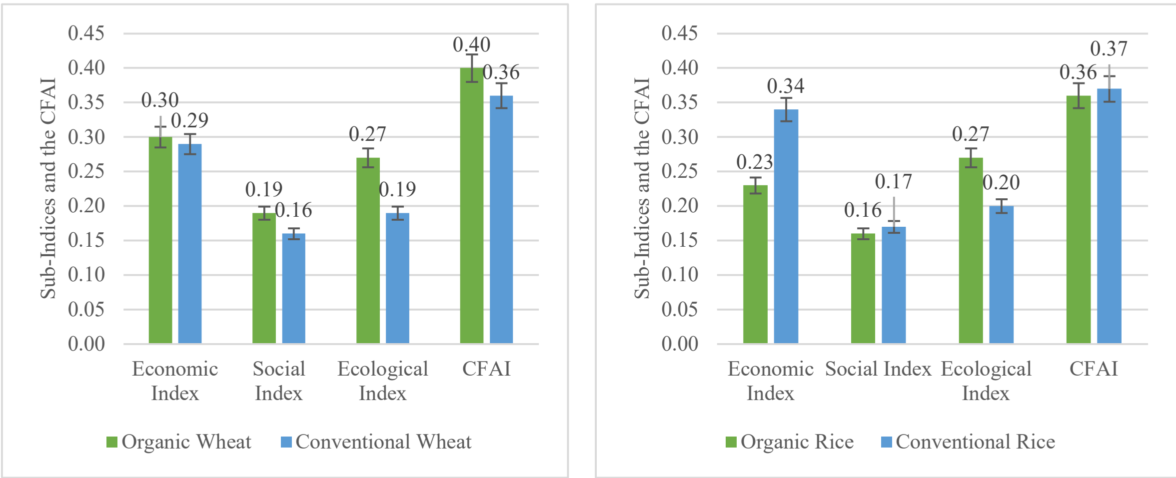
4.4 Composite indices

The composite indicator, CFAI, calculated by aggregating all the available quantitative and qualitative indicators captured through the dimensional indices, summarises the complex multi-dimensional realities of alternative farming systems. After interpreting a battery of individual indicators, it is imperative to summarise the individual and composite indices to help construct a comparative narrative and place issues at the centre of the policy pitch.

Figures 13 to 16 illustrate the dimensional and composite indices across the three agro-climatic zones. For the North-East Zone (Figure 13), the economic index of wheat is marginally higher for organic farms. This is due to relatively higher income and better nutrient efficiency.

However, the economic index of organic paddy has a lower score because of exorbitant total costs, especially the material costs. The social index indicates that the organic farms have scored higher than chemical farms for wheat but a tad lower for rice. The positive impact of being self-reliant and the health impacts of using negligible pesticides can be seen on the index for wheat. Furthermore, farm resources with peripheral trees, livestock ownership, and institutional support have a conducive effect. The colossal difference in the yield between organic and conventional paddy did undo the positive impact of the abundance of financial resources. Finally, the ecological index for both wheat and paddy is higher for organic plots, especially water contaminants and SOC. Overall, the CFAI for organic wheat is higher, while that for paddy is lower than that for conventional ones. Thus, farm economics that focuses on income and yield maximisation is essential for farm management.

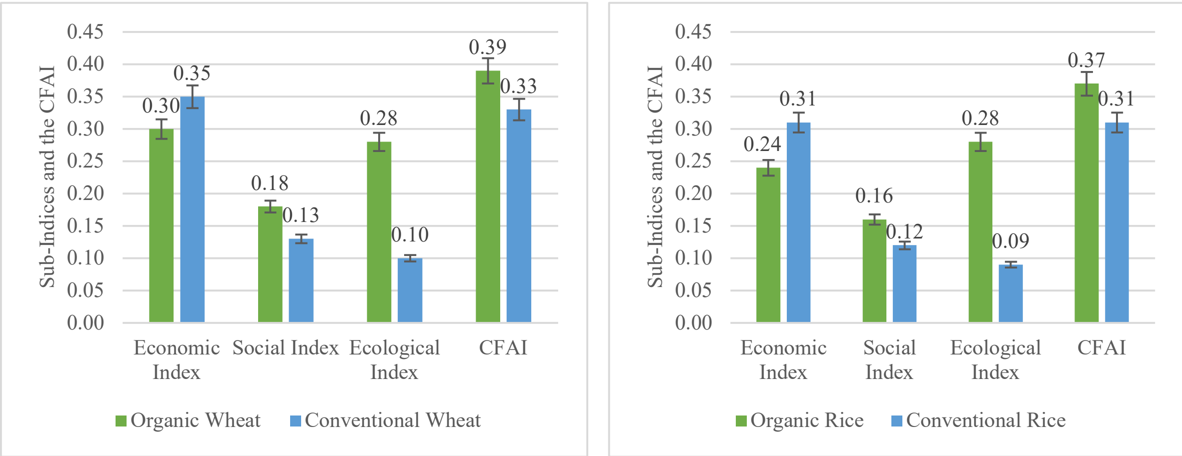
Figure 13 CFAI for Crops in the North-East Zone



Source: Depiction by Gill.

The economic indices for both wheat and paddy are less for organic vis-à-vis conventional wheat and paddy farms in the Central Zone, as shown in Figure 14. This is due to the exceedingly high cost of production, leading to poor incomes. On the other hand, the social indices for organic wheat and paddy are higher than conventional ones. For organically cultivated wheat, though the yield is similar to the one grown conventionally, the self-borne cost to the total cost and positive health impacts benefit the index. In the case of paddy, the health impacts based on the potential absence of toxicity in organic cultivation had a beneficial implication on the social index. The ecological index was higher for both organic wheat and paddy, implying the adverse implication of chemical farming on the soil, water, and beneficial

Figure 14 CFAI for Crops in the Central Zone

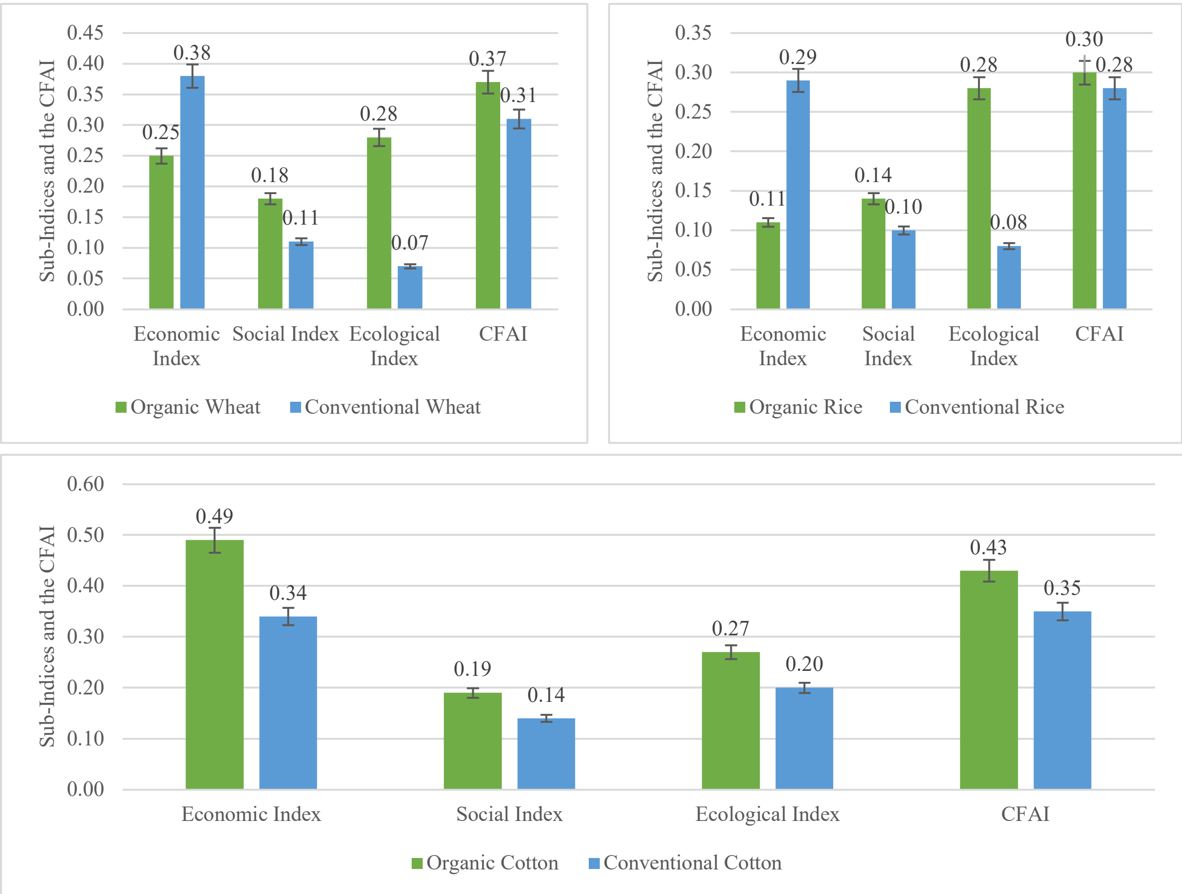


Source: Depiction by Gill.

organisms. All in all, the CFAI of organic farms was higher than that of chemical farms for wheat and paddy farms.

Figure 15 presents results for indices in the South-West Zone that differ for cotton crop

Figure 15 CFAI for Crops in the South-West Zone

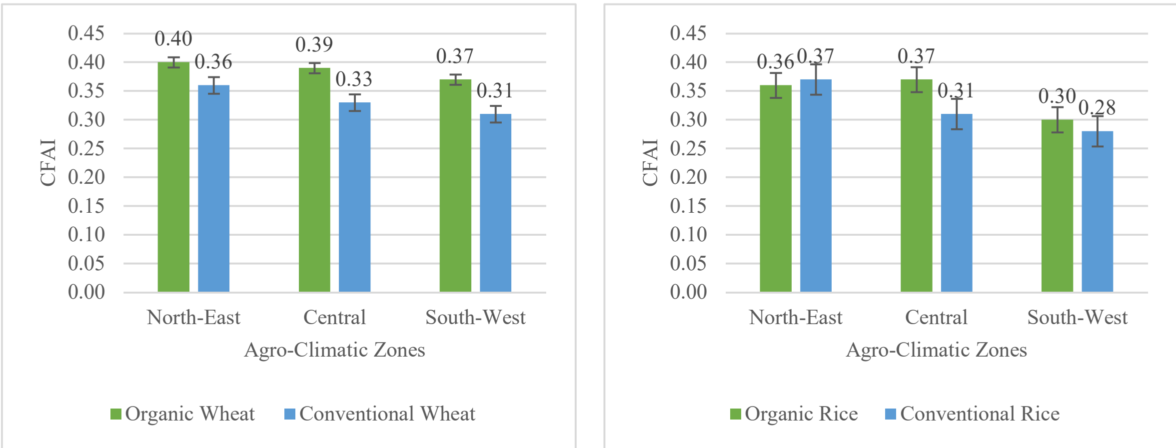


Source: Depiction by Gill.

vis-à-vis wheat and paddy. The economic index of organic production of wheat and rice is low because of higher costs and lower incomes. On the other hand, organic cotton plantations have significantly positive income with associated effects on BCR and riskiness. The social index of all the crops is higher on account of a positive effect of financial resources and self-reliance, together with good health implications because of no pesticide usage. The ecological indices are higher for organic relative to conventional wheat, paddy and cotton. On the whole, the CFAI is higher for organic as opposed to conventional production systems.

The comparative CFAI highlight that except for paddy cultivation in the North-East region, the composite indices for organic farming are higher than that for the conventional systems, as shown in Figure 16. The highest composite value calculated (0.47) is for organic cotton, which otherwise is also a cash crop compared to food grains, wheat and rice.

Figure 16 Comparative CFAI across Agro-Climatic Zones



Source: Depiction by Gill.

5 Conclusion and Recommendations

With the epistemological underpinning of a stock-and-flow based framework, the present analysis attempts to develop a composite index to assess alternate farming systems – organic and conventional – in the select districts of Punjab. A comprehensive set of quantitative and qualitative indicators based on three dimensions, namely economic, social, and ecological, was identified and validated. These indicators were transformed using min-max normalisation, followed by hierarchical weighting using the Delphi method and progressive aggregation using weighted mean to form the CFAI. Thus, the composite index measures a multidimensional aspect and is a first attempt to include some variables that are abstruse to measure because of their qualitative nature. However, these limits have been overcome by way of experts' evaluation.

The dimensional indices and the CFAI were applied to compare 88 organic and 90 conventional farming plots across three agro-climatic zones, viz., the North-East (Districts of S.A.S. Nagar, Rupnagar, and Hoshiarpur), Central (Patiala District) and South-West (Districts of Mansa and Bhatinda). A total of 125 farmers were interviewed across 68 villages. The two cropping seasons (Rabi 2020-2021 and Kharif 2021) were considered for analysis. In the pecking order, since the area under rice, wheat and cotton are respectively 42 per cent, 50 per cent, and 4 per cent of the total cropped area in Punjab, wheat, rice and cotton are the major crops of interest in the present study. In addition, the soil physicochemical properties based on the actual field soil sample analysis were tested on all farm plots.

Overall, the results from the CFAI application in the alternate farming systems indicate that a sole focus on economic returns is not tenable. Though the cost of production is a significant factor, it is relevant only in determining the economic viability of the farming system. As evident, the economic index for all zones shows lower CFAI for organic wheat and paddy plots. Beyond economics, indicators affecting both social and ecological indices have a profound implication in the composite farm assessment. Organic farms have scored better on both social and ecological indices. Pesticide and fertiliser impact quotients have been critical factors affecting the social and ecological indices of conventional farms. Further, the social index score has also been affected due to higher self-borne costs (self-reliance) in organic farms. Additionally, the outcomes are distinct for the three crops under study. Input intensive crops like paddy have relatively lower CFAIs and marginal differences between organic and conventional index scores (negative for organic in North-East Zone). On the other hand, organic cotton farming has benefitted the farmers economically and scored better in social and environmental indices.

The premeditated CFAI is an apt tool for assessing farming systems beyond the economics number-crunching, giving a holistic perspective of agriculture's social viability and ecological sustainability. The field application of the CFAI highlight that organic farming practices contribute to overall agricultural sustainability. This is because of the use of own and local resources (e.g., seeds, farmyard, bio-manure, green remedies), ingenious knowledge, increased soil fertility and reduced degradation, biodiversity conservation, and forging the spirit of collaborative partnership and support. In addition, the organic system is part of a diverse mixed farming system, including livestock and the cultivation of peripheral trees and plants, which reduces farmers' vulnerability. Over and above, organic agriculture provides considerable health benefits by lowering the pesticide exposure of farmers, workers, rural communities, and consumers.

The adoption of sustainable practice is, to a considerable extent, influenced by the institutional context as well as the national and state policies. Punjab was chosen as the initiation site for green revolution technology with State support. The State's top-down approach through investments and subsidies led to initial adoption and concomitant bumper harvests but resulted in spatial and social disparities over the years. The change from traditional sustainable methods to monocropping and unsustainable practices has adverse repercussions on the socio-economic conditions and environment of rural communities. Currently, organic farming is being promoted and facilitated through central governmental and non-governmental institutions, however with marginal success in Punjab. If organic agriculture is to play a role in providing sustainable food security and sustainable livelihoods, economic sustainability needs to be ensured through adequate pricing and market accessibility. Promoting networks, providing training and extension services, expanding value-added food processing facilities, engaging youth, and enabling women's participation to enhance social sustainability are imperative.

From the policy perspective, the CFAI enables assessment at a disaggregated spatial level, which provides valuable information at the state level. Moving forward, if applied at the national level, the index can help identify the strengths and weaknesses of each state and enable the comparison of the performance on individual and composite indicators with the national average. It can thus support local and national development strategies and effective policies. Furthermore, a temporal mapping of the CFAI can enable tracking changes to identify trends and progress. Finally, the index can also help create awareness amongst the diverse stakeholders of sustainability challenges, thus sensitising them to the perils of industrial agricultural practices. This is true in that market shares of organic food remain small since consumers prefer organic food but are unwilling to pay the price premium.

Overall, the results suggest that the field's status is promising, with numerous uncharted opportunities and challenges. Future research can explore alternate methodological frameworks for creating composite indices, including weighting, aggregation and robustness. Further, the choice of quantitative-based versus qualitative-based indicators impacts outcomes, thus it is worth exploring other surrogate measures. This is specifically true for social indicators, which are more complex and abstract; for example, indicators capturing both social capital and well-being. Ways and means of evolving and enhancing the evaluative tool to also work as a decision tool would contribute to the practical application benefiting decision-makers. Finally, good or best organic management practices must be documented and disseminated to achieve environmental sustainability.

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ANNEXURE A

CFAI Primary Indicators, Components and Definition

S. No.	Indicator	Component	Proxy Indicator	Measure	Unit	Explanation	Source
Panel A: Economic Index							
1.	Income per acre	Financial Benefits	Net income	QN	₹/acre	The total value of the farm produce minus the paid-out cost for cultivation	Muthuprakash (2018)
2.	Benefit-Cost Ratio (BCR)	Financial Benefits	–	QN	Dimensionless	The ratio of the total value of farm produce to paid out cost of cultivation	Muthuprakash (2018)
3.	Riskiness	Financial Benefits	Farm cost	QN	₹/acre	The total cost of cultivation with the cost imputed for self-borne labour and inputs	Muthuprakash (2018)
4.	Nutrient use efficiency	Resource Efficiency	Fertiliser Impact Quotient (FIQ)	QN	Dimensionless	An estimate of nutrient balance between total nutrients applied vis-à-vis consumed concerning the crop yield.	Muthuprakash (2018)
5.	Water use efficiency	Resource Efficiency	Q19.8	QL	Dimensionless	The input choice for the decision of irrigation timing	Survey Questionnaire (Annexure C)
Panel B: Social Index							
6.	Farmer knowledge	Producer Development	Q19.1, Q19.6, Q19.7, Q19.9, Q20.2, Q21.1, & Q21.2	QL	Dimensionless	The input choice for the basis of crop selection, willingness to learn new practices and access new information, level of knowledge of best farming practices (e.g., drip, sprinkler) and its sources, source of price info, and approached institution for advice	Survey Questionnaire (Annexure C)
7.	Social capital	Producer Development	Q20.1, Q20.2 & Q20.3	QL	Dimensionless	The input choice for associating with any community or producers' group, benefits gained from the group, and the strength and composition of the group	Survey Questionnaire (Annexure C)
8.	Farm resources	Producer Development	Q13 & Q14	QL	Dimensionless	The input choice for the presence of farm peripheral trees/plants and owning livestock	Survey Questionnaire (Annexure C)
9.	Financial resources	Producer Development	Paid-out cost of cultivation cost	QN	₹/acre	The paid-out cost of cultivation	Muthuprakash (2018)
10.	Self-reliance	Producer Development	Self-borne cost	QN	Dimensionless	The ratio of self-borne cost to total cost of cultivation	Muthuprakash (2018)
11.	Drudgery	Producer Development	Labour cost	QN	Dimensionless	Gross income per unit labour cost	Muthuprakash (2018)

S. No.	Indicator	Component	Proxy Indicator	Measure	Unit	Explanation	Source
12.	Health impacts from fertilisers	Consumer Impact	Fertiliser Impact Quotient (FIQ)	QN	Dimensionless	An estimate of nutrient balance between total nutrients applied vis-à-vis consumed concerning the crop yield.	Muthuprakash (2018)
13.	Health impacts from pesticides	Consumer Impact	Pesticide Impact Quotient (PIQ)	QN	Dimensionless	An estimate of impact based on the potential toxicity of active ingredients and dosage applied.	Muthuprakash (2018)
14.	Agricultural output	National Impact	Yield per acre	QN	Kg/acre	Total crop produce, including intercrops	Muthuprakash (2018)
15.	Employment	National Impact	Labour expenditure	QN	Dimensionless	The ratio of total labour cost to the total cost of cultivation	Muthuprakash (2018)
16.	Gender equality	National Impact	Q22.2	QL	Dimensionless	The input choice for the contribution of women in agricultural operations	Survey Questionnaire (Annexure C)
17.	Institutional strength	National Impact	Q16, Q19.1, Q19.6, Q19.9, Q20.2, Q20.3, & Q21.1	QL	Dimensionless	The input choice for the availability of credit sources, reasons for selecting a crop, sources of price trend and other info, and the benefit of joining a community or producers' group	Survey Questionnaire (Annexure C)
Panel C: Ecological Index							
18.	Biodiversity	Environmental	Q 13 & Q 19.1	QL	Dimensionless	The input choice for the decision to crop and plant peripheral trees	Survey Questionnaire (Annexure C)
19.	Soil contamination	Environmental	Fertiliser Impact Quotient (FIQ)	QN	Dimensionless	An estimate of nutrient balance between total nutrients applied vis-à-vis consumed concerning the crop yield.	Muthuprakash (2018)
20.	Water contamination	Environmental	Pesticide Impact Quotient (PIQ)	QN	Dimensionless	An estimate of impact based on the potential toxicity of active ingredients and dosage applied.	Muthuprakash (2018)
21.	Soil health (Nitrogen)	Field	–	QN	PPM of N	Available nitrogen (N) in the soil	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana
22.	Soil health (Phosphorus)	Field	–	QN	Kg P/Ha	Available phosphorus (P) in the soil	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana
23.	Soil health (Potassium)	Field	–	QN	Kg K/Ha	Available potassium (K) in the soil	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana

S. No.	Indicator	Component	Proxy Indicator	Measure	Unit	Explanation	Source
24.	Soil health (Soil Organic Carbon)	Field	–	QN	Organic content (%)	The carbon stored in soil organic matter	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana
25.	Soil health (pH)	Field	–	QN	Dimensionless	The pH of the soil	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana
26.	Soil health (salinity)	Field	–	QN	DS/cm	The salinity of the soil	Bhumi Vigyan Vibhag, Punjab Agricultural University, Ludhiana

Note: QN and QL stand for quantitative and qualitative measures for indicators.
Source: Compilation by Gill.

ANNEXURE B

Normalisation References for Indicators

Table B.1 Reference for Pesticide Impact Quotient (PIQ)

Pesticide	EIQ (Per unit litre)	Reference EIQ (% of threshold point)	Maximum Recommended Dose (Kg. per acre)	EIQ of Recommended Dose
Acephate	41.33	33.07	0.40	16.53
Carbendazim	55.70	33.42	0.30	16.71
Chloropyrophos	28.40	28.40	0.50	14.20
Clodinafop-Propargyl (Topik)	11.90	6.00	0.25	3.00
Cypermethrin	7.70	7.70	0.50	3.85
Diafenthiuron	35.33	11.31	0.16	5.65
Sulfosulfuron (Leader)	46.30	1.40	0.14	0.70

Note: EIQ stands for Environmental Impact Quotient (https://nysipm.cornell.edu/eiq/calculator-field-use-eiq/).
Source: Eshenaur et al. (2016).

Table B.2 Reference for Yield and Fertilizer Impact Quotient (FIQ)

Crop	Average yield (Kg. per acre)	Nutrient Absorption Reference (Kg. per metric tonne)		
		N	P	K
Wheat	561.86	128.00	46.00	219.00
Paddy	1,200.00	20.00	11.00	30.00
Cotton	127.50	156.00	36.00	151.00

Source: Directorate of Economics and Statistics (2019) and Roy et al. (2006).

Table B.3 Reference for Soil Parameters

Parameters	Reference	
	0	1
Soil Organic Carbon (%)	0.00	0.75
Total Nitrogen (%)	0.00	0.25
Available Nitrogen (Kg. /Ha)	0.00	560.00
Available Phosphorous (Kg. /Ha)	0.00	24.60
Available Potassium (Kg. /Ha)	0.00	280.00
pH	9.00	7.00
Salinity (mS/cm)	16.00	2.00

Source: Department of Agriculture and Cooperation (2011) and Hazelton and Murphy (2007).

Table B.4 NPK Composition Standard of Nutrient Inputs used in FIQ

Fertilizer Input	N (%)	P (%)	K (%)
10:26:26	10.00	26.00	26.00
15:15:15	15.00	15.00	15.00
18:18:10	18.00	18.00	10.00
19:19:19	19.00	19.00	19.00
20:20:00	20.00	20.00	0.00
Biosuper	0.00	0.00	0.00
Compost	0.75	0.60	1.00
Cow Dung Manure	0.45	0.35	0.35
DAP	21.00	23.00	0.00
FYM	0.95	0.60	1.10
Gomuthram	1.05	0.11	0.75
Green Leaves	2.85	0.37	1.67
Green Manuring	2.83	0.54	1.74
Jivamrut	1.96	0.17	0.28
Neem cake	5.20	1.00	1.40
Panchagavyam	2.29	2.09	2.32
Potash	0.00	0.00	50.00
Poultry Manure	1.40	1.60	0.85
Single Superphosphate	0.00	8.80	0.00
Urea	46.00	0.00	0.00
Vermicompost	1.06	0.61	0.44
Zinc and Magnesium	0.00	0.00	0.00

Source: Devakumar et al. (2014).

ANNEXURE C

Survey Questionnaire

Sustainability of Farming in the State of Punjab: The Economic, Social and Ecological Analysis

About the Project

Panjab University is partnering on an inter-disciplinary project, *'Transforming India's Green Revolution by Research and Empowerment for Sustainable food Supplies (TIGR2ESS)'*, as a part of the Global Challenges Research Fund award by the UK-India Research Councils. The project is led by the University of Cambridge, U.K., with multiple partner institutions in India and the U.K. The present research primarily aims to evaluate the sustainability of organic and conventional farming in Punjab.

ਯੂਕੇ-ਇੰਡੀਆ ਰਿਸਰਚ ਕੌਂਸਲਾਂ ਦੁਆਰਾ ਗਲੋਬਲ ਚੈਲੇਂਜਸ ਰਿਸਰਚ ਫੰਡ ਅਵਾਰਡ ਦੇ ਹਿੱਸੇ ਵਜੋਂ, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ ਇੱਕ ਅੰਤਰ-ਅਨੁਸ਼ਾਸਨੀ ਪ੍ਰੋਜੈਕਟ, *'ਟ੍ਰਾਂਸਫਾਰਮਿੰਗ ਇੰਡੀਆਜ਼ ਗ੍ਰੀਨ ਰੈਵੋਲਿਸ਼ਨ ਰਿਸਰਚ ਐਂਡ ਐਮਪਾਵਰਮੈਂਟ ਫਾਰ ਸਸਟੇਨੇਬਲ ਫੂਡ ਸਪਲਾਈਜ਼ (TIGR2ESS)'* ਤੇ ਭਾਈਵਾਲੀ ਕਰ ਰਹੀ ਹੈ। ਇਸ ਪ੍ਰੋਜੈਕਟ ਦੀ ਅਗਵਾਈ ਯੂਕੇ ਦੀ ਕੈਂਬਰਿਜ ਯੂਨੀਵਰਸਿਟੀ ਕਰਦੀ ਹੈ, ਜਿਸ ਵਿੱਚ ਭਾਰਤ ਅਤੇ ਯੂਕੇ ਦੀਆਂ ਕਈ ਸਹਿਭਾਗੀ ਸੰਸਥਾਵਾਂ ਹਨ। ਮੌਜੂਦਾ ਖੋਜ ਦਾ ਮੁੱਖ ਉਦੇਸ਼ ਪੰਜਾਬ ਵਿੱਚ ਜੈਵਿਕ ਅਤੇ ਰਵਾਇਤੀ ਖੇਤੀ ਦੀ ਸਥਿਰਤਾ ਦਾ ਮੁਲਾਂਕਣ ਕਰਨਾ ਹੈ।

Consent and Confidentiality Statement

Your participation is entirely voluntary, and all responses will be kept completely confidential. Individual respondents will not be identified, and results will only be presented in an aggregated or anonymous form. Thank you in advance, and we hope you will agree to participate in this survey to help us understand your farming practices.

I consent to be part of this PU Organic Farming Survey and to be interviewed and photographed.

ਤੁਹਾਡੀ ਭਾਗੀਦਾਰੀ ਪੂਰੀ ਤਰ੍ਹਾਂ ਸਵੈਇੱਛਤ ਹੈ, ਅਤੇ ਸਾਰੇ ਜਵਾਬ ਪੂਰੀ ਤਰ੍ਹਾਂ ਗੁਪਤ ਰੱਖੇ ਜਾਣਗੇ। ਵਿਅਕਤੀਗਤ ਉੱਤਰਦਾਤਾਵਾਂ ਦੀ ਪਛਾਣ ਨਹੀਂ ਕੀਤੀ ਜਾਏਗੀ, ਅਤੇ ਨਤੀਜੇ ਸਿਰਫ ਸਮੂਹਿਕ ਜਾਂ ਅਗਿਆਤ ਰੂਪ ਵਿੱਚ ਪੇਸ਼ ਕੀਤੇ ਜਾਣਗੇ। ਅਗਾ ਧੰਨਵਾਦ, ਅਤੇ ਅਸੀਂ ਉਮੀਦ ਕਰਦੇ ਹਾਂ ਕਿ ਤੁਸੀਂ ਇਸ ਸਰਵੇਖਣ ਵਿੱਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਸਹਿਮਤ ਹੋਵੋਗੇ ਤਾਂ ਜੋ ਤੁਹਾਡੀ ਖੇਤੀ ਦੇ ਤਰੀਕਿਆਂ ਨੂੰ ਸਮਝਣ ਵਿੱਚ ਸਾਡੀ ਮਦਦ ਕੀਤੀ ਜਾ ਸਕੇ।

ਮੈਂ ਇਸ ਪੀ. ਯੂ. ਆਰਗੈਨਿਕ ਫਾਰਮਿੰਗ ਸਰਵੇ ਦਾ ਹਿੱਸਾ ਬਣਨ ਅਤੇ ਇੰਟਰਵਿ ਅਤੇ ਫੋਟੋ ਖਿੱਚਣ ਲਈ ਸਹਿਮਤ ਹਾਂ।

Signature: Date:
ਦਸਤਖਤ ਤਾਰੀਖ਼

THE FARM ASSESSMENT INDEX SURVEY
(ਫਾਰਮ ਅਸੈਸਮੈਂਟ ਇੰਡੈਕਸ ਸਰਵੇਖਣ)

Date of the Survey: ________________ **Name of the Interviewer:** ______________________________

Name of the Farmer: __________________ **Farmer Code:** ____

Year/Season/Date of Sowing: _____________________________ **Harvest Time for Kharif /Rabi Crop (month/week):** _____________

1. BASIC DETAILS ਬੁਨਿਆਦੀ ਵੇਰਵੇ

1.1. State ਰਾਜ	**Punjab**	1.2. District ਜ਼ਿਲ੍ਹਾ		1.3 Tehsil ਤਹਿਸੀਲ		1.4. Block/Village ਲਾਕ/ਪਿੰਡ	

1.5. Full name of the cultivator/decision-maker ਕਾਸ਼ਤਕਾਰ/ਫੈਸਲਾ ਲੈਣ ਵਾਲੇ ਦਾ ਪੂਰਾ ਨਾਂ		1.6. Gender (✓): Male ☐ Female ☐ ਲਿੰਗ: ਮਰਦ ☐ ਔਰਤ ☐	1.7. Age (in years): ਸਾਲਾਂ ਵਿੱਚ ਉਮਰ

1.8. Name of the respondent and relationship with the cultivator ਉੱਤਰਦਾਤਾ ਦਾ ਨਾਮ ਅਤੇ ਕਾਸ਼ਤਕਾਰ ਨਾਲ ਸੰਬੰਧ	

1.9. Total number of members in the family ਪਰਿਵਾਰ ਵਿੱਚ ਮੈਂਬਰਾਂ ਦੀ ਕੁੱਲ ਸੰਖਿਆ	Adults ਬਾਲਗ: Children ਬੱਚੇ:	1.10. No. of family members involved in agriculture ਕੰਮ ਕਰਨ ਵਾਲੇ ਮੇਮ੍ਬਰ ਦੀ ਸੰਖਿਆ ਖੇਤੀਬਾੜੀ	Male ਮਰਦ: Female ਔਰਤ:

1.11. Complete postal address ਡਾਕ ਪਤਾ		1.12. Mobile/Phone/Email ਫੋਨ/ਮੋਬਾਈਲ/ਈਮੇਲ	
1.13. Primary occupation ਮੁੱਖ ਕਿੱਤਾ		1.14. Secondary occupation ਸਹਾਇਕ ਕਿੱਤੇ	

1.15. Alternate source of household income (Yes/No) ਘਰੇਲੂ ਆਮਦਨੀ ਦਾ ਵਿਕਲਪਿਕ ਸਰੋਤ (ਹਾਂ/ਨਹੀਂ)	1.16. Details, if yes: ਵੇਰਵੇ, ਜੇ ਹਾਂ

1.17. Farmer's Education ਸਿੱਖਿਆ (✓)	A. No formal education ☐ A. ਅਨਪੜ੍ਹ ☐	B. Primary ☐ B. ਪ੍ਰਾਇਮਰੀ ☐	C. Secondary ☐ C. ਸੈਕੰਡਰੀ ☐	D. Higher-secondary ☐ D. ਉੱਚ-ਸੈਕੰਡਰੀ ☐	E. Graduate ☐ E. ਗ੍ਰੈਜੂਏਟ ☐	F. Post-graduate ☐ F. ਪੋਸਟ-ਗ੍ਰੈਜੂਏਟ ☐

1.18. Education distribution of household (no.) No. of males with respective age: No. of females with respective age: ਘਰ ਦੀ ਸਿੱਖਿਆ ਵੰਡ (ਸੰ.) ਸੰਬੰਧਤ ਉਮਰ ਵਾਲੇ ਪੁਰਸ਼ਾਂ ਦੀ ਸੰਖਿਆ: ਸੰਬੰਧਤ ਉਮਰ ਵਾਲੀਆਂ ਰਤਾਂ ਦੀ ਸੰਖਿਆ:	A. No formal education ___ B. Primary ___ C. Secondary ___ D. Higher-secondary ___ E. Graduate ____ F. Post-graduate ______ A. ਅਨਪੜ੍ਹ ______ B. ਪ੍ਰਾਇਮਰੀ ______ C. ਸੈਕੰਡਰੀ _______ D. ਉੱਚ-ਸੈਕੰਡਰੀ ____ E. ਗ੍ਰੈਜੂਏਟ _______ F. ਪੋਸਟ-ਗ੍ਰੈਜੂਏਟ ______

1.19. How long have you been into farming? (experience in years) ਤੁਸੀਂ ਖੇਤੀਬਾੜੀ ਵਿੱਚ ਕਿੰਨੇ ਸਮੇਂ ਤੋਂ ਹੋ? (ਸਾਲਾਂ ਵਿੱਚ ਅਨੁਭਵ)	Total: ਕੁੱਲ:	Conventional: ਰਸਾਇਣਕ:	Organic: ਜੈਵਿਕ:

1.20. Who in the household takes farm-related decisions like crop/ nutrient/harvest? ਘਰ ਵਿੱਚ ਕੌਣ ਖੇਤੀ ਨਾਲ ਸੰਬੰਧਤ ਫੈਸਲੇ ਲੈਂਦਾ ਹੈ ਜਿਵੇਂ ਫਸਲ/ਪੌਸ਼ਟਿਕ ਤੱਤ/ ਵਾਢੀ	

2. ASSET DETAILS (to the extent relevant) **ਸੰਪਤੀ ਦੇ ਵੇਰਵੇ** (ਸੰਬੰਧਤ ਹੱਦ ਤੱਕ)

S. No.	Particulars ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ	Number ਗਿਣਤੀ	Year of Purchase/Building ਖਰੀਦ/ਇਮਾਰਤ ਦਾ ਸਾਲ	Leased/Rented ਕਿਰਾਏ 'ਤੇ	Source ਸਰੋਤ
2.1.	Tractor ਟਰੈਕਟਰ				
2.2.	Trolley ਟਰਾਲੀ				
2.3.	Diesel engine ਡੀਜ਼ਲ ਇੰਜਣ				
2.4.	Submersible pump ਸਬਮਰਸੀਬਲ ਪੰਪ				
2.5.	Spray pump ਸਪਰੇਅ ਪੰਪ				
2.6.	Electric motor ਇਲੈਕਟ੍ਰਿਕ ਮੋਟਰ				
2.7.	Generator ਜਨਰੇਟਰ				
2.8.	Leveller ਲੇਵਲਰ				
2.9.	Rotavator ਰੋਟਾਵੇਟਰ				
2.10.	Disc harrow ਡਿਸਕ ਹੈਰੋ				
2.11.	Cultivator ਕਾਸ਼ਤਕਾਰ				
2.12.	Seed drill ਬੀਜ ਦੀ ਮਸ਼ਕ				
2.13.	Thresher ਥ੍ਰੈਸ਼ਰ				
2.14.	Combine ਕੰਬਾਈਨ				
2.15.	Store drum ਸਟੋਰ ਡ੍ਰਮ				
2.16.	Happy seeder ਹੈਪੀ ਸੀਡਰ				
2.17.	Others* ਹੋਰ*				
2.18.	Cattle shed ਪਸ਼ੂ ਬਸੇਰਾ				
2.19.	Implement shed ਇਮਪਲੇਮੈਂਟ ਸ਼ੇਡ				
2.20.	Storage shed ਸਟੋਰੇਜ ਸ਼ੈੱਡ				

Note: *Includes reaper, ranger, chopper, planter, harvester, etc. *ਰੀਪਰ, ਰੇਂਜਰ, ਹੈਲੀਕਾਪਟਰ, ਪਲਾਂਟਰ, ਹਾਰਵੈਸਟਰ, ਆਦਿ ਸ਼ਾਮਲ ਹਨ

3. LANDHOLDING DETAILS ਜ਼ਮੀਨ ਦੇ ਵੇਰਵੇ

3.1 What is the total landholding of the farmer (in acres)? ਕਿਸਾਨ ਦੀ ਕੁੱਲ ਜ਼ਮੀਨ (ਏਕੜ ਵਿੱਚ) ਕੀ ਹੈ? ____________________________

Description	Plot 1	Plot 2	Plot 3
3.2. Plot size (in acres) ਪਲਾਟ ਦਾ ਆਕਾਰ (ਏਕੜ ਵਿੱਚ)			
3.3. Plot type ਪਲਾਟ ਦੀ ਕਿਸਮ: i. Owned ਮਲਕੀਅਤ ਹੈ ii. Leased-in (with rent in Rs./annum) ਠੇਕੇ ਤੇ ਲਿੱਤਾ (ਕਿਰਾਏ ਦੇ ਨਾਲ/ਰੁਪਏ ਵਿੱਚ) iii. Leased-out (with rent in Rs./annum) ਠੇਕੇ ਤੇ ਦਿੱਤਾ (ਕਿਰਾਏ ਦੇ ਨਾਲ/ਸਾਲਾਨਾ ਵਿੱਚ)			
3.4. Irrigated area (in acres) ਏਕੜ ਵਿੱਚ ਸਿੰਚਾਈ ਵਾਲਾ ਖੇਤਰ			
3.5. Source of irrigation (e.g., tube well, main canal, branch canal/other) ਸਿੰਚਾਈ ਦਾ ਸਰੋਤ (ਉਦਾਹਰਨ ਲਈ, ਟਿਬਵੈੱਲ, ਮੁੱਖ ਨਹਿਰ, ਸ਼ਾਖਾ ਨਹਿਰ/ਹੋਰ)			
3.6. Rainfed area (in acres) ਏਕੜ ਵਿੱਚ ਮੀਂਹ ਵਾਲਾ ਖੇਤਰ			
3.7. Land under ecological/organic farming (in acres) ਵਾਤਾਵਰਣਕ/ਜੈਵਿਕ ਖੇਤੀ ਅਧੀਨ ਜ਼ਮੀਨ ਦੀ ਹੱਦ (ਏਕੜ ਵਿੱਚ)			
3.8. If organic, is it certified? (Yes/No) ਜੇ ਜੈਵਿਕ, ਕੀ ਇਹ ਪ੍ਰਮਾਣਤ ਹੈ? (ਹਾਂ ਜਾਂ ਨਹੀਂ)			
3.9. If certified, what is the source (name of the agency/group) and cost? ਜੇ ਪ੍ਰਮਾਣਤ ਹੈ, ਸਰੋਤ ਕੀ ਹੈ (ਏਜੰਸੀ/ਸਮੂਹ ਦਾ ਨਾਮ) ਅਤੇ ਲਾਗਤ?			
3.10. Soil type (coarse loamy, coarse & fine loamy, fine loamy, other) ਮਿੱਟੀ ਦੀ ਕਿਸਮ (ਸੈਂਡੀ, ਸੈਂਡੀ ਲੋਮ, ਲੋਮੀ, ਲਾਲ, ਕਾਲਾ, ਹੋਰ)			
3.11. Main crop (variety) ਮੁੱਖ ਫਸਲ (ਕਿਸਮ)			
3.12. Previous harvest crop (variety) ਪਿਛਲੀ ਵਾਢੀ ਦੀ ਫਸਲ (ਕਿਸਮ)			
3.13. Do you have a Soil Health Card? (Yes/No) (Click photo, if handy) ਕੀ ਤੁਹਾਡੇ ਕੋਲ ਸੋਇਲ ਹੈਲਥ ਕਾਰਡ ਹੈ? (ਹਾਂ/ਨਹੀਂ) (ਫੋਟੋ 'ਤੇ ਕਲਿਕ ਕਰੋ, ਜੇ ਸੌਖਾ ਹੋਵੇ)			
3.14. If yes, then specify ਜੇ ਹਾਂ, ਤਾਂ ਨਿਰਧਾਰਤ ਕਰੋ: i. Soil Organic (micro-nutrients) ਮਿੱਟੀ ਜੈਵਿਕ (ਸੂਖਮ-ਪੌਸ਼ਟਿਕ ਤੱਤ) ii. Nitrogen (N) ਨਾਈਟ੍ਰੋਜਨ (ਐਨ) iii. Phosphorus (P) ਫਾਸਫੋਰਸ (ਪੀ) iv. Potassium (K) ਪੋਟਾਸ਼ੀਅਮ (ਕੇ) v. Soil pH ਮਿੱਟੀ pH vi. Soil salinity ਮਿੱਟੀ ਦੀ ਲੂਣਤਾ			

4. LAND PREPARATION PROCESSES ਜ਼ਮੀਨ ਤਿਆਰੀ ਪ੍ਰਕਿਰਿਆਵਾਂ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	Plot 1	Plot 2	Plot 3
NOP 1: Ploughing ਹਲਣਾ	**Self ਸਵੈ** (No.): **Hired ਕਿਰਾਏ ਤੇ** (No.):	**Self ਸਵੈ** (No.): **Hired ਕਿਰਾਏ ਤੇ** (No.):	**Self ਸਵੈ** (No.): **Hired ਕਿਰਾਏ ਤੇ** (No.):
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
NOP 2: Harrowing ਤਰਿਆਂ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
NOP 3: Puddling ਕੱਦੂ ਕਰਨਾ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
NOP 4: Other (Name: ____________________) **ਹੋਰ** (ਨਾਮ: ________________________)	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**

Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			

5. BASAL MANURE APPLICATION ਬੇਸਲ ਰੂੜੀ ਦੀ ਵਰਤੋਂ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	Plot 1	Plot 2	Plot 3
Fertilizer/Manure 1: Broadcasting/ Placement/Fertigation/ Mulching/Tilling (✓) ਖਾਦ/ਖਾਦ 4: ਪ੍ਰਸਾਰਣ/ਪਲੇਸਮੈਂਟ/ਫਰਟੀਗੇਸ਼ਨ/ਟਿਲਿੰਗ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home-made/market/govt.) ਸਰੋਤ (ਘਰੇਲੂ ਉਪਯੋਗ/ਮਾਰਕੀਟ/ਸਰਕਾਰ)			
Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨਰੀ (diesel and hours)			
Fertilizer/Manure 2: Broadcasting/ Placement/Fertigation/ Mulching/Tilling (✓) ਖਾਦ/ਖਾਦ 4: ਪ੍ਰਸਾਰਣ/ਪਲੇਸਮੈਂਟ/ਫਰਟੀਗੇਸ਼ਨ/ਟਿਲਿੰਗ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home-made/market/govt.) ਸਰੋਤ (ਘਰੇਲੂ ਉਪਯੋਗ/ਮਾਰਕੀਟ/ਸਰਕਾਰ)			
Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.)			

ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨਰੀ (diesel and hours)			
Fertilizer/Manure 3: Broadcasting/ Placement/Fertigation/ Mulching/Tilling (✓) ਖਾਦ/ਖਾਦ 4: ਪ੍ਰਸਾਰਣ/ਪਲੇਸਮੈਂਟ/ਫਰਟੀਗੇਸ਼ਨ/ਟਿਲਿੰਗ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home-made/market/govt.) ਸਰੋਤ (ਘਰੇਲੂ ਉਪਯੋਗ/ਮਾਰਕੀਟ/ਸਰਕਾਰ)			
Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨਰੀ (diesel and hours)			
Fertilizer/Manure 4: Broadcasting/ Placement/Fertigation/ Mulching/Tilling (✓) ਖਾਦ/ਖਾਦ 4: ਪ੍ਰਸਾਰਣ/ਪਲੇਸਮੈਂਟ/ਫਰਟੀਗੇਸ਼ਨ/ਟਿਲਿੰਗ	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home-made/market/govt.) ਸਰੋਤ (ਘਰੇਲੂ ਉਪਯੋਗ/ਮਾਰਕੀਟ/ਸਰਕਾਰ)			
Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			

Machine ਮਸ਼ੀਨਰੀ (diesel and hours)			

6. SOWING, RESOWING, TRANSPLANTING etc. **ਬਿਜਾਈ, ਮੁੜ ਬੀਜਾਈ, ਟ੍ਰਾਂਸਪਲਾਂਟਿੰਗ ਆਦਿ (All three activities combined)**

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	**Main crop ਮੁੱਖ ਫਸਲ**	**Inter crop 1 ਅੰਤਰ ਫ਼ਸਲ 1**	**Inter crop 2 ਅੰਤਰ ਫ਼ਸਲ 2**	**Inter crop 3 ਅੰਤਰ ਫ਼ਸਲ 3**	**Inter crop 4 ਅੰਤਰ ਫ਼ਸਲ 4**
Plot 1: Seed Broadcasting/Transplanting/ Seed Planting ਬੀਜ ਪ੍ਰਸਾਰਣ/ਟ੍ਰਾਂਸਪਲਾਂਟਿੰਗ/ ਬੀਜ ਲਾਉਣਾ (✓)	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Name of the crop ਫਸਲ ਦਾ ਨਾਮ					
Seed variety name ਬੀਜ ਦੀਆਂ ਕਿਸਮਾਂ ਦਾ ਨਾਮ					
Seed type (Bt/hybrid/improved/traditional) ਬੀਜ ਦੀ ਕਿਸਮ (ਬੀਟੀ/ਹਾਈਬ੍ਰਿਡ/ਸੁਧਾਰੀ/ਰਵਾਇਤੀ)					
Source (home/govt./pvt/fellow farmers) ਸਰੋਤ (ਘਰ/ਸਰਕਾਰ/ਪ੍ਰਾਈਵੇਟ/ਸਾਥੀ ਕਿਸਾਨ)					
Seed quantity ਬੀਜ ਦੀ ਮਾਤਰਾ (no. of kgs/acre)					
Seed cost per unit ਬੀਜ ਦੀ ਦਰ (Rs./per kg.)					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machinery ਮਸ਼ੀਨਰੀ (diesel and hours)					
For commercial/personal consumption ਵਪਾਰਕ/ਨਿੱਜੀ ਖਪਤ ਲਈ					
Plot 2: Seed Broadcasting/Transplanting/ Seed Planting ਬੀਜ ਪ੍ਰਸਾਰਣ/ਟ੍ਰਾਂਸਪਲਾਂਟਿੰਗ/ ਬੀਜ ਲਾਉਣਾ (✓)	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Name of the crop ਫਸਲ ਦਾ ਨਾਮ					
Seed variety name ਬੀਜ ਦੀਆਂ ਕਿਸਮਾਂ ਦਾ ਨਾਮ					
Seed type (Bt/hybrid/improved/traditional) ਬੀਜ ਦੀ ਕਿਸਮ (ਬੀਟੀ/ਹਾਈਬ੍ਰਿਡ/ਸੁਧਾਰੀ/ਰਵਾਇਤੀ)					
Source (home/govt./pvt/fellow farmers)					

ਸਰੋਤ (ਘਰ/ਸਰਕਾਰ/ਪ੍ਰਾਈਵੇਟ/ਸਾਥੀ ਕਿਸਾਨ)					
Seed quantity ਬੀਜ ਦੀ ਮਾਤਰਾ (no. of kgs/acre)					
Seed cost per unit ਬੀਜ ਦੀ ਦਰ (Rs./per kg.)					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machinery ਮਸ਼ੀਨਰੀ (diesel and hours)					
For commercial/personal consumption ਵਪਾਰਕ/ਨਿੱਜੀ ਖਪਤ ਲਈ	[redacted]				

7. TOP DRESSING ਚੋਟੀ ਦੇ ਡਰੈਸਿੰਗ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	Plot 1	Plot 2	Plot 3
Fertilizer ਖਾਦ 1 (Name): ______________	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home/govt./pvt. trader) ਸਰੋਤ (ਸਰਕਾਰ/ਘਰ/ਪ੍ਰਾਈਵੇਟ ਵਪਾਰੀ)			
Total quantity with unit ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit (ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ)			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
Fertilizer ਖਾਦ 2 (Name): ______________	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**

Source (home/govt./pvt. trader) ਸਰੋਤ (ਸਰਕਾਰ/ਘਰ/ਪ੍ਰਾਈਵੇਟ ਵਪਾਰੀ)			
Total quantity with unit ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit (ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ)			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
Fertilizer ਖਾਦ 3 (Name): _____________	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**	**Self ਸਵੈ (No.):** **Hired ਕਿਰਾਏ ਤੇ (No.):**
Source (home/govt./pvt. trader) ਸਰੋਤ (ਸਰਕਾਰ/ਘਰ/ਪ੍ਰਾਈਵੇਟ ਵਪਾਰੀ)			
Total quantity with unit ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Unit description (in kg.) ਕਿੱਲੋ ਵਿੱਚ ਇਕਾਈ ਦਾ ਵਰਣਨ			
Cost per unit (ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ)			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			

8. WEEDING/INTER-CULTIVATION ਬੂਟੀ/ਅੰਤਰ-ਉਪਜ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	Plot 1	Plot 2	Plot 3
Weeding Round 1: Manual De-Weeding /Herbicide/Inter-Cultivation (✓) ਨਦੀਨਾਂ ਦਾ ਰਾਡ 1: ਮੈਨੁਅਲ ਡੀ-ਵੈਡਿੰਗ ਜਾਂ ਜੜੀ-ਬੂਟੀਆਂ ਜਾਂ ਅੰਤਰ-ਕਾਸ਼ਤ			
Crop name ਫਸਲ ਦਾ ਨਾਮ (if particular)			
Name of the agro-chemical, if herbicide ਐਗਰੋ-ਕੈਮੀਕਲ ਦਾ ਨਾਂ, ਜੇਕਰ ਜੜੀ-ਬੂਟੀਆਂ ਦਾ ਖਾਤਮਾ ਹੋਵੇ			
Source (Home/Govt/Pvt/Fellow farmers) ਸਰੋਤ (ਘਰ/ਸਰਕਾਰ/ਪ੍ਰਾਈਵੇਟ/ਸਾਥੀ ਕਿਸਾਨ)			
Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
Weeding Round 2: Manual De-Weeding /Herbicide/Inter-Cultivation (✓) ਨਦੀਨਾਂ ਦਾ ਰਾਡ 2: ਮੈਨੁਅਲ ਡੀ-ਵੈਡਿੰਗ ਜਾਂ ਜੜੀ-ਬੂਟੀਆਂ ਜਾਂ ਅੰਤਰ-ਕਾਸ਼ਤ			
Crop name ਫਸਲ ਦਾ ਨਾਮ (if particular)			
Name of the agro-chemical, if herbicide ਐਗਰੋ-ਕੈਮੀਕਲ ਦਾ ਨਾਂ, ਜੇਕਰ ਜੜੀ-ਬੂਟੀਆਂ ਦਾ ਖਾਤਮਾ ਹੋਵੇ			
Source (Home/Govt/Pvt/Fellow farmers) ਸਰੋਤ (ਘਰ/ਸਰਕਾਰ/ਪ੍ਰਾਈਵੇਟ/ਸਾਥੀ ਕਿਸਾਨ)			

Total quantity (with unit) ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			

9. DETAILS OF IRRIGATION (ਸਿੰਜਾਈ ਦੇ ਵੇਰਵੇ)

Description	Plot 1	Plot 2	Plot 3
No. of irrigations/watering applied ਸਿੰਚਾਈ/ਸਿੰਚਾਈ ਦੀ ਸੰਖਿਆ ਲਾਗੂ ਕੀਤੀ ਗਈ			
Method of irrigation (Flood/Sprinklers/Drip/Piped) ਸਿੰਚਾਈ ਦੀ ਵਿਧੀ (ਹੜ੍ਹ/ਛਿੜਕਾਅ/ਡ੍ਰਿਪ/ਪਾਈਪਡ)			
If by pump, horsepower (HP) of pump used ਜੇ ਪੰਪ ਦੁਆਰਾ, ਪੰਪ ਦਾ ਐਚਪੀ ਵਰਤਿਆ ਜਾਂਦਾ ਹੈ			
If by pump, inch diameter of the pipe used ਜੇ ਪੰਪ ਦੁਆਰਾ, ਪਾਈਪ ਦਾ ਇੰਚ ਵਿਆਸ ਵਰਤਿਆ ਜਾਂਦਾ ਹੈ			
Depth of the tubewell ਟਿਊਬਵੈੱਲ ਦੀ ਗਹਰਾਹੀ			
Tubewell Age (how old is the tubewell?) ਟਿਯੂਬਵੈੱਲ ਦੀ ਉਮਰ ਕਿੰਨੀ ਹੈ?			
Estimated time in minutes to irrigate field each time ਰ ਵਾਰ ਖੇਤ ਦੀ ਸਿੰਚਾਈ ਲਈ ਮਿੰਟਾਂ ਵਿੱਚ ਅਨੁਮਾਨਤ ਸਮਾਂ			
Estimated quantity of water for each irrigation (in litres) ਲਿਟ ਵਿੱਚ ਹਰੇਕ ਸਿੰਚਾਈ ਲਈ ਪਾਣੀ ਦੀ ਅਨੁਮਾਨਤ ਮਾਤਰਾ			
Cost of water/irrigation ਪਾਣੀ/ਸਿੰਚਾਈ ਦੀ ਲਾਗਤ			

10. PESTS AND DISEASES ਕੀੜੇ ਅਤੇ ਬਿਮਾਰੀਆਂ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Description	Plot 1	Plot 2	Plot 3
Kind of Pest ਕੀੜਿਆਂ/Disease ਬਿਮਾਰੀਆਂ 1: ______________ **Spraying ਛਿੜਕਾਅ/Drenching ਡ੍ਰੈਂਚਿੰਗ (✓)**			
Severity (High/Medium/Low) ਗੰਭੀਰਤਾ (ਉੱਚ/ਮੱਧਮ/ਘੱਟ)			
Crop name (if particular) ਫਸਲ ਦਾ ਨਾਮ (ਜੇ ਖਾਸ ਹੋਵੇ))			
Name of the agro-chemical ਐਗਰੋ-ਕੈਮੀਕਲ ਦਾ ਨਾਮ			
Source ਸਰੋਤ			
Total quantity with unit ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			
Kind of Pest ਕੀੜਿਆਂ/Disease ਬਿਮਾਰੀਆਂ 2: ______________ **Spraying ਛਿੜਕਾਅ/Drenching ਡ੍ਰੈਂਚਿੰਗ (✓)**			
Severity (High/Medium/Low) ਗੰਭੀਰਤਾ (ਉੱਚ/ਮੱਧਮ/ਘੱਟ)			
Crop name (if particular) ਫਸਲ ਦਾ ਨਾਮ (ਜੇ ਖਾਸ ਹੋਵੇ))			
Name of the agro-chemical ਐਗਰੋ-ਕੈਮੀਕਲ ਦਾ ਨਾਮ			
Source ਸਰੋਤ			
Total quantity with unit ਯੂਨਿਟ ਦੇ ਨਾਲ ਕੁੱਲ ਮਾਤਰਾ			
Cost per unit ਲਾਗਤ ਪ੍ਰਤੀ ਯੂਨਿਟ			
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)			

Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)			
Machine ਮਸ਼ੀਨ (type) (if any)			
Hours ਘੰਟੇ			
Diesel consumed ਡੀਜ਼ਲ ਦੀ ਖਪਤ			

11. HARVESTING AND MARKETING ਵਾਢੀ ਵੇਚਣਾ ਅਤੇ ਮਾਰਕੇਟਿੰਗ

Wage Rate for Men: ₹………/day
ਪੁਰਸ਼ਾਂ ਲਈ ਤਨਖਾਹ ਦਰ: ₹………/ ਦਿਨ

Wage Rate for Women: ₹………/day
ਔਰਤ ਲਈ ਉਜਰਤਾਂ ਦੀ ਦਰ: ₹…………/ਦਿਨ

Machine hire cost: ₹………/hour
ਮਸ਼ੀਨ ਕਿਰਾਏ ਦੀ ਲਾਗਤ:…………/ਘੰਟਾ

Plot 1	Main crop ਮੁੱਖ ਫਸਲ	Inter crop 1 ਅੰਤਰ ਫ਼ਸਲ 1	Inter crop 2 ਅੰਤਰ ਫ਼ਸਲ 2	Inter crop 3 ਅੰਤਰ ਫ਼ਸਲ 3	Inter crop 4 ਅੰਤਰ ਫ਼ਸਲ 4
Harvesting Process Machine/Manual ਕਟਾਈ ਪ੍ਰਕਿਰਿਆ (ਮਸ਼ੀਨ/ ਮੈਨੁਅਲ) (✓)					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machine hours ਮਸ਼ੀਨ ਦੇ ਘੰਟੇ					
If machine, diesel consumed in litres ਜੇ ਮਸ਼ੀਨ, ਡੀਜ਼ਲ ਲੀਟਰ ਦੀ ਖਪਤ ਹੁੰਦੀ ਹੈ					
Post-Harvesting Process ਕਟਾਈ ਤੋਂ ਬਾਅਦ ਦੀ ਪ੍ਰਕਿਰਿਆ **Threshing/Drying/Milling ਥਰੈਸ਼ਿੰਗ/ਸੁਕਾਉਣਾ/ਮਿਲਿੰਗ (✓)**					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machine/livestock (ਮਸ਼ੀਨ/ਪਸ਼ੂਧਨ)					
Hours (ਘੰਟੇ)					
Diesel consumed (ਡੀਜ਼ਲ ਦੀ ਖਪਤ)					
Sales & Transportation					

ਵਿਕਰੀ ਅਤੇ ਆਵਾਜਾਈ					
Sources of information on price trends (PY/local market/traders/ Neighbours/ internet/mobile) ਕੀਮਤ ਦੇ ਰੁਝਾਨਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇ ਸਰੋਤ (ਪੀਵਾਈ/ ਸਥਾਨਕ ਬਾਜ਼ਾਰ/ਵਪਾਰੀ/ ਗੁਆਂਢੀ /ਇੰਟਰਨੈਟ/ਮੋਬਾਈਲ)					
Place of sale (Mandi/Farmgate - direct or contract/FCI/Other) ਵਿਕਰੀ ਦਾ ਸਥਾਨ (ਮੰਡੀ/ਫਾਰਮਗੇਟ- ਸਿੱਧਾ ਜਾਂ ਇਕਰਾਰਨਾਮਾ/ਐਫਸੀਆਈ/ਹੋਰ)					
Mode of travel ਯਾਤਰਾ ਦੇ ਸਾਧਨ					
Distance travelled (in kms.) ਯਾਤਰਾ ਕੀਤੀ ਦੂਰੀ (ਕਿਲੋਮੀਟਰ ਵਿੱਚ)					
Diesel consumption ਡੀਜ਼ਲ ਦੀ ਖਪਤ					
Total cost ਕੁੱਲ ਲਾਗਤ					
Plot 2					
Harvesting Process Machine/Manual **ਕਟਾਈ ਪ੍ਰਕਿਰਿਆ (ਮਸ਼ੀਨ/ ਮੈਨੁਅਲ) (✓)**					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machine hours ਮਸ਼ੀਨ ਦੇ ਘੰਟੇ					
If machine, diesel litres consumed ਜੇ ਮਸ਼ੀਨ, ਡੀਜ਼ਲ ਲੀਟਰ ਦੀ ਖਪਤ ਹੁੰਦੀ ਹੈ					
Post-Harvesting Process ਕਟਾਈ ਤੋਂ ਬਾਅਦ ਦੀ ਪ੍ਰਕਿਰਿਆ **Threshing/Drying/Milling**					

ਥਰੈਸ਼ਿੰਗ/ਸੁਕਾਉਣਾ/ਮਿਲਿੰਗ (✓)					
Man power ਮਨੁੱਖ ਸ਼ਕਤੀ (number × days)					
Women power ਔਰਤ ਸ਼ਕਤੀ (number × days)					
Machine/livestock (ਮਸ਼ੀਨ/ਪਸ਼ੂਧਨ)					
Hours (ਘੰਟੇ)					
Diesel consumed (ਡੀਜ਼ਲ ਦੀ ਖਪਤ)					
Sales & Transportation **ਵਿਕਰੀ ਅਤੇ ਆਵਾਜਾਈ**					
Sources of information on price trends (PY/local market/traders/ Neighbours/ internet/mobile) ਕੀਮਤ ਦੇ ਰੁਝਾਨਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇ ਸਰੋਤ (ਪੀਵਾਈ/ਸਥਾਨਕ ਬਾਜ਼ਾਰ/ਵਪਾਰੀ/ ਗੁਆਂਢੀ /ਇੰਟਰਨੈਟ/ਮੋਬਾਈਲ)					
Place of sale (Mandi/Farmgate- direct or contract/FCI/Other) ਵਿਕਰੀ ਦਾ ਸਥਾਨ (ਮੰਡੀ/ਫਾਰਮਗੇਟ- ਸਿੱਧਾ ਜਾਂ ਇਕਰਾਰਨਾਮਾ/ਐਫਸੀਆਈ/ਹੋਰ)					
Mode of travel ਯਾਤਰਾ ਦੇ ਸਾਧਨ					
Distance travelled (in kms.) ਯਾਤਰਾ ਕੀਤੀ ਦੂਰੀ (ਕਿਲੋਮੀਟਰ ਵਿੱਚ)					
Diesel consumption ਡੀਜ਼ਲ ਦੀ ਖਪਤ					
Total cost ਕੁੱਲ ਲਾਗਤ					

12. YIELD DETAILS (ਉਪਜ ਵੇਰਵੇ)

Plot 1	Main crop ਮੁੱਖ ਫਸਲ	Inter crop 1 ਅੰਤਰ ਫ਼ਸਲ 1	Inter crop 2 ਅੰਤਰ ਫ਼ਸਲ 2	Inter crop 3 ਅੰਤਰ ਫ਼ਸਲ 3	Inter crop 4 ਅੰਤਰ ਫ਼ਸਲ 4
Main product quantity produced (in kg.) ਮੁੱਖ ਉਤਪਾਦ ਮਾਤਰਾ ਦਾ ਉਤਪਾਦਨ ਕੀਤਾ ਗਿਆ ਹੈ, ਜਿਸਦਾ ਜ਼ਿਕਰ ਇਕਾਈਆਂ ਨਾਲ ਕੀਤਾ ਗਿਆ ਹੈ					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					
Quantity sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					
Market price ਮਾਰਕੀਟ ਕੀਮਤ					
Byproduct ਉਪ -ਉਤਪਾਦ 1: ________					
Quantity produced ਪੈਦਾ ਕੀਤੀ ਮਾਤਰਾ (in kg.)					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					
Removed/Burned/Mixed in the soil ਹਟਾਇਆ/ਸਾੜਿਆ ਗਿਆ/ਮਿੱਟੀ ਵਿੱਚ ਮਿਲਾਇਆ ਗਿਆ (✓)					
Quantity, if sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					
Byproduct ਉਪ -ਉਤਪਾਦ 2: ________					
Quantity produced ਪੈਦਾ ਕੀਤੀ ਮਾਤਰਾ (in kg.)					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					
Removed/Burned/Mixed in the soil ਹਟਾਇਆ/ਸਾੜਿਆ ਗਿਆ/ਮਿੱਟੀ ਵਿੱਚ ਮਿਲਾਇਆ ਗਿਆ (✓)					
Quantity, if sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					
Plot 2					
Main product quantity produced (in kg.) ਮੁੱਖ ਉਤਪਾਦ ਮਾਤਰਾ ਦਾ ਉਤਪਾਦਨ ਕੀਤਾ ਗਿਆ ਹੈ, ਜਿਸਦਾ ਜ਼ਿਕਰ ਇਕਾਈਆਂ ਨਾਲ ਕੀਤਾ ਗਿਆ ਹੈ					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					

Quantity sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					
Market price ਮਾਰਕੀਟ ਕੀਮਤ					
Byproduct ਉਪ -ਉਤਪਾਦ **1**: ________					
Quantity produced ਪੈਦਾ ਕੀਤੀ ਮਾਤਰਾ (in kg.)					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					
Removed/Burned/Mixed in the soil ਹਟਾਇਆ/ਸਾੜਿਆ ਗਿਆ/ਮਿੱਟੀ ਵਿੱਚ ਮਿਲਾਇਆ ਗਿਆ (✓)					
Quantity, if sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					
Byproduct ਉਪ -ਉਤਪਾਦ **2**: ________					
Quantity produced ਪੈਦਾ ਕੀਤੀ ਮਾਤਰਾ (in kg.)					
Description of unit ਯੂਨਿਟ ਦਾ ਵੇਰਵਾ					
Removed/Burned/Mixed in the soil ਹਟਾਇਆ/ਸਾੜਿਆ ਗਿਆ/ਮਿੱਟੀ ਵਿੱਚ ਮਿਲਾਇਆ ਗਿਆ (✓)					
Quantity, if sold ਮਾਤਰਾ, ਜੇ ਵੇਚੀ ਜਾਵੇ (in kg.)					
Selling price per unit ਪ੍ਰਤੀ ਯੂਨਿਟ ਕੀਮਤ ਵੇਚੀ ਗਈ					

13. **MISCELLANEOUS OUTPUTS (Peripheral trees, like poplars, eucalyptus, etc.) ਅਨੇਕ ਉਤਪਾਦ: ਕੀ ਫਾਰਮ ਵਿੱਚ ਪੈਰੀਫਿਰਲ ਰੁੱਖ ਹਨ (ਜਿਵੇਂ ਪੋਪਲਰ, ਯੂਕੇਲਿਪਟਸ)**

S. No.	Tree/plant name	Number	Cost incurred (in ₹)	Product name	Quantity produced, with unit mentioned	Quantity sold	Sale Price per unit	Unit description

14. **EXPENSES ON LIVESTOCK** ਪਸ਼ੂਧਨ ਤੇ ਖਰਚਾ

Type of Animal/Bird ਪਸ਼ੂ ਜਾਂ ਪੰਛੀ ਦੀ ਕਿਸਮ	Type ਕਿਸਮ 1: Number (ਗਿਣਤੀ) : Breed (ਨਸਲ):			Type ਕਿਸਮ 2: Number (ਗਿਣਤੀ) : Breed (ਨਸਲ):			Type ਕਿਸਮ 3: Number (ਗਿਣਤੀ) : Breed (ਨਸਲ):		
Cost	**Number**	**Calculation**	**Amount (₹)**	**Number**	**Calculation**	**Amount (₹)**	**Number**	**Calculation**	**Amount (₹)**
Infrastructure annual maintenance cost ਬੁਨਿਆਦੀ ਢਾਂਚਾ ਕਾਇਮ ਰੱਖਣ ਦੀ ਕੀਮਤ									
Cost of feed/fodder purchased ਖਰੀਦੇ ਗਏ ਫੀਡ/ਚਾਰੇ ਦੀ ਲਾਗਤ									
Imputed Labour cost (own) ਬਾਹਰੀ ਲੇਬਰ ਦੀ ਲਾਗਤ (ਆਪਣਾ)									

Labour cost (hired) ਬਾਹਰੀ ਲੇਬਰ ਦੀ ਲਾਗਤ (ਕਿਰਾਏ 'ਤੇ)									
Veterinary cost ਵੈਟਰਨਰੀ ਲਾਗਤ									
Cost of marketing produce ਮਾਰਕੀਟਿੰਗ ਉਤਪਾਦਾਂ ਦੀ ਲਾਗਤ									
Total Cost ਕੁੱਲ ਲਾਗਤ									

15. **INCOME FROM LIVESTOCK** **ਪਸ਼ੂਧਨ ਤੋਂ ਆਮਦਨੀ**

Type of Animal/Bird ਪਸ਼ੂ ਜਾਂ ਪੰਛੀ ਦੀ ਕਿਸਮ	**Type ਕਿਸਮ 1**: **Number (ਗਿਣਤੀ) :** **Breed (ਨਸਲ):**			**Type ਕਿਸਮ 2**: **Number (ਗਿਣਤੀ) :** **Breed (ਨਸਲ):**			**Type ਕਿਸਮ 3**: **Number (ਗਿਣਤੀ) :** **Breed (ਨਸਲ):**		
Product Type ਉਤਪਾਦ ਦੀ ਕਿਸਮ									
Income ਆਮਦਨ	**Number**	**Calculation**	**Amount (₹)**	**Number**	**Calculation**	**Amount (₹)**	**Number**	**Calculation**	**Amount (₹)**
Yearly yield (total with unit) ਇਕਾਈ ਦੇ ਨਾਲ ਸਾਲਾਨਾ ਉਪਜ (ਕੁੱਲ)									
Sales price of unit produce ਇਕਾਈ ਉਤਪਾਦਾਂ ਦੀ ਵਿਕਰੀ ਕੀਮਤ									
Total Income ਕੁੱਲ ਆਮਦਨ									

16. **INDEBTEDNESS, IF ANY** (only for crop investment, and not for capital investments)
ਕਰਜ਼ਾ ਨਿਵੇਸ਼, ਜੇ ਕੋਈ (ਸਿਰਫ ਫਸਲੀ ਨਿਵੇਸ਼ ਲਈ, ਅਤੇ ਰਾਜਧਾਨੀ ਨਿਵੇਸ਼ ਲਈ ਨਹੀਂ)

1. Did you borrow any money for agricultural investment for your farming this season (This includes credit for the purchase of external inputs)
ਕੀ ਤੁਸੀਂ ਇਸ ਸੀਜ਼ਨ ਵਿੱਚ ਆਪਣੀ ਖੇਤੀ ਲਈ ਖੇਤੀਬਾੜੀ ਨਿਵੇਸ਼ ਲਈ ਕੋਈ ਪੈਸਾ ਉਧਾਰ ਲਿਆ ਸੀ(ਇਸ ਵਿੱਚ ਬਾਹਰੀ ਇਨਪੁਟਸ ਦੀ ਖਰੀਦ ਲਈ ਕ੍ਰੈਡਿਟ ਸ਼ਾਮਲ ਹੈ)?: **Yes** □/**No** □
2. If yes, what is it for? (mention details) ਜੇ ਹਾਂ, ਤਾਂ ਇਹ ਕਿਸ ਲਈ ਹੈ? (ਵੇਰਵਿਆਂ ਦਾ ਜ਼ਿਕਰ ਕਰੋ)
____
3. If yes, what is the total amount borrowed ਜੇ ਹਾਂ, ਤਾਂ ਉਧਾਰ ਲਈ ਗਈ ਕੁੱਲ ਰਕਮ ਕੀ ਹੈ?
ਰੁਪਏ?:____
4. Source of Credit ਕ੍ਰੈਡਿਟ ਦਾ ਸਰੋਤ: (A) Friend □ (B) Relative □ (C) Moneylender □ (D) Input Dealer □ (E) Bank □ (F) Coop Society □ (G) Others □ ___________________________________
5. Interest Rate (%) (ਵਿਆਜ ਦਰ): ....%

17. **INSURANCE, IF ANY** (only for crop investment, and not for capital investments)
ਬੀਮਾ, ਜੇ ਕੋਈ ਹੋਵੇ (ਸਿਰਫ ਫਸਲੀ ਨਿਵੇਸ਼ ਲਈ, ਅਤੇ ਰਾਜਧਾਨੀ ਨਿਵੇਸ਼ ਲਈ ਨਹੀਂ)

1. Did you take any insurance on crops ਕੀ ਤੁਸੀਂ ਫਸਲਾਂ ਦਾ ਕੋਈ ਬੀਮਾ ਲਿਆ ਸੀ? **Yes** □ **No** □
2. If yes, what is the insured amount and premium ਜੇ ਹਾਂ, ਤਾਂ ਬੀਮਾ ਰਕਮ ਅਤੇ ਪ੍ਰੀਮੀਅਮ ਕੀ ਹੈ?

____

18. **SUBSIDIES** availed ਸਬਸਿਡੀਆਂ ਦਾ ਲਾਭ (only for the current crop)

Name	Source	Amount (₹)
i. Fertilizer ਖਾਦ		
ii. Power ਬਿਜਲੀ		
iii. Irrigation ਸਿੰਚਾਈ		
iv. Other (name) ਹੋਰ (ਨਾਮ)		

19. **FARM MANAGEMENT AND RESOURCES** **ਖੇਤ ਪ੍ਰਬੰਧਨ ਅਤੇ ਸਰੋਤ**

19.1	What is the reason for selecting a crop ਫਸਲ ਦੀ ਚੋਣ ਕਰਨ ਦਾ ਕੀ ਕਾਰਨ ਹੈ? (✓)	
	i. Conventional/habit ਰਵਾਇਤੀ/ਆਦਤ	
	ii. Experienced ਤਜਰਬੇਕਾਰ	
	iii. Lead farmers ਕਿਸਾਨਾਂ ਦੀ ਅਗਵਾਈ	
	iv. Based on market trend ਬਾਜ਼ਾਰ ਦੇ ਰੁਝਾਨ ਦੇ ਅਧਾਰ ਤੇ	
	v. Based on various knowledge from groups/institutions ਸਮੂਹਾਂ/ਸੰਸਥਾਵਾਂ ਦੇ ਵੱਖੋ ਵੱਖਰੇ ਗਿਆਨ ਦੇ ਅਧਾਰ ਤੇ	
	vi. Minimum Support Price (MSP) (ਐਮ.ਐਸ.ਪੀ)	
19.2	How willing is the farmer to learn about new agricultural practices and information? ਕਿਸਾਨ ਖੇਤੀ ਦੇ ਨਵੇਂ ਤਰੀਕਿਆਂ ਅਤੇ ਜਾਣਕਾਰੀ ਬਾਰੇ ਸਿੱਖਣ ਲਈ ਕਿੰਨਾ ਤਿਆਰ ਹੈ? (✓)	
	i. Not willing ਇੱਛੁਕ ਨਹੀਂ	
	ii. Willing but apprehensive ਇੱਛੁਕ ਪਰ ਚਿੰਤਤ	

	iii. Willing to try once ਇੱਕ ਵਾਰ ਕੋਸ਼ਿਸ਼ ਕਰਨ ਲਈ ਤਿਆਰ	
	iv. Willing to try always ਹਮੇਸ਼ਾਂ ਕੋਸ਼ਿਸ਼ ਕਰਨ ਲਈ ਤਿਆਰ	
19.3.	What is the basis for a decision to apply fertiliser ਖਾਦ ਲਾਗੂ ਕਰਨ ਦੇ ਫੈਸਲੇ ਦਾ ਆਧਾਰ ਕੀ ਹੈ? (✓)	
	i. Based on personal conjecture ਵਿਅਕਤੀਗਤ ਅਨੁਮਾਨ ਦੇ ਅਧਾਰ ਤੇ	
	ii. Advise by shop keeper ਦੁਕਾਨਦਾਰ ਦੁਆਰਾ ਸਲਾਹ	
	iii. Based on experience ਤਜ਼ਰਬੇ ਦੇ ਅਧਾਰ ਤੇ	
	iv. Based on expert recommendation ਮਾਹਰ ਦੀ ਸਿਫਾਰਸ਼ ਦੇ ਅਧਾਰ ਤੇ	
	v. Based on soil testing and advise ਮਿੱਟੀ ਪਰਖ ਅਤੇ ਸਲਾਹ ਦੇ ਅਧਾਰ ਤੇ	
	vi. Based on yield and profitability ਉਪਜ ਅਤੇ ਮੁਨਾਫੇ ਦੇ ਅਧਾਰ ਤੇ	
19.4.	What is the basis for deciding which pesticide to apply? ਕਿਹੜੀ ਕੀਟਨਾਸ਼ਕ ਦਵਾਈ ਨੂੰ ਲਾਗੂ ਕਰਨਾ ਹੈ, ਇਸਦਾ ਅਧਾਰ ਕੀ ਹੈ? (✓)	
	i. Based on personal estimation ਵਿਅਕਤੀਗਤ ਅਨੁਮਾਨ ਦੇ ਅਧਾਰ ਤੇ	
	ii. Based on experience ਤਜ਼ਰਬੇ ਦੇ ਅਧਾਰ ਤੇ	
	iii. Based on shopkeeper ਦੁਕਾਨਦਾਰ 'ਤੇ ਅਧਾਰਤ	
	iv. Based on expert suggestion or training ਮਾਹਰ ਦੇ ਸੁਝਾਅ ਜਾਂ ਸਿਖਲਾਈ ਦੇ ਅਧਾਰ ਤੇ	
19.5.	When do you decide to apply pesticides? ਤੁਸੀਂ ਕੀਟਨਾਸ਼ਕਾਂ ਨੂੰ ਲਾਗੂ ਕਰਨ ਦਾ ਫੈਸਲਾ ਕਦੋਂ ਕਰਦੇ ਹੋ? (✓)	
	i. At regular interval/stage of the crop ਫਸਲ ਦੇ ਨਿਯਮਤ ਅੰਤਰਾਲ/ਪੜਾਅ' ਤੇ	
	ii. At first sighting of the pest ਕੀੜੇ ਦੇ ਪਹਿਲੀ ਨਜ਼ਰ ਤੇ	
	iii. After visible symptoms of infestation ਲਾਗ ਦੇ ਦਿਖਾਈ ਦੇਣ ਵਾਲੇ ਲੱਛਣਾਂ ਦੇ ਬਾਅਦ	
	iv. Only if it appears to get severe and create significant loss ਸਿਰਫ ਤਾਂ ਹੀ ਜੇ ਇਹ ਗੰਭੀਰ ਹੁੰਦਾ ਜਾਪਦਾ ਹੈ ਅਤੇ ਮਹੱਤਵਪੂਰਣ ਨੁਕਸਾਨ ਪੈਦਾ ਕਰਦਾ ਹੈ	
	v. Never or very rarely ਕਦੇ ਜਾਂ ਬਹੁਤ ਘੱਟ	
19.6.	What can help farmers improve their handling of pesticides? ਕੀਟਨਾਸ਼ਕਾਂ ਦੇ ਪ੍ਰਬੰਧਨ ਨੂੰ ਬਿਹਤਰ ਬਣਾਉਣ ਵਿੱਚ ਕਿਸਾਨਾਂ ਦੀ ਕੀ ਮਦਦ ਹੋ ਸਕਦੀ ਹੈ? (✓) (can select more than one option)	
	i. Knowledge support ਗਿਆਨ ਦਾ ਸਮਰਥਨ	
	ii. Equipment support ਉਪਕਰਣ ਸਹਾਇਤਾ	
	iii. Skilled labour ਹੁਨਰਮੰਦ ਕਿਰਤ	
	iv. Market incentives ਮਾਰਕੀਟ ਪ੍ਰੋਤਸਾਹਨ	
	v. Subsidies ਸਬਸਿਡੀਆਂ	
19.7.	What is the level of knowledge about different methods like drip/sprinkler ਡਰਿਪ/ਸਪ੍ਰਿੰਕਲਰ ਵਰਗੇ ਵੱਖੋ ਵੱਖਰੇ ਤਰੀਕਿਆਂ ਬਾਰੇ ਗਿਆਨ ਦਾ ਪੱਧਰ ਕੀ ਹੈ? (✓)	
	i. None ਕੋਈ ਨਹੀਂ	
	ii. Some knowledge ਕੁਝ ਗਿਆਨ	
	iii. Good knowledge ਚੰਗਾ ਗਿਆਨ	
	iv. Good knowledge and practice ਚੰਗਾ ਗਿਆਨ ਅਤੇ ਅਭਿਆਸ	
19.8.	What is the usual irrigation timing ਆਮ ਸਿੰਚਾਈ ਦਾ ਸਮਾਂ ਕੀ ਹੈ? (✓)	
	i. Irrigate during evening ਸ਼ਾਮ ਨੂੰ ਸਿੰਚਾਈ ਕਰੋ	
	ii. Irrigate early morning ਸਵੇਰੇ ਜਲਦੀ ਸਿੰਜਾਈ ਕਰੋ	
	iii. Depends on power supply ਬਿਜਲੀ ਸਪਲਾਈ 'ਤੇ ਨਿਰਭਰ ਕਰਦਾ ਹੈ	

	iv. Irrigate in daytime ਦਿਨ ਵੇਲੇ ਸਿੰਚਾਈ ਕਰੋ	
19.9.	What are the sources of information on price trends ਕੀਮਤ ਦੇ ਰੁਝਾਨਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਦੇ ਸਰੋਤ ਕੀ ਹਨ? (✓) (can select more than one option)	
	i. Previous year trend ਪਿਛਲੇ ਸਾਲ ਦਾ ਰੁਝਾਨ	
	ii. Local market scenario ਸਥਾਨਕ ਬਾਜ਼ਾਰ ਦਾ ਦ੍ਰਿਸ਼	
	iii. Neighbours ਗੁਆਂਢੀ	
	iv. Traders ਵਪਾਰੀ	
	v. Media ਮੀਡੀਆ	
	vi. Internet/mobile ਇੰਟਰਨੈਟ/ਮੋਬਾਈਲ	
19.10.	Does the farmer face any issue in getting labour for the farm work? ਕੀ ਕਿਸਾਨ ਨੂੰ ਖੇਤ ਦੇ ਕੰਮ ਲਈ ਲੇਬਰ ਪ੍ਰਾਪਤ ਕਰਨ ਵਿੱਚ ਕਿਸੇ ਸਮੱਸਿਆ ਦਾ ਸਾਹਮਣਾ ਕਰਨਾ ਪੈਂਦਾ ਹੈ? (✓)	
	i. Mostly self-labour ਜਿਆਦਾਤਰ ਸਵੈ-ਕਿਰਤ	
	ii. Sufficient supply ਲੋੜੀਂਦੀ ਸਪਲਾਈ	
	iii. Seasonal ਮੌਸਮੀ	
	iv. Poor labour supply ਖਰਾਬ ਲੇਬਰ ਸਪਲਾਈ	

20. **SOCIAL INTERFACE ਸਮਾਜਿਕ ਇੰਟਰਫੇਸ**

20.1.	Are you associated with any community or producers' group? ਕੀ ਤੁਸੀਂ ਕਿਸੇ ਭਾਈਚਾਰੇ ਜਾਂ ਉਤਪਾਦਕਾਂ ਦੇ ਸਮੂਹ ਨਾਲ ਜੁੜੇ ਹੋਏ ਹੋ? (✓) (can select more than one option)	
	i. Good rapport with adjacent/neighbouring farmers ਨੇੜਲੇ/ ਗੁਆਂਢੀ ਕਿਸਾਨਾਂ ਨਾਲ ਚੰਗਾ ਸੰਬੰਧ	
	ii. Part of SHGs/NGO	
	iii. Part of farmer association/co-operative/farmer producer organisations ਕਿਸਾਨ ਐਸੋਸੀਏਸ਼ਨ/ਸਹਿਕਾਰੀ/ਕਿਸਾਨ ਉਤਪਾਦਕ ਸੰਸਥਾਵਾਂ ਦਾ ਹਿੱਸਾ	
	iv. Others (name):	
	v. None	
20.2.	What is the benefits farmer gain from the groups he belongs to? ਕਿਸਾਨ ਉਨ੍ਹਾਂ ਸਮੂਹਾਂ ਤੋਂ ਕੀ ਲਾਭ ਪ੍ਰਾਪਤ ਕਰਦਾ ਹੈ ਜਿਨ੍ਹਾਂ ਨਾਲ ਉਹ ਸੰਬੰਧਤ ਹਨ? (✓) (can select more than one option)	
	i. Knowledge like crop selection, weather, etc. ਗਿਆਨ ਜਿਵੇਂ ਫਸਲ ਦੀ ਚੋਣ, ਮੌਸਮ, ਆਦਿ.	
	ii. Input support ਇਨਪੁਟ ਸਹਾਇਤਾ	
	iii. Market support like access, transport etc. ਮਾਰਕੀਟ ਸਹਾਇਤਾ ਜਿਵੇਂ ਪਹੁੰਚ, ਆਵਾਜਾਈ ਆਦਿ.	
	iv. Capacity building activities ਸਮਰੱਥਾ ਨਿਰਮਾਣ ਗਤੀਵਿਧੀਆਂ	
20.3.	What is the strength and composition of the group ਸਮੂਹ ਦੀ ਤਾਕਤ ਅਤੇ ਰਚਨਾ ਕੀ ਹੈ? (✓) (can select more than one option)	
	i. Very good or equal participation from women ਔਰਤਾਂ ਦੀ ਬਹੁਤ ਚੰਗੀ ਜਾਂ ਬਰਾਬਰ ਭਾਗੀਦਾਰੀ	
	ii. Equivalent voice and participation from majority of members ਬਹੁਗਿਣਤੀ ਮੈਂਬਰਾਂ ਦੀ ਸਮਾਨ ਆਵਾਜ਼ ਅਤੇ ਭਾਗੀਦਾਰੀ	
	iii. Different caste ਵੱਖਰੀ ਜਾਤ	
	iv. Different religion ਵੱਖਰਾ ਧਰਮ	

21. **DETAILS OF EXTENSION SUPPORT RECEIVED DURING THE PAST SEASON ਪਿਛਲੇ ਸੀਜ਼ਨ ਦੌਰਾਨ ਪ੍ਰਾਪਤ ਹੋਏ ਐਕਸਟੈਂਸ਼ਨ ਸਪੋਰਟ ਦੇ ਵੇਰਵੇ**

21.1.	What are the sources of information and knowledge on farming? ਖੇਤੀ ਬਾਰੇ ਜਾਣਕਾਰੀ ਅਤੇ ਗਿਆਨ ਦੇ ਸਰੋਤ ਕੀ ਹਨ? (✓)	
	i. Family knowledge/experience ਪਰਿਵਾਰਕ ਗਿਆਨ/ਅਨੁਭਵ	
	ii. Formal education ਰਸਮੀ ਸਿੱਖਿਆ	
	iii. Neighbouring farmers ਗੁਆਂਢੀ ਕਿਸਾਨ	
	iv. State extension services ਰਾਜ ਵਿਸਥਾਰ ਸੇਵਾਵਾਂ	
	v. Television/Radio ਟੈਲੀਵਿਜ਼ਨ/ਰੇਡੀਓ	
	vi. Newspaper/Magazines ਅਖ਼ਬਾਰ/ਮੈਗਜ਼ੀਨ	
	vii. Mobile/internet ਮੋਬਾਈਲ/ਇੰਟਰਨੈਟ	
21.2.	Have you ever taken advice regarding the farming practice from any institution ਕੀ ਤੁਸੀਂ ਕਦੇ ਕਿਸੇ ਸੰਸਥਾ ਤੋਂ ਖੇਤੀ ਦੇ ਅਭਿਆਸ ਬਾਰੇ ਸਲਾਹ ਲਈ ਹੈ? (✓)	
	i. Not willing (No trust) ਤਿਆਰ ਨਹੀਂ (ਕੋਈ ਭਰੋਸਾ ਨਹੀਂ)	
	ii. Not aware ਪਤਾ ਨਹੀਂ	
	iii. Rarely ਬਹੁਤ ਘੱਟ	
	iv. Sometimes ਕਈ ਵਾਰ	
	v. Regularly ਬਾਕਾਇਦਾ	

21.3.	**Type of Support**	**Received (Yes/No)**	**Who provided support? (A) NGO/SHG (B) Govt organisation (C) PAU (D) Farmers Association/Co-operative (E) Others (mention):……………………………………**
	i. Training ਸਿਖਲਾਈ		
	ii. Exposure visits ਐਕਸਪੋਜ਼ਰ ਦੌਰੇ		
	iii. Input support ਇਨਪੁਟ ਸਹਾਇਤਾ		
	iv. Marketing support ਮਾਰਕੀਟਿੰਗ ਸਹਾਇਤਾ		
	v. Any other support ਕੋਈ ਹੋਰ ਸਹਾਇਤਾ: ______________________		

22. **EXPERIENCE, CHALLENGES, AND SUGGESTIONS (ਅਨੁਭਵ, ਚੁਣੌਤੀਆਂ, ਅਤੇ ਸੁਝਾਅ)**

22.1 Experience of farmers in this cropping season *vis-à-vis* previous crop (ਪਿਛਲੀ ਫਸਲ ਦੇ ਮੁਕਾਬਲੇ ਇਸ ਫਸਲ ਦੇ ਸੀਜ਼ਨ ਵਿੱਚ ਕਿਸਾਨਾਂ ਦਾ ਤਜਰਬਾ (✓)

Parameters	Significant decrease	Marginal decrease	No change	Marginal increase	Significant increase	Don't know
i. Cost of cultivation ਕਾਸ਼ਤ ਦੀ ਲਾਗਤ						
ii. Labour requirement ਕਿਰਤ ਦੀ ਲੋੜ						
iii. Drudgery ਸਖਤ ਕੰਮ ਜਾਂ ਥਕਾਵਟ ਵਾਲਾ ਕੰਮ						
iv. Crop yield ਫਸਲ ਦੀ ਪੈਦਾਵਾਰ						
v. Net farm income ਸ਼ੁੱਧ ਖੇਤੀ ਆਮਦਨ						
vi. Number of crops cultivated ਕਾਸ਼ਤ ਕੀਤੀਆਂ ਫਸਲਾਂ ਦੀ ਸੰਖਿਆ						
vii. Number of saleable produces ਵੇਚਣਯੋਗ ਉਤਪਾਦਾਂ ਦੀ ਸੰਖਿਆ						
viii. Price received for the produce ਉਪਜ ਲਈ ਪ੍ਰਾਪਤ ਕੀਮਤ						
ix. Crop duration ਫਸਲ ਦੀ ਮਿਆਦ						
x. Any Other:___________________						

22.2 Contribution of women in different agricultural operations ਵੱਖ -ਵੱਖ ਖੇਤੀ ਕਾਰਜਾਂ ਵਿੱਚ ਔਰਤਾਂ ਦਾ ਯੋਗਦਾਨ (✓)

Operation	All	Maximum	Equal	Minimum	Nil	Don't Know
i. Land preparation ਜ਼ਮੀਨ ਦੀ ਤਿਆਰੀ						
ii. Sowing (nursery, transplantation) ਬਿਜਾਈ (ਨਰਸਰੀ, ਟ੍ਰਾਂਸਪਲਾਂਟੇਸ਼ਨ)						
iii. Fertilizer application ਖਾਦ ਦੀ ਅਰਜ਼ੀ						
iv. Weeding ਬੂਟੀ						
v. Pest control ਕੀੜਿਆਂ ਦਾ ਨਿਯੰਤਰਣ						
vi. Irrigation ਸਿੰਚਾਈ						
vii. Harvesting ਕਟਾਈ						
viii. Post harvesting operations ਕਟਾਈ ਤੋਂ ਬਾਅਦ ਦੇ ਕੰਮ						
ix. Marketing ਮਾਰਕੀਟਿੰਗ						
x. Any Other:___________________						

22.3 Challenges faced by farmers ਕਿਸਾਨਾਂ ਨੂੰ ਦਰਪੇਸ਼ ਚੁਣੌਤੀਆਂ (✓)

Parameters	Stressed	Yes	No	Don't Know
i. Low yield ਘੱਟ ਉਪਜ				
ii. Pest and disease ਗ ਅਤੇ ਕੀੜੇ				
iii. Weed management ਬੂਟੀ ਪ੍ਰਬੰਧਨ				
iv Access to organic inputs ਜੈਵਿਕ ਇਨਪੁਟਸ ਤੱਕ ਪਹੁੰਚ				
v. Lack of knowledge ਗਿਆਨ ਦੀ ਘਾਟ				

vi. Higher labour requirement ਵਧੇਰੇ ਕਿਰਤ ਦੀ ਲੋੜ				
vii. Drudgery ਸਖਤ ਕੰਮ ਜਾਂ ਥਕਾਵਟ ਵਾਲਾ ਕੰਮ				
viii. Marketing challenges ਮਾਰਕੀਟਿੰਗ ਚੁਣੌਤੀਆਂ				
ix. Price realization ਕੀਮਤ ਦੀ ਪ੍ਰਾਪਤੀ				
x. Credit requirements ਕ੍ਰੈਡਿਟ ਲੋੜਾਂ				
xi. Net income ਸ਼ੁਧ ਆਮਦਨੀ				
xii. Difficulty in livestock management ਸੂਧਨ ਪ੍ਰਬੰਧਨ ਵਿੱਚ ਮੁਸ਼ਕਲ				
xiii. Lack of institutional support ਸੰਸਥਾਗਤ ਸਹਾਇਤਾ ਦੀ ਘਾਟ				
xiv. Irrigation constraints ਸਿੰਚਾਈ ਦੀਆਂ ਕਮੀਆਂ				
xv. Rented land ਕਿਰਾਏ ਦੀ ਜ਼ਮੀਨ				
xvi. Any Other:___________________				

22.4 Suggestions to resolve the constraints faced by farmers (ਕਿਸਾਨਾਂ ਨੂੰ ਦਰਪੇਸ਼ ਮੁਸ਼ਕਿਲਾਂ ਦੇ ਹੱਲ ਲਈ ਸੁਝਾਅ) (✓)

Constraints (ਪਾਬੰਦੀਆਂ)	**Suggestions (ਸੁਝਾਅ)**
i. Production ਉਤਪਾਦਨ	
ii. Input ਇਨਪੁਟ	
iii. Technology and Process ਤਕਨਾਲੋਜੀ ਅਤੇ ਪ੍ਰਕਿਰਿਆ	
iv. Marketing ਮਾਰਕੀਟਿੰਗ	
v. Certification ਸਰਟੀਫਿਕੇਸ਼ਨ	
vi. Institutional ਸੰਸਥਾਗਤ	
vii. Any Other:__________________	

ANNEXURE D

Sample Soil Testing Report

10/28/21, 3:51 PM ਮਿੱਟੀ ਪਰਖ ਰਿਪੋਰਟ

ਪੰਜਾਬ ਖੇਤੀਬਾੜੀ ਯੂਨੀਵਰਸਿਟੀ, ਲੁਧਿਆਣਾ

ਭੂਮੀ ਵਿਗਿਆਨ ਵਿਭਾਗ

ਮਿੱਟੀ ਪਰਖ ਪ੍ਰਯੋਗਸ਼ਾਲਾ

ਮਿੱਟੀ ਪਰਖ ਰਿਪੋਰਟ | ਰਸੀਦ ਨੰਬਰ : 2110756

ਨਾਮ	[redacted]	ਪਿਤਾ ਦਾ ਨਾਮ		ਪਿੰਡ	Mossa
ਡਾਕਖਾਨਾ		ਬਲਾਕ	jhuneer	ਜ਼ਿਲਾ	Mansa

ਨਤੀਜਾ ਖੇਤ ਨੰ: 1 [redacted] [OF] Moosa

ਪ੍ਰਯੋਗਸ਼ਾਲਾ ਨੰ:	ਖੇਤ ਨੰ:	ਸਿੰਚਾਈ	ਜ਼ਮੀਨ ਦੀ ਕਿਸਮ	ਖਾਰੀ ਅੰਗ	ਨਮਕੀਨ ਪਦਾਰਥ (ਮਿ: ਮਹੋਜ਼/ਸੈ: ਮੀ:)	ਜੀਵਕ ਕਾਰਬਨ ਸ੍ਰੇਣੀ (ਪ੍ਰਤੀਸ਼ਤ)	ਫ਼ਾਸਫ਼ੋਰਸ ਸ੍ਰੇਣੀ (ਕਿਲੋ/ ਏਕੜ)	ਪੋਟਾਸ਼ ਸ੍ਰੇਣੀ (ਕਿਲੋ/ ਏਕੜ)	ਜਿਪਸਮ (ਟਨ/ਏਕੜ)	
									ਪਰਖ ਅਨੁਸਾਰ	ਸਿਫਾਰਸ਼
47	1		ਰੇਤਲੀ ਮੈਰਾ	8.5 (ਠੀਕ)	0.16 (ਠੀਕ)	0.240 (ਘੱਟ)	7.4 (ਦਰਮਿਆਨਾ)	93 (ਜ਼ਿਆਦਾ)		0

ਸਿਫਾਰਸ਼ ਖੇਤ ਨੰਬਰ 1 ਲਈ: [redacted] [OF] Moosa

ਫ਼ਸਲ	ਨਾਈਟਰੋਜਨ	ਫ਼ਾਸਫ਼ੋਰਸ		ਮਿਊਰੇਟ ਆਫ਼ ਪੋਟਾਸ਼	ਵਿਸ਼ੇਸ਼ ਕਥਨ
	ਨੀਮ ਲੇਪਤ ਯੂਰੀਆ	ਸੁਪਰ	ਡਾਇਆ		
ਕਣਕ	130	155	55	-	
ਰਾਇਆ	110	75	25	-	
ਜੌਂ	45	75	25	-	
ਛੋਲੇ	20	50	20	-	
ਬਰਸੀਮ	25	185	65	-	
ਤੋਰੀਆ	65	50	20	-	
ਸੂਰਜਮੁਖੀ (ਦੋਗਲਾ)	65	75	25	-	
ਕਮਾਦ	165	-	-	-	
ਝੋਨਾ	110	-	-	-	
ਬਾਸਮਤੀ	22	-	-	-	
ਮੱਕੀ	130	155	55	-	
ਆਲੂ	205	155	55	-	
ਕਪਾਹ	80	75	25	-	
ਕਪਾਹ (ਹਾਈਬਰਿਡ)	165	75	25	-	

Note: The name of the farmer has been redacted to keep anonymity.
Source: Bhumi Vigyan Vibhag (Soil Testing Laboratory), Punjab Agricultural University, Ludhiana.

Funding Call	Growing Research Capacity: UKRI GCRF
Country	India
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